

**EUROPEAN SOCIETY OF NEURORADIOLOGY
XXXI CONGRESS AND 15TH ADVANCED COURSE
GENEVA, 13–16 SEPTEMBER 2006**

Wednesday, September 13, 2006

09:00 – 11:00

SS 1

Room: ESNR / Diagnostic

Main session: *Aneurysms Basics*

Chairs: J. Campos, L. Guimaraens

ML1

ISAT

A. Molyneux, Oxford OX2 6HE/GB

ML2

CLASSIFICATION AND TREATMENT OF INTRACRANIAL ANEURYSMS

J. Byrne, Oxford OX2 6HE/GB

ML3

TREATMENT OF UNRUPTURED ANEURYSMS

P. Lylyk, Buenos Aires/AR

ML4

LONG TERM FOLLOW-UP OF ENDOVASCULAR TREATMENT

C. Cognard, Toulouse/FR

09:00 – 11:00

SS 5

Room: ICS / Interventional

Main session: *Aneurysms Basics*

Chairs: J. Campos, L. Guimaraens

ML1

ISAT

A. Molyneux, Oxford OX2 6HE/GB

ML2

CLASSIFICATION AND TREATMENT OF INTRACRANIAL ANEURYSMS

J. Byrne, Oxford OX2 6HE/GB

ML4

LONG TERM FOLLOW-UP OF ENDOVASCULAR TREATMENT

C. Cognard, Toulouse/FR

11:00 – 11:30

COFFEE BREAK: *COFFEE BREAK*

11:30 – 13:00

SS 10

Room: Free Paper

Free paper session: *ICS / Stenotic lesions*

Chairs: A. Molyneux, I. Wanke

O10.1**FMRI WITH BREATH HOLDING AS AN EASY METHOD TO ASSESS TISSUE AT RISK IN PATIENTS WITH SEVERE INTRACRANIAL ARTERIAL STENOSIS**

C. Dannenberg¹, H. Hentschel¹, T. Goldhagen¹, T. Scholle¹, C. Disque¹, A. Werner², G. Gahn¹, R. von Kummer²;

¹University Hospital, Technische Universität Dresden, Dresden/DE, ²University Hospital, Dresden/DE

PURPOSE

Contrast enhanced perfusion MRI is used to assess hemodynamic relevance of intracranial stenosis. TTP-shortening, however, is not mandatory connected with reduced cerebrovascular reactivity and tissue at risk for infarction. The aim of our study was to test a simple, fast and reliable MRI method for regional cerebrovascular reactivity in patients with severe intracranial stenosis.

MATERIAL AND METHODS

We included so far 16 patients with moderate to severe intracranial arterial stenosis or vessel occlusion, 15/16 MCA - 1/15 bilateral, 1/16 BA stenosis and 5 cases with additional extracranial stenosis. We used BOLD imaging for breath-holding fMRI: EPI sequences, 30 transversal slices, TR 3 sec, 150 runs, Block design, 1.5T scanner (Sonata, Siemens), data analysis with Brainvoyager (Brain Innovation B.V.): general linear model, FDR < 0,05. We performed CE-MR or CT angiography and perfusion MRI in all cases, additional breath-holding transcranial doppler ultrasound in 12 patients.

RESULTS

Breath-holding fMRI was successfully performed in all cases. Only in patients with severe stenosis or vessel occlusion different parts of vascular territories had a reduced or negative BOLD response, 1 of these patients developed ischemic events in the involved brain area. TTP shortening in perfusion MRI was not able to predict the area of diminished BOLD response, but reduced or negative BOLD response areas were connected with TTP shortening in the corresponding contrast enhanced perfusion MRI. Results of transcranial Doppler ultrasound during breath holding were in accordance with fMRI results.

CONCLUSION

Breath-holding fMRI seems to be a useful and feasible technique in assessment of brain tissue at risk for infarction in patients with severe intracranial arterial stenosis. We are currently studying whether angioplasty can reduce the brain tissue volume with impaired cerebral vasoreactivity. The assessment of regional cerebrovascular reactivity may help in the decision between intervention and conservative management.

O10.2**INITIAL EXPERIENCE ON THE MANAGEMENT OF INTRACRANIAL STENOSIS WITH SELF-EXPANDING STENTS**

D.K. Lopes

Rush University Medical Center, Chicago/US

PURPOSE

The use of flexible self-expanding stents (Neuroform and Wingspan) on the management of intracranial stenosis is appealing. We report our initial experience with these devices on the treatment of symptomatic high-grade intracranial stenosis.

MATERIAL AND METHODS

We reviewed all cases of symptomatic intracranial stenosis treated using self-expanding nitinol stents. The technique used aimed to undersize angioplasty and atraumatic stent deployment (minimal distal wire). All cases were evaluated clinically before and after procedure. We report the rate of procedural success, intraoperative complication and control of symptoms.

RESULTS

Twenty-three cases were identified treated with either Wingspan or Neuroform stents. The average age of these patients was 62 years old. The procedure success rate was 100%. The stent were delivered at ICA, MCA, Vertebral and Basilar arteries). There were 3 clinical complications (1 transient and 2 permanent events (8.7%)). All patient had resolution of symptoms on immediate follow-up.

CONCLUSION

We report our initial experience with self-expanding nitinol stents on the treatment of intracranial symptomatic stenosis. The experience has been positive in regards to feasibility. The question remains regarding restenosis rates.

O10.3**TREATMENT OF INTRACRANIAL STENOSES USING A SELF-EXPANDING STENT - PRELIMINARY EXPERIENCE WITH THE WINGSPAN™ SYSTEM**

R.P. Klucznik¹, G. Benndorf¹, R.K. Shah¹, D. Meyer², C.M. Strother¹;

¹The Methodist Hospital, Houston/US, ²SCSM AG, Zürich/CH

PURPOSE

The purpose of this study is to report on our preliminary experience in using a new-self-expanding stent (Wingspan™ Stent system) for endovascular treatment of intracranial stenoses.

MATERIAL AND METHODS

Twenty patients (42–85 years, 11 females, 9 males) underwent treatment of 23 stenotic lesions of intracranial arteries (ICA:4, MCA:12, VA:5, BA:1, A1:1) using a new self-expanding Nitinol stent (Wingspan™, BSC). After pre-dilatation of the stenosis using a PTA balloon catheter (Gateway™, BSC), a single stent was deployed in 17 patients while 2 stents were placed in 3 patients with more than one stenosis. Stenoses prior to stent placement ranged from 66–95%.

RESULTS

Technical success was achieved in 22/23 lesions (95%) in all locations with good anatomical results. Among them were two patients in whom previous attempts of placing a drug eluted balloon-expandable stents had failed. In three patients two lesions could be treated during the same session. Increase of vessel diameter was accomplished in 22/22 lesions with a remaining residual stenosis ranging from 0–40%. One patient died due to a progressive stroke, 1 patient developed a hemorrhage in the contralateral hemisphere, another patient developed a minor ipsilateral bleeding causing headache. Clinical and angiographic follow-up was performed after 6 months and results will be presented.

CONCLUSION

The use of the self-expanding Wingspan Stent for treatment of intracranial stenoses is technically feasible and our initial results are encouraging. This stent appears to be a valuable alternative to balloon-expandable coronary stents.

O10.4

PRELIMINARY EXPERIENCE WITH THE WINGSPAN STENT FOR THE TREATMENT OF SYMPTOMATIC INTRACRANIAL ATHEROMATOUS DISEASE

A.S. Turk¹, D. Fiorella², E. Levy³, F. Albuquerque⁴, D. Niemann¹, B. Aa-gaard-Kienitz¹, H. Woo², P. Rasmussen², L.N. Hopkins³, T. Masaryk², C. McDougall⁴;

¹University of Wisconsin, Madison/US, ²Cleveland Clinic, Cleveland/US, ³SUNY at Buffalo, Buffalo/US, ⁴Barrows Neurologic Institute, Phoenix/US

PURPOSE

The Wingspan, a flexible, self-expanding, microcatheter-delivered, microstent is the first stent system designed specifically for the treatment of symptomatic intracranial atheromatous disease (ICAD). The current report details our initial experience with the device in a series of 47 patients.

MATERIAL AND METHODS

All patients undergoing angioplasty and stenting with the Gateway Balloon - Wingspan stent system were prospectively tracked in our collaborative four institution endovascular database. Patient data, lesion characteristics, procedural details, pre and peri-procedural anti-thrombotic pharmacology, and clinical and imaging follow up were recorded.

RESULTS

Over a 5 month period 48 patients (16 females, 32 males; average age 62.9 years, range 41–83 years) with 51 intracranial atheromatous lesions were treated with the Gateway balloon and Wingspan stent system. 50 of the 51 lesions were successfully treated (98% technical success). In one case, the stent could not be delivered across the lesion and the patient was treated with angioplasty only. The treated lesions involved the internal carotid (n=22; 8 petrous, 6 cavernous, 6 supraclinoid segment, 2 terminus), vertebral (n=9; V4 segment), basilar (n=11), and middle cerebral (n=9) arteries. The average pre-treatment stenosis was 74.8 (14.7) percent, improving to 46.1 (15.7) percent after Gateway balloon angioplasty and to 29.8 (16.0) percent after Wingspan stent placement. 36 of 51 lesions treated were > 70% stenotic. Of these 51 lesions treated, there was one neurological complication with a pontine stroke and subsequent death (2%); otherwise, there were no permanent neurological complications. One additional patient experienced a transient neurological deficit after the procedure with a visual field deficit that completely resolved at 36 hours.

CONCLUSION

Angioplasty and stenting for symptomatic intracranial atheromatous disease can be performed with the Gateway balloon-Wingspan stent system with a high rate of technical success and low peri-procedural morbidity. In the context of the WASID data, our initial experience indicates that this procedure represents a viable treatment option for patients with symptomatic ICAD.

O10.5

A MULTICENTER STUDY ON TREATMENT STRATEGY FOR INTRACRANIAL STENO-OCCLUSIVE LESIONS BASED ON ANGIOPLASTY BY USING A DOUBLE LUMEN BALLOON DILATATION CATHETER: PART 1. REPERFUSION THERAPY FOR INTRACRANIAL EMBOLIC OCCLUSION

K. Tokunaga¹, K. Sugiu², A. Nishida¹, K. Yoshino³, Y. Terai³, T. Imaoka⁴, A. Handa⁵, N. Hirotsune⁶, N. Kusaka⁷, I. Date¹;

¹Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Okayama/JP, ²Okayama University Medical School, Okayama/JP, ³Kagawa Rosai Hospital, Marugame/JP, ⁴Tottori Municipal Hospital, Tottori/JP, ⁵Okayama Rosai Hospital, Okayama/JP, ⁶Hiroshima City Hospital, Hiroshima/JP, ⁷National Hospital Organization Iwakuni Clinical Center, Iwakuni/JP

PURPOSE

The efficacy of intravenous thrombolysis with recombinant tissue plasminogen activator is still limited because of short therapeutic time window and hemorrhagic complications. In this part of our retrospective multicenter study, we evaluated the safety and efficacy of balloon-based clot disruption with or without intra-arterial thrombolysis for patients with intracranial embolic occlusion.

MATERIAL AND METHODS

Consecutive patients with acute embolic occlusion of intracranial arteries between October 2002 and March 2005 were enrolled in this study. A double lumen balloon dilatation catheter (GatewayTM) was used for percutaneous transluminal angioplasty (PTA) to disrupt clots in every patient. Techniques of balloon inflation, necessity and timing of urokinase infusion and doses of urokinase were at the discretion of each interventionalist. Clinical outcomes, technique-related complications and angiographic recanalization rate were evaluated. Technical details of reperfusion therapy were also described.

RESULTS

Fifty-two patients were included, and the sites of occlusion were internal carotid arteries (ICAs) in 16 patients, M1 segments of middle cerebral arteries in 31, M2 segment in 1, a vertebral artery in 1 and basilar arteries (BAs) in 3. Most patients were transferred to the hospitals within 4 hours after onset. Twenty-one patients (40%) were treated with thrombolysis first, and 19 patients (37%) were treated with PTA first followed by thrombolysis. PTA only was performed in 12 patients (23%). Pressure for inflation was relatively low (manual, 2 or 3 atm), and duration of inflation was 30 seconds or less in 89%. A balloon with 2.0 mm of diameter and 9 mm of length was applied in 63% of the patients. Mean dose of urokinase was 203×103 U. The extent of recanalization was complete in 15 (29%), and partial in 25 (48%). Functional independence at discharge was preserved in 80%, 28% and 0% of the patients with complete, partial and no recanalization, respectively. Combination of PTA and thrombolysis resulted in significantly higher recanalization rate than PTA only (P=0.004). Severe neurological deterioration after treatment was observed in 2 (4%), though technical complications related to balloon inflations were not encountered.

CONCLUSION

Mechanical clot disruption by using a double lumen balloon catheter combined with low-dose urokinase is a safe and effective

treatment for intracranial embolic occlusion with low risk of hemorrhagic complications.

O10.6

MID TERM OUTCOME FOLLOWING ENDOVASCULAR TREATMENT OF INTRACRANIAL ATHEROSCLEROTIC DISEASE WITH SELF EXPANDABLE STENTS

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¹National Institute of Neurosurgery, Budapest/HU, ²KING'S COLLEGE HOSPITAL, London/GB, ³Boston Scientific, San Leandro/US

PURPOSE

To evaluate mid term clinical outcome and rate of restenosis following endovascular stent treatment of intracranial atherosclerotic disease.

MATERIAL AND METHODS

Three patients were treated for significant symptomatic intracranial arterial stenoses. Locations involved the distal internal carotid-proximal middle cerebral artery in one case, the supraclinoid internal carotid artery in one case and the distal intradural vertebral artery in one case. Indications included repeat stroke with hemiparesis, stroke and repeat episodes of aphasia and multiple episodes of dizziness and dysarthria in one case each. A self expanding microstent system was used in each case following predilatation by a PTA balloon (the Wingspan system, Boston Scientific, Fremont, CA). All patients had angiographic follow up at 6 months and one had a follow up at 18 months, and all were clinically followed for 2 years.

RESULTS

All three lesions were successfully dilated with no more than 20% residual stenosis. Clinically, all patients remained free of new symptoms during the 2 years follow up period. Six months follow up angiogram demonstrated no restenosis in one case, but mild and significant restenosis was found in the other two cases. The significant restenosis was successfully redilated. Repeat follow up angiogram at 18 months demonstrated less than 20% recurrent stenosis only.

CONCLUSION

Stent assisted dilatation of symptomatic intracranial arterial stenosis using a self expandable microstent is a feasible technique. Considering the high rate of recurring stroke in this patient population, the clinical results in these few cases were excellent. The restenosis rate in this small group was high, but easily manageable and without clinical sequelae. Redilatation of the recurrent narrowing in one case produced durable morphological and excellent clinical results.

O10.7

STENTING FOR ATHEROSCLEROTIC STENOSIS OF THE INTRACRANIAL CEREBRAL ARTERIES -EFFECTIVENESS AND PROBLEMS-

A. Hyodo, H. Yonaha;
 University of the Ryukyus, Nishihara-cho/JP

PURPOSE

We have performed 40 procedures of intracranial stenting for atherosclerotic stenosis of the intracranial cerebral arteries. From our experiences, we will discuss the effectiveness and problems of the intracranial stenting for atherosclerotic stenotic lesions.

MATERIAL AND METHODS

Since May 1992, we have performed percutaneous transluminal angioplasty (PTA) or stenting 110 times for 104 lesions in 99 patients with atherosclerotic stenosis of the intracranial or skull base cerebral arteries. Stenting was carried out 40 times for 40 lesions in 38 cases. Stenting was performed on patients with an average age of 64. The patients were 35 men and 3 women. The stenotic lesions involved the internal carotid artery (petrous portion) in 15 cases, the internal carotid artery (cavernous portion) in 16 cases, the internal carotid artery (supraclinoid portion) in 2 cases, the middle cerebral artery (M1) in 1 case, the basilar artery in 1 case and the vertebral artery (V4) in 5 cases. The degree of stenosis ranged from 70% to 99%, with a mean of 80%. A stent for coronary arteries was used in all cases. All stents were delivered through transfemoral route under local or general anesthesia using standard endovascular technique.

RESULTS

Stent was successfully delivered in all cases. As for the complications of the treatment, subarachnoid hemorrhage occurred in 2 cases due to perforation by the guidewire, and a case within those cases, a major deficit was accepted. During the operation, cerebral infarction by distal embolism occurred in 2 cases, and a case became symptomatic (RIND). Although obstruction of the lesion occurred 3 months after treatment in 1 case, symptoms did not appear.

CONCLUSION

Stents used for atherosclerotic stenosis of the intracranial or skull base cerebral arteries still do not have sufficient performance. Although the stenting had problems, such as a prolonged patent, in the present condition, it was effective in terms of recovery from the severe stenotic lesion of the intracranial cerebral arteries.

O10.8

INTRASTENT - DEVELOPMENT OF A REGISTRY FOR INTRACRANIAL STENT TREATMENT

W. Kurre¹, M. Humpich¹, M. Parmentier¹, B.J. Nowotny², O. Gürvit¹, B. Yan³, R. Du Mesnil de Rochemont¹, M. Sitzer¹, J. Berkefeld¹, F. Zanella⁴;

¹Universitätsklinik Frankfurt, Frankfurt/DE, ²EDV, Seeheim-Jugenheim/DE, ³Royal Melbourne Hospital, Melbourne/AU, ⁴University Hospital Frankfurt, Frankfurt/DE

PURPOSE

Intracranial stenting is a relatively new therapeutic option for patients who, with intracranial arterial stenosis, have recurrent cerebral ischaemia despite medical therapy. However, the number of cases treated is low even in highly specialized centres due to the high peri-procedural risks and restricted indications. Therefore, the initiation of a large randomized study does not seem to be very promising. A registry could be a solution. The aim of this work is to develop a registry (INTRASTENT), which allows data

collection from different hospitals for a better understanding of treatment risks and results.

MATERIAL AND METHODS

To allow for quick data transfer we chose an internet-based solution. Data concerning vascular risk factors, clinical status before and after intervention and the procedure itself were to be entered. All patients scheduled for the procedure were included in the registry. We chose a three-month and a six-month interval for follow up. Three-month follow up could be done by a telephone interview, questionnaire or an outpatient visit. A six-month follow up would be done as an inpatient or outpatient. Time required for data entry was kept to a minimum by restriction of input to the most relevant information. To minimize input errors the computer interface was kept as simple as possible. Mostly tick-boxes and selection fields were used. Every participating physician could export his own data for further evaluation and compare it to the whole database for internal quality assurance. The database was tested with our own retrospective and first prospective data.

RESULTS

We designed a database which fulfilled the above requirements. The system was tested with our own 47 retrospective and 1 prospective patients treated between January 2001 and April 2006. Time required to enter data was 4.5 min/patient. Treatment results showed a technical success rate of 98%. Major stroke and death rate was 8.3% (4/48). Within the first 6 months there was one recurrent stroke in one patient and three patients were retreated for restenosis.

CONCLUSION

The INTRASTENT registry is an efficient tool for data collection from different sites. First statistical analysis of our own data shows that the results are comparable to previously published data. All centres involved in stent treatment of intracranial stenosis are invited to contribute to the registry to create a reliable database for further development of intracranial stenting. Contact information is available on www.intrastent.de.

11:30 – 13:00

SS 2

Main session: *Aneurysms Basics*

Chairs: J. Byrne, J. Pruvo

Room: ESNR / Diagnostic

ML5

NON-INVASIVE TECHNIQUES FOR THE EVALUATION OF INTRACRANIAL VESSELS

C. Taschner, Lille/FR

ML6

CTA FOR THE PRE-THERAPEUTIC WORK-UP OF INTRACRANIAL ANEURYSMS

X. Leclerc, Lille/FR

ML7

FUNCTIONAL MR METHODS FOR THE EVALUATION OF VASCULAR DISEASES

T. Krings, Aachen/DE

11:30 – 13:00

SS 6

Main session: *Aneurysms Basics*

Chairs: J. Byrne, J. Pruvo

Room: ICS / Interventional

ML5

NON-INVASIVE TECHNIQUES FOR THE EVALUATION OF INTRACRANIAL VESSELS

C. Taschner, Lille/FR

ML6

CTA FOR THE PRE-THERAPEUTIC WORK-UP OF INTRACRANIAL ANEURYSMS

X. Leclerc, Lille/FR

ML7

FUNCTIONAL MR METHODS FOR THE EVALUATION OF VASCULAR DISEASES

T. Krings, Aachen/DE

13:00 – 14:00

LUNCH SYMPOSIUM: LUNCH SESSION

14:30 – 16:30

SS 11**Room: Free Paper****Free paper session: Other / Brain Tumour**

Chairs: S. Wetzel, Valk

O11.1**CONTRAST-ENHANCED 4D SUBTRACTION MRA IN THE EVALUATION OF CNS NEOPLASMS AT 3T**T. Krings¹, P. Reinacher², K. Lodemann³, P. Stracke², J. Bunke⁴, F. Hans², A. Thron²;¹University Hospital Aachen and Hopital Kremlin Bicetre, Aachen/DE, ²University Hospital Aachen, Aachen/DE, ³Bracco-Byk Gulden, Konstanz/DE, ⁴Philips, Hamburg/DE**PURPOSE**

Advances in MR hardware performance and imaging techniques have enabled us to perform time-resolved contrast enhanced 3D MR angiographies as a clinical routine resulting in subtraction angiographies with a high temporal and spatial resolution. This technique might not only prove helpful in the evaluation of fistulae and AV malformations but also in the presurgical evaluation of tumors. Concerning angiography for tumour evaluation, the salient points are: Displacement of normal vessels, localization of bridging veins, vascularization of the tumor, and the determination of tumor feeders.

MATERIAL AND METHODS

A 3D-dynamic contrast-enhanced MR Subtraction Angiography was performed at a 3 Tesla Philips Achieva system using the keyhole technique with a centric profile ordering (from lower to higher k-values) and parallel imaging techniques (SENSE technique) to speed up the temporal resolution to 2.1 sec/3D volume while registering 160 slices with a submillimeter isotropic voxelsize, resulting in a true 3D volume block. 20 ml Multihance (Gadobenate-Dimeglumin, Bracco-Altana) was injected at a flow rate of 3 ml/sec simultaneous to the start of the dynamic study that lasted 40 seconds. 15 patients harbouring meningiomas were investigated. The dynamic MRA sequences were evaluated regarding: Differentiation into early, late arterial and venous phases, detectability of normal vessels, detection of the tumor feeders, localization of bridging veins, and tumor vascularization.

RESULTS

In all 15 investigated patients separation of early and late arterial phases, capillary phases, early and late venous phases was possible. The localization and displacement of cerebral arteries, the tumor vascularization, the anatomy of the venous system including the tributaries to the large sinuses could be well defined. Moreover, depiction of the tumor feeding vessels was possible in all cases.

CONCLUSION

Contrast enhanced 4D MR angiography proves helpful in the characterization of the degree of vascularization of brain tumors, which might help to select those patients amenable for preoperative

embolisation. Moreover, by being able to differentiate in an arterial and venous phase, the displacement of normal vessels and the localization of bridging veins can be perceived in a short period of time. The high spatial resolution even allows for demonstration of the major feeding arteries, which will help in reducing the number of conventional angiographies for tumor evaluation.

O11.2**ALTERED KINETICS OF PULSED ARTERIAL SPIN LABELING PERFUSION PARAMETERS IN DIFFERENT PERFUSION LEVELS: EVALUATION WITH TIME TO PEAK VALUES**H.J. Kim¹, N.J. Rim², S.Y. Kim²;¹Ajou University School of Medicine, Suwon/KR, ²Ajou University Hospital, Suwon/KR**PURPOSE**

BACKGROUND AND PURPOSE: Quantification of cerebral perfusion using pulsed arterial spin labeling (PASL) is complicated in the area of delayed blood transit time. We tested the altered kinetics of perfusion parameters measured by PASL in different perfusion levels according to the time to peak (TTP) values.

MATERIAL AND METHODS

MATERIALS and METHODS: 46 areas of delayed perfusion were studied in 23 patients. Three PASL-MR images with different inversion times (TIs) and a corresponding dynamic susceptibility contrast (DSC) MR images were performed in all patients. The area of decreased cerebral blood flow (aCBF) was assessed. Ratios of CBF (rCBF) were calculated for regions of interest (ROIs) according to the TTP difference (dTTP) between the ipsi- and contralateral areas.

RESULTS

RESULTS: The aCBF obtained from the three FAIR images were greater than those from the DSC-MR images in areas with more prolonged TTP (dTTP \geq 3 seconds) in all cases. The mean rCBF of the FAIR image with the shortest TI (= 800 milliseconds (ms)) was significantly lower than that with the longest TI (= 1,600 ms; $P < 0.01$) in areas with delayed perfusion irrespective of the value of dTTP. The mean rCBF of the FAIR images with the longest TI was significantly lower than those from the corresponding DSC-MR images in areas with more prolonged TTP.

CONCLUSION

CONCLUSION: If blood transit time measured by TTP is delayed significantly (dTTP \geq 3 s) in patients with carotid stenosis, the estimate of CBF obtained using PASL-MR image is lower than that obtained using DSC-MR image.

O11.3**A SIMPLE SCORING SYSTEM USING PULSED ARTERIAL SPIN LABELING AND APPARENT DIFFUSION COEFFICIENTS IN ROUTINE BRAIN TUMOR IMAGING: A PROSPECTIVE STUDY**

H.J. Kim¹, N.J. Rim², S.Y. Kim²; ¹Ajou University School of Medicine, Suwon/KR, ²Ajou University Hospital, Suwon/KR

PURPOSE

To test the feasibility of a simple scoring system using the pulsed arterial spin labeling (PASL) technique and apparent diffusion coefficients (ADC) in differentiating brain tumors during routine brain tumor imaging and to compare it with quantitative methods.

MATERIAL AND METHODS

The institutional review board and informed consent were obtained. PASL and ADC were studied prospectively in 45 suspected brain tumors. Qualitative analysis was performed using a scoring system based on tumor perfusion signal intensity (sTP) of PASL and visual ADC scoring (sADC). Quantitative analysis was performed for seven regions of interest placed in the main mass, peritumoral area, and contralateral normal area on PASL and ADC maps. The ratio of maximum tumor perfusion signal intensity (rTPmax) and minimum ADC value (mADC) were calculated. The five qualitative and quantitative parameters (sTP, sADC, sTP + sADC, rTPmax, mADC) were compared for the all suspected brain tumors.

RESULTS

The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) for determining a high-grade glioma using sTP and sADC were 81.8, 93.3, 94.8, and 77.4% and 81.8, 66.7, 78.7, and 71.0%, respectively. The combined sTP + sADC scoring resulted in a sensitivity, specificity, PPV, and NPV of 86.4, 93.3, 95.1, and 82.1%, respectively. Statistical analysis gave a threshold value of 1.75 for rTPmax and 0.98 for mADC to provide a sensitivity, specificity, PPV, and NPV of 90.9, 80.0, 87.2, and 85.4% and 86.4, 73.3, 82.9, and 73.3%, respectively. The differences in the area under the receiver operating characteristic curve between the parameters were not statistically significant.

CONCLUSION

The application of a simple scoring system using PASL and ADC is feasible in a routine brain tumor imaging protocol.

O11.4**MONOVOXEL MAGNETIC RESONANCE 1H - SPECTROSCOPY IN THE PROGRESSION OF GLIOMAS.**

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¹HUG, Geneva/CH, ²Hopital Universitaire de Gen, Gen/CH, ³University Hospitals of Geneva, Geneva, Switzerland/CH, ⁴Neuroradiology, Genève/CH

PURPOSE

The aim of this study is to determine whether repeated monovoxel MRS can reliably follow tumour progression in low-grade glioma.

MATERIAL AND METHODS

21 Patients with low-grade glioma underwent at least 3 MRS with one or more regions of interest (ROI). Four patient categories were defined. Group A: no tumour progression (8), B: tumour progression before therapy (n=10), C: good evolution after therapy (n=4), and D: bad prognosis after therapy (n=4). We studied four metabolites: Lipids, NAA/Cho, Cho/Cr, and ml/Cr.

RESULTS

For each group we found the following: A: stable lipids in 40% of cases; stable NAA/Cho (50%), unchanged Cho/Cr (60%), and stable ml/Cr (60%). B: change in lipids levels in 57.1%, with change in NAA/Cho in 42.9%, change in Cho/Cr in 35.7%, and change in ml/Cr in 50%. C: 28.6% stable lipids and NAA/Cho in 85.7% of the cases, with stable ml/Cr in 71.4% and Cho/Cr in 100%. D: change in lipids, in NAA/Cho and ml/Cr of 57.1%, and Cho/Cr in 42.9%. For progression from a grade II to grade III a sensitivity of 57.1% and specificity of 60%, with PPV of 48.8% and NPV of 54.5%. For progression under treatment we obtained a sensitivity of 57.1% by NAA/Cho and ml/Cr and a specificity of 100% by Cho/Cr and lipids, with a PPV of 80% and a NPV of 63.6%.

CONCLUSION

We found that NAA/Cho is the best marker in tumour progression before therapy, with a sensitivity of 53.9%. For the therapeutic response sensitivity was only 28.2%.

O11.5**THE VALUE OF CEREBRAL PERFUSION OBTAINED BY MAGNETIC RESONANCE (MR) AFTER GADOLINIUM IN THE DIFFERENTIAL DIAGNOSIS BETWEEN BRAIN TUMOURS WITH LOW AND HIGH GRADES OF MALIGNANCY**

J.A. Villanua¹, E. Fernández², J.A. Larrea³, E. Pardo³;

¹Osatek SA, San Sebastian-Donostia/ES, ²Osatek SA, San Sebastian-Donostia/ES, ³H. Donostia, San Sebastian-Donostia/ES

PURPOSE

The purpose of this work was to determine the value of cerebral perfusion using MR in a differential diagnosis between grade I–II and grade III–IV tumours.

MATERIAL AND METHODS

The EPI T2* cerebral perfusion sequences was performed after a dose of gadolinium of 0.1 mmol/kg at a velocity of 5 cm/s. There were 73 cases (38 grade III–IV tumours, 12 grade I–II tumours, 20 post-surgical/radio necrosis changes and 3 metastases). The data was processed afterwards on a work station and the normalised relative cerebral volume was obtained (the ratio between the highest reading of six taken from the injury and also the contra lateral white-grey matter). This sampling strategy was chosen because it was the technique that presented the lowest variability between intra and inter-observer according to work published in the literature. The ratios obtained were correlated with results from anatomical-pathological studies and/or clinical-radiological evolution using ROC curves.

RESULTS

In accordance with the obtained results under the ROC curve, the ratio that discriminated better between grade III–IV and grade I–II tumours were >1.7 ($S=100\%$, $E=83.3\%$) and >2.7 ($S=86.8\%$ and $E=100\%$). The area under the curve was 0.985, the standard error was 0.015 and the confidence interval was 95% of 0.901 at 0.996. There were 2/12 grade I–II tumours (16%) and 5/38 grade III–IV tumours (13%) situated between ratios of 1.7 and 2.7. At ratios lower than 1.7 there were no grade III–IV tumours and at ratios greater than 2.7 there were no grade I–II tumours.

CONCLUSION

The cerebral perfusion by MR alter gadolinium allows the discrimination between brain tumours with low and high grades of malignancy.

O11.6

RELATIONSHIP BETWEEN SITE OF RECURRENCE AND LARGEST PREOPERATIVE EDEMA IN PATIENTS WITH GLIOBLASTOMA MULTIFORME - INITIAL RESULTS

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PURPOSE

To measure the location of the largest edema of primary tumors and to correlate the preoperative location of the largest edema with the location of recurrences of glioblastoma multiforme.

MATERIAL AND METHODS

Retrospective analysis of 60 consecutive patients (27 female, 33 male; mean age 59 y) with recurrence of glioblastoma multiforme. Only patients without pathological enhancement in the early postoperative MRI were included. These patients were scanned in three months intervals from 48 h postoperative up to 18 months postoperative. Follow-up ended with the occurrence of the recurrent tumor. Tumor size was measured by RECIST and McDonald. Tumor location was described by a circular coordinate system centered in the middle of the resection cavity and consisting of eight parts indicating the following directions: antero-medial, medio-anterior, medio-dorsal, dorso-medial, dorso-lateral, latero-dorsal, latero-anterior, antero-lateral in the axial plane. The size of the largest edema of the primary tumor was measured from the contrast-enhancing rim of the primary tumor to the end of the maximum perifocal edema. Its location was documented in the same way as the recurrence (center of coordinate system positioned in tumor center).

RESULTS

29 primary tumors were located temporal, 17 frontal, 11 parietal, two occipital and one parieto-occipital. 49 recurrences were unilocal, 10 were multifocal and one recurrence showed diffuse spread. The mean size of recurrence was 2,9 cm (RECIST) and 6,9 cm² (McDonald). The most frequent location of recurrences (44) was dorso-medially from the center of the resection cavity.

The second most affected area was the antero-medial direction (38). The smallest amount of recurrences was found in the latero-anterior position (29). The largest preoperative edema was found in most cases (22) in the dorso-medial position. No maximum edema was described in the latero-anterior direction. If only considering the positions where maximum edema and recurrence had the same location, the most observed area was dorso-medial (17 recurrences) and the second most was antero-medial (11).

CONCLUSION

Our preliminary data show that in the area of the largest edema, the probability of recurrent tumor growth is higher than in areas with less edema observed preoperatively. These findings need to be further assessed in a larger patient population in the future. If this observation can be reproduced, therapeutic strategies would need to be adjusted.

O11.7

LONGITUDINAL STUDY OF THE INTRATUMOURAL DISTRIBUTION OF ADC VALUES IN CEREBRAL GLIOMAS

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PURPOSE

The apparent diffusion coefficient (ADC) has been shown to differ between low-grade and high-grade gliomas, with the latter having generally lower ADC values. The aim of this study is to perform a longitudinal analysis of diffusion weighted imaging (DWI) in tumours progressing from low- to high-grade gliomas, and to assess whole tumour ADC histograms and the geographical distribution of low ADC values within these tumours.

MATERIAL AND METHODS

We analyzed sequential DWI of 10 conservatively treated patients who had initially a low grade glioma that progressed to a high-grade tumour over an average period of 20.3 months (range 6 – 30 months). Seven male and three female patients were between 30 and 57 years old (average 46.7). Whole tumour histograms of ADC maps were generated and peak height (PH), peak location (PL) and 25th centile points (c25) of the histograms were calculated. We then produced thresholded colour-coded ADC maps to show exclusively areas with lower ADC values within these tumours, using the c25 of the baseline study as an upper threshold.

RESULTS

Between the baseline study and the study at transformation, 7 patients showed a left shift of the PL. Nine patients showed a decrease of c25, and eight patients a decrease in PH. In the low-grade stage, the thresholded ADC maps showed a mainly peripheral distribution of the low ADC values within the tumour, usually involving more than 50% of the tumour circumference. Following transformation, the distribution of low ADC values was less uniform, showing either eccentric peripheral nodules of low ADC (n=7) or predominately central areas of low ADC (n=3).

CONCLUSION

Longitudinal DWI demonstrated significant changes of whole tumour ADC histograms during transformation from low-grade to high-grade gliomas, which was associated with a change in the geographical distribution of lower ADC values. Longitudinal DWI contributes to the understanding of the natural history of glial tumours.

O11.8

LONGITUDINAL PERFUSION-WEIGHTED MR IMAGING IN PATIENTS WITH LOW GRADE GLIOMAS: DO CHANGES IN RCBV MEASUREMENTS PREDICT MALIGNANT TRANSFORMATION?

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PURPOSE

Relative cerebral blood volume (rCBV) measurements have been shown to be higher in high grade gliomas than in low-grade gliomas. Little is known about the changes of rCBV over time in conservatively treated low-grade gliomas (LGG). The aim of this study is to perform longitudinal rCBV measurements in LGG to assess whether an alteration in rCBV precedes conventional markers of malignant transformation.

MATERIAL AND METHODS

21 medically treated patients with LGG (aged 26–69 years) were studied longitudinally with susceptibility-weighted MR perfusion imaging, T2-weighted, FLAIR and double dose contrast-enhanced T1 weighted images at 6 monthly intervals until progression to high grade tumors occurred. Ten of 21 patients showed progression to high-grade tumors between 6–36 months (mean 19.8 months) and 11 patients remained stable over a period of 12–48 months (mean 27.8 months). Student's t-tests were used to determine differences in rCBV values between transformers (T) and non-transformers (NT) at various time points.

RESULTS

T had a slightly higher group mean rCBV than the NT at the point of study entry (2.02 versus 1.31, not significant). In NT the rCBV remained relatively stable and increased only to 1.85 over 27.8 months. T showed a continuous increase in rCBV up to the point of transformation when contrast-enhancement became apparent on the T1-weighted images. The group mean rCBV was 5.23 at transformation but showed already a significant increase from baseline to 12 months (to 3.16, $p=0.003$) and 6 months (to 3.67, $p=0.006$) before transformation. Rates of rCBV change between two successive time points were also significantly higher in T compared to NT.

CONCLUSION

In transforming LGG susceptibility-weighted MR perfusion imaging demonstrates significant increases in rCBV 12 months before contrast enhancement on T1-weighted images.

O11.9

IMPROVED VISUALIZATION OF INTRA-AXIAL GLIOMAS ON ENHANCED MR IMAGING WITH GADOBENATE DIMEGLUMINE COMPARED TO GADOPENTETATE DIMEGLUMINE: IMPLICATIONS FOR THERAPEUTIC INTERVENTION

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PURPOSE

To determine whether the high relaxivity contrast agent gadobenate dimeglumine (Gd-BOPTA) offers increased information for treatment planning in patients with cerebral glioma compared to equimolar gadopentetate dimeglumine (Gd-DTPA).

MATERIAL AND METHODS

Forty-seven patients with cerebral gliomas each underwent two MR examinations at 1.5 T. One examination was performed with 0.1 mmol/kg bodyweight Gd-BOPTA and the other with Gd-DTPA at identical dose. Administrations (2 ml/sec) were in randomized order and the interval between examinations was 2–7 days. T1wSE and T2wFSE sequences were acquired pre-dose with post-dose repetition of the T1wSE sequence. Acquisition parameters and post-dose acquisition time were identical for the two examinations. Three fully blinded readers independently evaluated all images for lesion border delineation, definition of disease extent, visualization of lesion internal morphology, lesion contrast enhancement and global preference. Differences were evaluated with the Wilcoxon signed rank test. Reader agreement was assessed using weighted kappa (κ) statistics. Quantitative lesion enhancement (% enhancement, lesion-to-brain ratio [LBR] and contrast-to-noise ratio [CNR]) was determined.

RESULTS

Gd-BOPTA was preferred globally in 24, 30 and 30 of 47 patients (readers 1, 2, 3, respectively) whereas Gd-DTPA was preferred in just 1 patient (all readers). Analogous findings were obtained for all other qualitative parameters. For each reader and each qualitative parameter the improved performance with Gd-BOPTA compared to Gd-DTPA was highly significant ($p<0.0001$). Three-reader agreement ranged from $\kappa=0.49$ (63.8%) for lesion internal morphology to $\kappa=0.68$ (80.9%) for definition of disease extent. Quantitative enhancement was significantly greater after Gd-BOPTA (% enhancement and LBR: $p<0.0001$; CNR: $p<0.004$).

CONCLUSION

The significantly improved depiction of gliomas (better lesion delineation, better definition of tumor extent and internal morphology and greater lesion enhancement) achievable with 0.1 mmol/kg Gd-BOPTA compared to equimolar Gd-DTPA facilitates improved interventional planning and better patient management.

O11.10**GEOGRAPHICAL DISTRIBUTION OF CONTRAST ENHANCEMENT, RAISED RCBV AND LOW ADC VALUES WITHIN HIGH GRADE GLIOMAS**

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PURPOSE

Pathological contrast enhancement (PCE), increased relative cerebral blood volume (rCBV), and low apparent diffusion coefficient (ADC) values have all been used as markers of malignancy in cerebral gliomas and have also been used to predict the histological tumour grade. The aim of this study is to compare the spatial distribution of these parameters within high grade gliomas, and to assess to which degree they overlap with each other.

MATERIAL AND METHODS

We studied 9 patients with WHO grade III gliomas (5 Astrocytomas, 4 Oligodendrogliomas). These patients were studied with contrast enhanced volumetric T1-weighted images, dynamic susceptibility-weighted perfusion imaging (PWI) and diffusion-weighted images (DWI) studies. Maps of rCBV and ADC were calculated and volumetric T1 weighted images were reformatted to match the slice thickness and orientation of the DWI and PWI images. We then produced whole tumour histograms of ADC. Using the 10th and 25th centile points of these histograms as upper threshold, colour-coded ADC maps were generated, showing exclusively areas with the lowest 10% (ADC10) and 25% (ADC 25) of intratumoural ADC values. We measured the rCBV in normal brain structures to produce colour-coded maps that highlighted intratumoural areas with an rCBV greater than gray matter, and that excluded large peritumoural vessels.

RESULTS

Areas of elevated rCBV were consistently larger than regions of PCE. In all cases the PCE was completely enclosed within the area of increased rCBV. Areas of ADC25 were larger than areas of PCE in eight cases; PCE was completely enclosed within ADC25 in 4 cases, with the other 4 showing only partial overlap of these regions. In one case ADC25 was contained within the PCE. Areas of ADC10 showed only partial overlap with PCE in six cases. In two cases ADC10 was contained within regions of PCE and in one case PCE lay within ADC10. There were no cases where ADC25 and ADC10 were completely separate from regions of PCE.

CONCLUSION

Areas of high rCBV show a better geographical match with areas of PCE than do areas of decreased ADC. Regions of elevated rCBV were always larger than PCE, indicating that tumour neovascularity is more widespread than blood-brain barrier breakdown. Partial overlap between PCE and low ADC values in some cases indicates that these parameters share less of a pathomechanism. These changes in ADC values may be influenced by factors such as tumour calcification and matrix composition.

O11.11**INTRA-AXIAL METASTASES: IMPROVED THERAPEUTIC DECISION-MAKING WITH GADOBENATE DIMEGLUMINE COMPARED TO GADOPENTETATE DIMEGLUMINE**

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PURPOSE

To compare equimolar 0.1 mmol/kg doses of high relaxivity gadobenate dimeglumine (Gd-BOPTA) and conventional gadopentetate dimeglumine (Gd-DTPA) for enhancement and conspicuity of intra-axial metastases.

MATERIAL AND METHODS

Thirty-seven patients with intra-axial metastases each underwent two MR examinations at 1.5 T. One examination was performed with 0.1 mmol/kg bodyweight Gd-BOPTA and the other with Gd-DTPA at identical dose. Administrations (2 ml/sec) were in randomized order and the interval between examinations was 2–7 days. T1wSE and T2wFSE sequences were acquired pre-dose with post-dose repetition of the T1wSE sequence. Acquisition parameters and post-dose acquisition time were identical for the two examinations. Three fully blinded readers independently evaluated all images for lesion border delineation, definition of disease extent, visualization of lesion internal morphology, lesion contrast enhancement and global preference. Differences were evaluated with the Wilcoxon signed rank test. Reader agreement was assessed using weighted kappa (κ) statistics. Quantitative lesion enhancement (% enhancement, lesion-to-brain ratio [LBR] and contrast-to-noise ratio [CNR]) was determined.

RESULTS

Significant ($p \leq 0.035$) preference for Gd-BOPTA was expressed by all readers for all qualitative comparisons. Lesion contrast enhancement was preferred in 18, 21, 25 patients after Gd-BOPTA compared with 2, 3, 4 patients after Gd-DTPA (readers 1, 2, 3, respectively). Similar preference was noted for global preference (18, 20, 26 patients vs. 2, 3, 5 patients, respectively) and all other qualitative parameters. Reader agreement was good for all evaluations (up to $\kappa = 0.55$; 67.6%). Quantitative enhancement was also significantly greater after Gd-BOPTA (% enhancement: $p \leq 0.013$; LBR: $p \leq 0.002$; CNR: $p \leq 0.04$).

CONCLUSION

Visualization of brain metastases is significantly better with Gd-BOPTA. Potential clinical implications are improved surgical decision-making (yes/no) based on improved depiction of lesion number and location, and improved surgical planning and follow-up. Gd-BOPTA may be the preferred contrast agent for MR screening in patients with confirmed systemic cancer.

O11.12

PLANNING, EVALUATION AND INSTALLATION OF A PICTURE ARCHIVING AND COMMUNICATION SYSTEM (PACS) IN A UNIVERSITY HOSPITAL - THE BERN EXPERIENCE

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PURPOSE

To describe our experience from the earliest planning phases to the final installation of a PACS in a 1060 bed hospital and to point out potential pitfalls in a project like this.

MATERIAL AND METHODS

In 1998, we began to plan the installation of a PACS in our university hospital. After an extensive planning phase, the first units were installed in 2003. Now, we have three years experience with a PACS that manages more than 100000 radiological studies per year and serves 950 physicians clinic-wide.

RESULTS

Due to developments like multi-slice CT, introduced in the early 2000s, the amount of data that we handle today is eight times higher than initially planned. The number of concurrent licenses for simultaneous access to the system also had to be increased compared to previous analysis. The system was readily accepted; radiologists are generally more critical than the clinical partners. Performance problems could be solved in close cooperation with the manufacturer.

CONCLUSION

When planning a PACS, users are well advised to plan for a generous installation as the amount of data and the data traffic on the local network tend to increase between planning and actual installation. Wide-spread open communication within the hospital helps to have the system accepted by users outside the radiology department. Within the department, PACS does not simply mean another archival medium, but it involves marked changes in technicians' and physicians' workflow.

14:30 – 17:00

SS 3**Main session:** *Stroke Basics*

Chairs: A. Gouliamos, L. Remonda

Room: ESNR / Diagnostic**ML8**

IMPACT OF NEUROIMAGING IN STROKE

A.E. Baird, Bethesda, MD 20892–1294/US**ML9**

DISTRIBUTION TERRITORIES AND THEIR CAUSE ON STROKE

A. Rovira, Barcelona/ES**ML10**

USEFULNESS OF CT IN STROKE MANAGEMENT

R. Von Kummer, Dresden/DE**ML11**

CT PERFUSION IN STROKE

R. Meuli, Lausanne/CH**ML12**

DIFFUSION MRI IN STROKE

K. Lövblad, Geneva/CH

14:30 – 16:30

SS 7**Main session:** *AneurIST*

Chairs: A. Frangi, J. Cebral

Room: ICS / Interventional**ML13**

AN INTEGRATIVE APPROACH TO RISK ASSESSMENT AND THERAPY PLANNING

R. Hose, /

ML14

ANEURYSMS: A MULTIFACTORIAL AND COMPLEX DISEASE PROCESS

R. Poston, /**ML15**

INTEGRATING BIOMEDICAL DATA FOR ITS MINING: AN ALTERNATIVE ROUTE TO UNDERSTANDING DISEASE?

M. Hofmann, /**ML16**

MINING CLINICAL DATABASES

D. Sturkenboom, /

16:30 – 17:30

COFFEE BREAK SYMPOSIUM: COFFEE BREAK SYMPOSIUM

16:30 – 17:00

COFFEE BREAK: COFFEE BREAK

17:00 – 19:30

SS 12**Free paper session: Other**

Chairs: O. Flodmark, M. Vargas

Room: Free Paper**O12.1**

PASSIVE FILTERING FOR NOISE REMOVAL FROM ELECTRICAL NERVE STIMULATION CABLES DURING FUNCTIONAL MAGNETIC RESONANCE SPECTROSCOPY (fMRS) AND IMAGING (fMRI)

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PURPOSE

When using electrical nerve stimulation in functional magnetic resonance spectroscopy (fMRS) and imaging (fMRI), a direct cable connection from the outside has to be used because there is no MR compatible stimulation equipment. This electrical connection introduces noise from the outside. We investigated passive filtering for pulses up to 400 V and 100 mA.

MATERIAL AND METHODS

Electrical pulses of 0.2 ms duration were applied with two surface electrodes to the peroneal or ulnar nerve of subjects participating in a fMRS and BOLD imaging study at 1.5 Tesla. The stimulation equipment on the outside was connected to the subject with a shielded cable, with or without a passive high frequency (low pass) RC filter (cutoff frequency 10 kHz), or a low frequency (high pass) filter (cutoff 700 Hz).

RESULTS

Image and spectroscopy artifacts with components at 50 Hz and 17 kHz were present. The high frequency filter removed the artifacts and also reduced background noise, while not altering stimulation parameters. The low frequency filter had no effect on

MR quality, but consumed a significant proportion of the electrical pulses, which had to be compensated for by higher currents to achieve equivalent nerve stimulation.

CONCLUSION

The cable introduces noise and discernible artificial frequency components, probably corresponding to the vertical and horizontal blanking intervals from local television signal at a carrier frequency which, around 63 MHz, happens to be the same as the 1H resonance frequency at 1.5 Tesla. High frequency filtering is sufficient to remove the artifacts and reduce the noise without reducing the efficiency of stimulation. Supported by the Swiss National Science Foundation (SNF grant 3200B0-107499/1)

O12.2

NEURONAL NETWORK OF COMPLEX MANUAL FORCE CONTROL: INITIAL RESULTS OF A NEW MR-COMPATIBLE HAPTIC DEVICE

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PURPOSE

The neuronal network that controls complex manual force was investigated by the combination of fMRI and a newly developed MR-compatible haptic device. This haptic device allows applying force and motion to index finger and thumb of the subject (passive movement of the subject) and simultaneously measure position, motion and the force of the subject (active movement of the subject).

MATERIAL AND METHODS

In the baseline CONSTANT condition, subjects had to maintain constant position with index finger/thumb according to visual feedback, while a constant force field was applied. The complex VARYING condition was identical except for unpredictably varying force field.

RESULTS

CONSTANT and VARYING activated the well-known motor network including primary motor area (M1) and supplementary motor area (SMA). VARYING compared to CONSTANT revealed stronger activations in M1, SMA and cerebellum, which implies a fundamental functional role of these areas in complex manual force control.

CONCLUSION

The presented initial results of the new tactile device allowed the assessment of the neuronal network that mediates complex manual force control in healthy subjects. Eventually, the presented haptic device is intended as standardized and reproducible investigation tool of motor control - with or without simultaneous fMRI measurement - in patients with motor deficiency like stroke or Parkinson's disease.

O12.3

CORRECTIVE SACCADDES DURING FIXATION, PURSUIT AND PRO-SACCADDES EVOKE SPECIFIC NEURONAL ACTIVATIONS AND REPRESENT PUTATIVE SYSTEMATIC CONFOUNDS FOR THE STUDY OF EYE MOVEMENTS

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PURPOSE

Corrective saccades are small eye movements that redirect gaze whenever the actual eye position differs from the desired eye position. In contrast to various forms of saccades including pro-saccades, retro-saccades or memory guided saccades, corrective saccades have been widely neglected so far. The fMRI correlates of these corrective saccades were studied, that spontaneously occurred during fixation, pursuit or saccadic tasks.

MATERIAL AND METHODS

Eyetracking was performed during the fMRI data acquisition with a fiber-optic device. Using a combined block and event-related design, we isolated the cortical activations associated with visually guided fixation, pursuit or saccadic tasks and compared these to the activation associated with the occurrence of corrective saccades.

RESULTS

Specific neuronal activations associated with corrective saccades were present in anterior inferior cingulate and bilateral middle and inferior frontal gyri, bilateral anterior insula, left inferior temporal gyrus and cerebellum. Additionally, overlapping activations with the established pro-saccade and, to a lesser extent, overlapping activations with pursuit network were present. The extent and distribution of these enhanced cortical activations depended in part on the underlying oculomotor task.

CONCLUSION

The presented results imply that corrective saccades represent a potential systematic confound in eye-movement studies, in particular because the frequency of spontaneously occurring corrective saccades significantly differed between fixation, pursuit or pro-saccades.

O12.4

ENHANCING NON-AUDITORY BOLD EFFECTS BY SOUND-ATTENUATED, CONTINUOUS GRADIENT NOISE EMITTING EPI: A DATA-DRIVEN PERSPECTIVE

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PURPOSE

Emission of continuous instead of pulsed scanning noise by a novel quasi-steady gradient switch pattern results in sound-attenuated EPI. By hypothesis-driven analyses according to the general linear model (GLM), this has previously been shown to enhance auditory as well as non-auditory BOLD responses. Here we illustrate that a data-driven multi-subject approach by tensorial extension of probabilistic independent component analysis (tensor-PICA) reveals additional evidence for enhancement of task-related and -unrelated non-auditory BOLD effects evoked by a working memory paradigm.

MATERIAL AND METHODS

In two random sessions, sixteen healthy subjects were scanned by conventional pulsed and novel continuous sound emitting EPI while performing a non-auditory N-back working memory task. For data analysis, tensor-PICA was used to simultaneously estimate modes of variation which represent information from the spatial, temporal and session / subject domain. Results are compared to a previous GLM-based analysis.

RESULTS

In contrast to the hypothesis-driven GLM approach, tensor-PICA revealed a task-related motor component exhibiting a significant 20% increase in effect size for the continuous as opposed to conventional EPI. Furthermore, another task-unrelated component was significantly different between continuous and conventional EPI scanning. It introduces "structured noise" of a broad power spectrum (arising from liquor and cardiac pulsations, for example) but is precluded from detection by GLM analyses.

CONCLUSION

Data-driven multi-subject analysis by tensor-PICA provides additional evidence for enhancement of task-related and -unrelated non-auditory BOLD effects by novel continuous sound emitting EPI. In contrast to standard GLM analyses, common spatiotemporal components modulated by the session / subject mode can be extracted and directly compared in their effect size. Contaminating "structured noise" is properly accounted for and may, in addition to auditory and non-auditory responses of interest, also be influenced by EPI gradient noise. Sound-attenuated continuous EPI seems more sensitive to non-auditory paradigm-related as well as -unrelated BOLD effects despite comparable task performance.

O12.5**FMRI OF THE HUMAN SENSORIMOTOR CORTEX AFTER TOE-TO-FINGER TRANSPLANTATION - INITIAL EXPERIENCE**

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PURPOSE

To prospectively investigate functional changes of the brain and somatotopic representation of transplanted toes, after toe-to-finger transplantation, using motor and sensory fMRI.

MATERIAL AND METHODS

Six patients who had toe-to-finger transplantation for 3–8 years received motor and sensory functional magnetic resonance studies from transplanted toes and opposite corresponding normal fingers. The motor task was performed by repetitively tapping the transplanted toe or finger against the thumb whereas the sensory task was applied by tactilely stimulating the pulp of the transplanted toe or finger.

RESULTS

The main activation areas from both types of stimulations were located in the expected location of finger homunculus of the primary sensorimotor cortex. In addition, activated volumes from the transplanted toes were significantly greater than those from the opposite fingers ($P = 0.017$ for motor task and $P = 0.005$ for tactile sensory task, paired samples Students' *t*-test).

CONCLUSION

Functional recruitment in the primary sensorimotor cortex seemed to have occurred following toe-to-finger transplantation. The transplanted toe was somatotopically represented in the hand area.

O12.6**HAND MUSCLE FUNCTIONAL MAGNETIC RESONANCE SPECTROSCOPY (fMRS) DURING TETANIC ELECTRICAL NERVE STIMULATION: NORMAL RANGE**

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PURPOSE

Functional magnetic resonance spectroscopy (fMRS) allows for a well standardized, non-invasive assessment of metabolites involved in energy turnover before, during and after electrically imposed muscle activity in large leg muscles. Some nerve and muscle diseases selectively affect small, distal muscles which are not easily amenable to spectroscopy. The aim of this study was to derive normal values for small hand muscles.

MATERIAL AND METHODS

15 healthy volunteers were included up to now. The hand was placed with a glove into a cylindrical vessel filled with water to allow for a shim quality sufficient for spectroscopy. The ulnar nerve was stimulated with a supramaximal (20–40 mA) electrical

pulse train of 20 Hz during 2 min to achieve an isometric maximal tetanic muscle contraction. Proton spectra of those thenar muscles innervated by the ulnar nerve were acquired with a 12 s temporal resolution before, during and after stimulation.

RESULTS

Due to their small size, the signal-to-noise ratio (SNR) in hand muscles was considerably lower than for the larger leg muscles reported earlier. The decrease of the phosphocreatine (CrP) associated peaks during, and the incomplete recovery in the first minutes after stimulation, was comparable to the leg muscles, but the increase in acetyl carnitine (AcCt) was seen less consistently.

CONCLUSION

Assessment of muscle metabolites with fMRS during electrically imposed maximal exercise is also possible in small hand muscles, and normal values can be obtained. Supported by the Swiss National Science Foundation (SNF grant 3200B0-107499/1)

O12.7**HIPPOCAMPAL MALROTATION IN SUBJECTS WITHOUT SEVERE DEVELOPMENTAL ANOMALIES - HIGHER FREQUENCY IN PATIENTS HAVING EPILEPSY**

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PURPOSE

Development of the hippocampus during the fetal period has been explained as progressive infolding of the gyrus dentatus, cornu ammonis, subiculum and parahippocampal gyrus around the progressively smaller hippocampal sulcus. Hippocampal malrotation is a condition in which the inversion of the hippocampus has not become completed. It is common in patients with severe developmental malformations and has also been described in patients having epilepsy. We have reported previously that hippocampal malrotation is found in 19% of subjects without obvious developmental anomalies and without epilepsy. The aim of this study was to compare the frequency of hippocampal malrotation in populations having and not having epilepsy. Subjects with obvious developmental anomalies were excluded.

MATERIAL AND METHODS

296 patients, examined with MRI, were drawn from the regional epilepsy register. MRI examinations of the brain of 132 subjects without epilepsy were used as controls: 20 of them were healthy volunteers, 112 were patients without obvious intracranial developmental anomalies, intracranial masses, hydrocephalus or any other condition which may affect the structures of the temporal lobes. The examinations of the epilepsy patients and the controls were mixed and evaluated by an experienced radiologist in a blinded way. 74 epilepsy patients were excluded because of a disease or condition affecting the temporal lobes on MRI. The final material consisted of 222 epilepsy patients and 132 controls. The coronal images were used for analysis of the hippocampal regions.

RESULTS

Hippocampal malrotation was found in 25/132 controls (19%) and in 65/222 epilepsy patients (29%). The difference was statistically significant ($p < 0.05$). Distribution between bilateral and unilateral

malrotations was the same in both groups. In the controls, malrotation was bilateral in 7/25 subjects and unilateral in 18/25. In the epilepsy group, it was bilateral in 17/65 and unilateral in 48/65. In the epilepsy group, 43/48 unilateral malrotations were on the left side and 5 on the right. In the controls, malrotation was never found on the right side.

CONCLUSION

Hippocampal malrotation is common in non-epileptic subjects but it is significantly more common in epilepsy patients without obvious intracranial developmental malformations. Unilateral hippocampal malrotation is more common than bilateral. It is noteworthy that unilateral hippocampal malrotation on the right side was only seen in the epilepsy patients.

O12.8

3 TESLA MRI T2 RELAXOMETRY OF SUBTHALAMIC NUCLEI IN HEALTHY CONTROLS: AN ANALYSIS OF THE SUBTHALAMIC AREA TO IMPROVE TARGETING IN DEEP BRAIN STIMULATION (DBS)

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PURPOSE

The clinical demand on improvement of MR-imaging of midbrain structures is motivated by a therapeutic approach with deep brain stimulation (DBS). Deep brain stimulation (DBS) of the subthalamic nucleus (STN) is an established therapy in Parkinson's disease. New therapeutic targets and indications are in evaluation. Our aim is to optimise the MR-sequences for visualisation of the subthalamic nucleus (STN) and adjoining parenchyma as well as characterisation of the STN, nucleus ruber (NR) and substantia nigra (SN) by T2 relaxometry at 3 Tesla MRI.

MATERIAL AND METHODS

Nine healthy subjects without neurologic diseases (6 men, 3 women, age range 22–57, average 34,9) were examined using 3 Tesla Trio (Siemens Medical Solutions, Erlangen, Germany). STN was identified and measured in a 3D T2 weighted TSE-sequence with TR 2500 or 3000 ms, TE 354 ms in an 8 channel head coil. A multi-contrast SE sequence with TR 1500 was performed at TE 12 ms to 96 ms in steps of 12 ms. The signal decay was fitted using a Levenberg-Marquardt algorithm. The T2-values of STN, NR and SN were measured with an automated ROI-analysis on grey-scale basis additionally to manual marking of the nuclei. The T2 maps were identified on a single image plane best showing the STN in a series of TE. The ROIs were placed manually using an image at TE =72 ms where the STN showed best contrast. The ROIs were chosen to cover the centres of the nuclei with the resulting signal being the average of the intensity values covered by the chosen ROIs. For reference values a ROI was placed into right frontal cortex and into right centrum semiovale.

RESULTS

The average T2-values were for NR T2=67 ms, SN T2= 72 ms and STN T2= 92 ms allowing for automatic delineation of the nuclei against the surrounding tissue.

CONCLUSION

3 Tesla imaging improves the visualisation of STN and of the adjoining parenchyma to a degree of high reliability. Healthy controls show very little variability in T2 relaxometry and morphology of the STN. The STN, NR and SN nuclei show weak contrast with regard to each other but seem to have distinct relaxometric properties. The T2 values of the nuclei are distinct from the surrounding tissue. We expect a further improvement in imaging as well as the possibility of automatic segmentation of the nuclei by implementing a multimodal image analysis algorithm using the different relaxometric properties of the nuclei. The role of T2 relaxometry in patients remains to be evaluated.

O12.9

3 TESLA DIFFUSION TENSOR IMAGING WITH REGARD TO THE BASAL GANGLIA, ESPECIALLY MAIN THALAMIC NUCLEI, GLOBUS PALLIDUM AND NUCLEUS SUBTHALAMICUS: A METHOD FOR VISUALISATION THE ANATOMIC CONNECTIVITIES OF THE BASALGANGLIA.

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PURPOSE

Objective: The basal ganglia, especially thalamus, globus pallidum and nucleus subthalamicus are therapeutic targets in the treatment of different neurologic diseases by deep brain stimulation (DBS). Until recently the procedure depended on arithmetical calculation of the targets, because direct visualisation of the targets, esp. nucleus ventro-intermedius is challenging even at 3T high resolution Magnetic Resonance Imaging (MRI) with sophisticated sequences. Until now, low field diffusion tensor imaging (DTI) has not a sufficient resolution of anatomic connectivities to be clinically relevant for DBS of the basal ganglia. As high field MRI has already proven a superior morphologic resolution, our attempt is to apply these properties to DTI to improve the imaging of anatomic connectivities of the basal ganglia.

MATERIAL AND METHODS

Methods: (SE-EPI) DTI sequences were performed on a 3 Tesla Trio (Siemens Medical Solutions, Erlangen, Germany) using two different parameter settings a) b=0,1200 s/mm² , Matrix 64×64, 42–45 directions, AVG=4 and b) b=0,1200 s/mm² , Matrix 192×192, 6 directions, AVG=4. Anisotropy values were calculated in the thalamic nuclei, globus pallidum, nucleus subthalamicus and the surrounding tissue. Fiber tracking was performed according to the Parker algorithm as a part of a house intern algorithm. The DTI was coregistrated with a high resolution 3D T2 TSE sequence for anatomic identification. Schaltenbrand and Wahren Anatomic Atlas

(Thieme, Stuttgart 1977) and Salamon's Neuroanatomy and Neurovasculature Web-Atlas Resource were used as anatomic reference.

RESULTS

Results: Characterization of the main thalamic nuclei, globus pallidum and of the subthalamic structures and their connectivities by their most prominent fibertracts was accomplished.

CONCLUSION

Conclusions: Combined 3D-T2 and DTI at 3Tesla of particular thalamic nuclei, globus pallidum and nucleus subthalamicus allows a more detailed morphologic localisation of particular nuclei in the basal ganglia. The anatomical connectivities are the basis of optimised mathematical models for future functional imaging and open the possibility of new targets for DBS.

O12.10

STRUCTURAL 3TESLA MAGNETIC RESONANCE IMAGING IN DRUG RESISTANT EPILEPSY - DO SURFACE COILS PROVIDE ADDITIONAL INFORMATION?

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PURPOSE

To assess the additional value of surface coils for the detection and characterization of cerebral lesions in 3Tesla (T) magnetic resonance imaging (MRI) of patients with drug resistant epilepsy.

MATERIAL AND METHODS

25 patients (mean age 19 years, range 4–51 years) with drug resistant epilepsy undergoing evaluation for epilepsy surgery were examined with high resolution MRI to further improve the morphological evaluation of the brain, especially the cortex. They had previously been examined with MRI at 1.5T or lower field strength. MRI was performed with a 3T scanner (Philips Intera) using a 4-channel head coil and parallel imaging. The protocol included T2-weighted FLAIR and T1-weighted 3D gradient echo (isotropic 1 mm resolution) sequences covering the entire brain and T1-weighted inversion recovery (IR) sequences in 2 planes (resolution 0.4×0.4 mm, slice thickness 2 mm) covering the region with the suspected epileptogenic zone. In addition, surface coils were applied over the latter region obtaining T1-weighted IR sequences in 2 planes with 0.4 mm×0.4 mm resolution and 1.2 mm slice thickness. In MRI negative patients placement of the coils was defined by semiological analysis, subtraction ictal SPECT co-registered with MRI, PET and extracranial video-EEG. All images were retrospectively evaluated with knowledge of the lateralization of the suspected focus.

RESULTS

Pathology was detected on MRI in 12 patients and no abnormalities were found in the remaining 13 patients. The identified epileptogenic lesions were cortical dysplasia in 6, heterotopic gray matter in 1, hippocampal sclerosis in 3, white matter lesions in 1, and atrophy in 1 patient. 3T MRI provided new or additional information compared with reports from previous MRI in 6 patients. Surface coil MRI visualized the cortical lesions with somewhat better demarcation and detail, but did not add information regarding extent or type of lesion and did not

contribute to the detection of previously not visualized lesions. Surface coil MRI was inferior to head coil MRI for evaluation of subcortical structures due to the inherent signal decrease with increasing distance from the coil.

CONCLUSION

3T MRI with high resolution is valuable for the detection and characterization of structural lesions in patients with drug resistant epilepsy. Surface coil imaging at 3T does not provide additional information that would influence the therapeutic decisions.

O12.11

MRI BEFORE PARIETAL AND OCCIPITAL LOBE EPILEPSY SURGERY

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PURPOSE

To analyze the diagnostic accuracy of MRI in patients undergoing parietal and occipital lobe epilepsy surgery.

MATERIAL AND METHODS

In a retrospective study, we analyzed MRI scans and neuropathology reports of 41 patients who had undergone resective epilepsy surgery in the parietal and occipital lobe between 1998 and 2003. We evaluated, whether lesions were precisely characterized by MRI and whether lesion characterization allowed to estimate postsurgical seizure outcome.

RESULTS

Within the categories epilepsy associated tumors, focal cortical dysplasias, vascular malformations, scarring, and others, MRI was congruent to histopathology in 36 of 41 (88%) lesions. Histopathologic diagnosis was at least questionable in 2 of 5 differently classified lesions. Seizure freedom (Engel class I) was achieved in 24 patients (59%) which is slightly worse than for temporal lobe epilepsy surgery. Seizure outcome was different for lesion categories (Engel class I: epilepsy associated tumors, 58%; focal cortical dysplasias, 69%; vascular malformations, 75%; scarring, 40%), and was unchanged if no lesion was found on preoperative MRI.

CONCLUSION

If MRI and histopathology are discordant, not only the MRI findings may be debatable. MRI lesion detection is important, since chance of seizure freedom is low if no lesion is detected.

O12.12

LOCALIZATION OF SYNCHRONIZED BRAIN ACTIVITY USING COMBINED ELECTROENCEPHALOGRAPHY AND FUNCTIONAL MAGNETIC RESONANCE IMAGING IN FOCAL EPILEPSY

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PURPOSE

Combining fMRI with EEG is a promising addition to the current battery in the workup of epilepsy patients for resective surgery. Areas of EEG/fMRI activations to interictal spikes are likely to represent the irritative zone, which is itself a reflection of the epileptogenic zone. This information may guide depth electrode and grid placement as well as tailoring resections. The present project aims to develop a feasible path to overcome the deficiencies of EEG and fMRI in spatial and temporal resolution, and to provide a matrix of connectivity between brain regions involved into the generation and the network of epileptic seizures.

MATERIAL AND METHODS

The analysis is tailored to identify consistent patterns of transient connectivity between brain regions in the blood oxygen level-dependent (BOLD) signal, the EEG frequency spectrum, and the EEG topographies, through synchronized oscillations using independent component analysis (ICA). Patients with focal epilepsies (either with frontal lobe epilepsy, FLE; or with temporal lobe epilepsy; TLE) were recorded with simultaneous EEG-fMRI @3T (Siemens Magnetom Trio). Post processing of the EEG/fMRI data included the convolution of the time-varying intensity of the different topographies and frequencies with the hemodynamic response function. The time-scales of the EEG were mapped onto the much slower time-scale of the fMRI. Statistical models that used the time- and frequency varying amplitude of the identified EEG topographies of interictal spikes were computed as predictors for the fMRI BOLD changes. Regions with significant correlation were interpreted as having been active synchronously at specific EEG frequencies during the time course of the interictal discharges.

RESULTS

Continuous EEG/fMRI detected the irritative zone, as displayed by the interictal spike activity. In the first four patients we measured, there was a decreased BOLD signal in the irritative zone, indicating an increased metabolic demand or neuronal inhibition. The interictal focus localisation was in accordance with previously and simultaneously recorded EEG sources and fitted the clinical semiology. Moreover, we found that the combined EEG/fMRI provided additional activations in the propagated network during interictal spiking in remote brain areas.

CONCLUSION

Preliminary data suggest, that combined EEG/fMRI recordings using independent component analysis may provide hypothesis independent information about the irritative zone and networks involved in partial epilepsies.

O12.13**REVERSIBILITY OF CEREBRAL FOCAL WHITE MATTER LESIONS IN CIRRHOSIS AFTER LIVER TRANSPLANTATION**

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PURPOSE

The aim of this study was to investigate potential changes in T2-weighted focal lesion load in the brain of cirrhotic patients after

liver transplantation and assess the relationship between these changes and overall cognitive function.

MATERIAL AND METHODS

We used MR imaging to measure the total volume of supratentorial focal white matter lesions in 30 patients with liver cirrhosis 4 to 6 weeks before liver transplantation using a semiautomatic segmentation technique (DISPImage program) performed by a trained technician. None of the patients showed signs of overt hepatic encephalopathy; all were perfectly alert, without flapping tremor, and oriented in space, person and time. All patients underwent neuropsychological assessment, consisting of a short battery of tests designed to give a general assessment of neuropsychological function and to detect the most frequently impaired functions. The results of the neuropsychological tests were combined into a single general index we have termed overall cognitive function. In 27 of these patients brain MR imaging and neuropsychological assessment were repeated 6 to 12 months after liver transplantation. The study could not be repeated in the three remaining patients because of death (n=2) or a clinically unstable condition (n=1).

RESULTS

Baseline MR examination identified focal T2-weighted lesions in 20 patients (66.6%). This group was significantly older than those who presented normal brain MR scans (60.2 vs. 46.1 years; $P=.001$). No significant differences were observed between the groups in cardiovascular risk factors or biological parameters of liver dysfunction. Baseline T2 lesion load showed a significant correlation with overall cognitive function ($r=-.710$; $P<.0001$). A significant reduction in T2 lesion load was observed after liver transplantation (28% decrease; Wilcoxon test $P=.001$). The T2 lesion load decrease correlated significantly with an improvement in the overall cognitive function ($r=-.710$; $P=.001$).

CONCLUSION

Focal signal changes on brain MR imaging are common in patients with liver cirrhosis. These abnormalities are partially reversible after liver transplantation and the changes correlate significantly with overall cognitive function improvement. This observation can be explained by the presence of focal brain edema in areas with a special vulnerability, probably induced by the presence of age-related microvascular changes.

O12.14**DIFFERENTIAL DIAGNOSIS OF AIDS-RELATED LESIONS AND NEUROCYSTICERCOSIS BY MR AND CT IMAGING.**

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PURPOSE

Neurocysticercosis as well as AIDS are frequent diseases in Central America, and the combination of both entities can pose diagnostic problems. Therefore, we looked for differential diagnostic features in cerebral imaging.

MATERIAL AND METHODS

We retrospectively analysed the MR and CT images of a group of 25 patients with neurocysticercosis proven by biopsy, serology and/or clinical course (response to treatment within one month in most cases) and compared them to the typical findings of AIDS patients suffering from toxoplasmosis, tuberculosis, lymphoma and HIV-related white matter lesions.

RESULTS

Cysticercosis shows a typical course of ring-enhancing lesions without much edema as long as the larva is alive (vesicular stage), which may increase after treatment (colloid stage). Old lesions are

calcified. Most cysts are intraparenchymal, but intraventricular cysts can cause hydrocephalus. Unusual presentations are acute encephalitis in children, subarachnoid grape-like clusters causing granulomatous arachnoiditis and miliary seeding.

CONCLUSION

Although in some cases imaging findings as (i) extraparenchymal localization, (ii) calcification and (iii) lack of edema in the first stage can differentiate cysticercosis from typical AIDS-related lesions, the differential diagnosis is still a challenge and depends on further clinical information.

17:00 – 19:00

SS 4

Main session: *Stroke Basics*

Chairs: K. Lovblad, L. Remonda

Room: ESNR / Diagnostic

ML17

MRI AS A PREDICTOR OF HEMORRHAGE

C. Oppenheim, Paris Cedex 14/FR

ML18

CT VS MRI IN STROKE

J.B. Fiebach, Essen/DE

ML19

IMAGING THE ISCHEMIC PENUMBRA

S. Warach, Bethesda/US

ML20

NEUROIMAGING IN PEDIATRIC STROKE

P. Hüppi, Genève/CH

17:30 – 19:30

SS 8

Main session: *Aneurysm Rupture Risk*

Chairs: D. Rüfenacht, W. Taki

Room: ICS / Interventional

ML21

EPIDEMIOLOGICAL ASPECTS

G. Rinkel, Utrecht/NL

ML22

MORPHOLOGY: SHAPE ANALYSIS

A. Frangi, Barcelona/ES

ML23

FUNCTION: FLOW AND SHEAR STRESS

A. Takahashi, Tohoku University, Sendai/JP

ML24

PERIANEURYSMAL CONTACT

D. San Millan Ruiz, HUG, Geneva/CH

19:00 – 19:30

Main session: *Roundtable Discussion*

Chairs: K. Lovblad, L. Remonda

Thursday, September 14, 2006

08:00 – 09:30

SS 13

Room: ESNR / Diagnostic

Main session: *Tissue characterization*

Chairs: M. Law, S. Wetzel

ML25

MR SEQUENCES

İ Özsarlak, Edegem/BE

ML26

CLINICAL RELEVANCE OF RECENT ADVANCES IN MRI TECHNOLOGY

G. Sorensen, Director, MGH Martinos NMR Center, Charlestown/US

ML27

SPECTROSCOPIC TECHNIQUES

R. Kreis, Bern/CH

08:00 – 10:00

SS 17

Room: ICS / Interventional

Main session: *Clinical Experience: Stenosis*

Chairs: J. Berkefeld, W. Taki

ML28

INTRACRANIAL STENOSIS

S. Bracard, Nancy CEDEX/FR

ML29

INTRACRANIAL STENOSIS

N. Sakai, Osaka/JP

ML30

INTRACRANIAL STENOSIS

J. Liu, /CN

ML31

INTRACRANIAL STENOSIS

P. Lylyk, Buenos Aires/AR

08:00 – 09:30

SS 21

Room: Free Paper

Free paper session: *Cerebrovascular / Interventional*

Chairs: X. Leclerc, L. Remonda

O21.1**TEST OF A NEW CLOT RETRIEVING WIRE WITH POLY-VINYL ALCOHOL HYDROGEL VASCULAR MODELS**

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PURPOSE

Cerebral embolism is one of the major causes of cerebral infarction. Recently, mechanical embolectomy has been proposed as a rapidly effective method. We performed a preclinical evaluation of a new mechanical clot retrieving wire. This clot retrieving wire consists of three nitinol loops at the tip of a micro guide wire. These 3 loops can be collapsed into a 0.018 inch wire compatible microcatheter. Each loop is 8 mm long and 3.5 mm wide.

MATERIAL AND METHODS

For simulation, poly-vinyl-alcohol vascular models exhibiting human like anatomy of the carotid (8 models) and vertebro-basilar (3 models) circulation were constructed. A pulsatile flow circulation system was used. Embolic clots were produced using pig blood plasma. The clot location was documented and clot retrieval with this wire was attempted through braided and non-braided microcatheters.

RESULTS

The micro catheter and the micro guide wire were advanced beyond the clot. The wire was then exchanged for the retrieving wire. The microcatheter was then slightly pulled back, to open the loops. Clot catching was attempted by withdrawal of the system. Once caught, the clot was retrieved to the guiding catheter tip. We investigated the following points: ease of device deployment, clot capture capability, clot removal against blood flow and removal of the clot out of the introducer system. A total of 104 procedures in 11 PVA models were performed and evaluated. We succeeded in partial and total recanalization in 51.0% (53/104) within 30 minutes.

CONCLUSION

We have tested in vitro a new clot retrieving device that allows to recanalize vessels in conditions simulating acute human stroke. A clinical trial in Europe will start soon.

O21.2**ASSESSMENT OF PROXIMAL BALLOON OCCLUSION IN MECHANICAL THROMBECTOMY - AN ANIMAL STUDY FOR ACUTE STROKE TREATMENT**

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PURPOSE

To evaluate the impact of proximal balloon occlusion on the success and complication rate during mechanical thrombectomy.

MATERIAL AND METHODS

In vivo experiments were performed in swines using catheters and devices that are applied in clinical routine. After embolization of the lingual or internal carotid artery with a barium-marked

thrombus, thrombectomy was performed in the angiography suite. Thrombectomy was done by aspiration (proximal approach) in 5 occlusions with respectively without proximal balloon protection. For the distal approach of thrombectomy the Catch device (Balt, Montgomery, France) was used in 5 occlusions with respectively without balloon occlusion. A maximum of five retrieval attempts were allowed per occluded vessel. Recanalization rate, vasospasm and loose of thrombotic material during retrieval were recorded.

RESULTS

When using aspiration catheters for thrombectomy (proximal approach) proximal balloon protection had no significant influence on recanalization rate, the occurrence of vasospasm or thrombembolic events. During the distal approach by the Catch device, thrombembolization occurred in 6 of 23 retrieval attempts. The risk of thrombembolization was significantly lower when proximal balloon occlusion was applied (Odds ratio 7.1, 95% Confidence interval: 0.7 – 75.2). Recanalization rate and vasospasms were not influenced by the balloon protection.

CONCLUSION

Thrombectomy devices should be employed in combination with proximal balloon occlusion when the occluding thrombus is attacked from the distal side. Flow arrest seems not to be mandatory if aspiration catheters are used for thrombectomy.

O21.3**COMPARISON OF PROXIMAL AND DISTAL THROMBECTOMY APPROACHES IN STROKE - AN IN-VIVO ANIMAL STUDY**

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PURPOSE

To assess the feasibility of different mechanical thrombectomy approaches with respect to thrombus-device interaction, success rate and time needed for recanalization.

MATERIAL AND METHODS

After embolization of the lingual or internal carotid artery with a barium marked thrombus, thrombectomy was performed in swines by aspiration (proximal device) or by the basket-like Catch device (Balt, Montgomery, France) deployed behind the thrombus (distal device). Each device was tested in 10 occlusions. A maximum of five retrieval attempts was allowed per occlusion. Recanalization rate, overall time needed for recanalization and time per attempt as well as complications were recorded.

RESULTS

Visibility of the thrombus during angiography allowed for documentation of thrombus-device interaction. Proximal device (PD): In 7/10 occlusions complete recanalization was achieved in 33 attempts (mean 3.3, range 2–5). In all attempts it was possible to navigate the aspiration catheter to the thrombus. However, thrombotic material could only be removed in 13/33 attempts. Success rate increased in case the thrombus entered the catheter tip during aspiration. One thrombembolic event occurred. Distal device (DD): In 8/10 occlusions complete recanalization with a total of 23 attempts (mean 2.3, range 1–3) was achieved. The passing procedure of DD carries

the risk of distal dislocation of the thrombus. Thrombembolization rate and rate of vasospasm were significantly higher compared to PD. Mean time to successful recanalization was 42.1 minutes compared to 20.8 minutes in PD ($p>0.01$).

CONCLUSION

Both thrombectomy approaches (PD and DD) are effective. DD offers a slightly higher success rate compared to PD. Since the DD procedure is more complicated a longer recanalization time is needed and complication rate increases.

O21.4

COMBINED SIMPLE MICROWIRE AND MICROCATETER MECHANICAL THROMBOLYSIS WITH MINIMUM DOSE IA UK FOR TREATMENT OF HYPERACUTE MCA ISCHEMIC STROKE PATIENTS

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PURPOSE

The outcome of localized intra-arterial thrombolysis (LIT) may be enhanced by effectively combining simple mechanical thrombolysis with minimum dose of thrombolytic drug administration. The purpose of this study was to assess the feasibility and results of simple mechanical thrombolysis using microwire and microcatheter with concomitant minimum dose intraarterial (IA) urokinase (UK) for the treatment of hyperacute MCA stroke.

MATERIAL AND METHODS

Between May 2004 and December 2005, 12 consecutive patients with hyperacute proximal MCA occlusions were treated by simple mechanical thrombolysis using microwire and microcatheter with concomitant minimum dose IA UK. To minimize the thrombolytic drug dosage and maximize the effects of mechanical thrombolysis, mechanical thrombolysis was performed alternatingly with pulsed IA UK injections. Initial mechanical thrombolysis was performed by simple to and fro passages through the clot with the microwire and microcatheter with injections of 50,000 IU aliquots of UK distal, within, and proximal to the clot. If the clot showed resistance to thrombolysis after 4 to 5 passes and IA UK injections, more aggressive mechanical thrombolysis was performed by to and fro disruptions of the clot with the microcatheter guided by a J or pigtail shaped wire tip. IA UK was injected immediately following mechanical manipulations. Contrast angiograms or fluoroscopic examinations were performed after injection of every 50,000 IU of UK or less. The recanalization rates, incidences of post-thrombolysis branch vessel emboli, post-thrombolysis hemorrhage and clinical outcomes (baseline and discharge National Institute of Health Stroke Scale (NIHSS), mortality, 3 month modified Rankin scale (mRS)) were evaluated.

RESULTS

The 12 patients consisted of 7 males and 5 females (mean age: 63.8 years). In 6 patients, LIT was performed as a rescue therapy after the patient showed no signs of early response (improvement of ≤ 4 points on the NIHSS scale) to IV tPA therapy (0.9 mg/kg). The mean time for the initiation of LIT therapy was 305±75

minutes. The mean dose of UK was 383,333 IU (range: 130,000 – 500,000 IU). Recanalization was achieved in 91.7% (11/12 patients). Post thrombolysis angiogram revealed distal branch embolic occlusions in all 11 patients showing recanalization. No complications related to the mechanical thrombolysis procedure were seen. The baseline NIHSS scores showed improvement at discharge (median: from 17 to 6). One patient (8.3%) developed symptomatic hemorrhage and expired. Three month good outcome was noted in 9 of 12 patients (75%, mRS; 0–2).

CONCLUSION

Simple mechanical thrombolysis using the microwire and microcatheter with concomitant minimum dose IA UK may be effective in achieving recanalization with good long term outcome. Further validation in a larger scale group is necessary.

O21.5

MAGNETIC VERSUS MANUAL GUIDEWIRE MANIPULATION IN NEURORADIOLOGY. IN-VITRO RESULTS

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PURPOSE

Standard microguidewires used in present interventional neuroradiology have a predefined shape of the tip that can not be changed while the guidewire is in the vessel. Although the idea to use magnetism to direct intravascular catheters is not new, its feasibility has only been described recently for cardiovascular applications. The aim of this study was to evaluate, in vitro, a novel magnetic navigation system (MNS) that generates a magnetic field to control the movement and deflection of a microguidewire. This system can be used to reshape the guidewire-tip in vivo without removing the wire from the body, thereby potentially facilitating navigation along tortuous paths or multiple acute curves.

MATERIAL AND METHODS

The MNS consists of two permanent magnets positioned on either side of the fluoroscopy table. The magnet positions relative to each other, are computer-controlled to create a constant precisely-controlled magnetic field in the defined region of interest. This field enables omni-directional rotation of a 0.014 inch magnetic microguidewire (MG) equipped with a 2–3 mm long permanent magnet positioned at the tip. The speed of navigation, the accuracy in a tortuous vessel anatomy and the potentials for navigating into in-vitro aneurysms were tested by four investigators with differing experience in neurointervention and compared to navigation with a standard, manually-controlled microguidewire (SG).

RESULTS

Navigation using the MG was faster ($p=0.0056$) and more accurate (0.2 mistakes/trial vs. 2.6 mistakes/trial) by the less experienced investigators. There were no statistical differences between the MG and the SG for the experienced investigator. One aneurysm with an acute angulation from the carrier vessel could be navigated only with the MG. In this instance, the SG failed, even after multiple reshaping manoeuvres.

CONCLUSION

Our data suggest that magnetic navigation seems to be easier, more accurate and faster in less experienced investigators in interventional Neuroradiology using magnetic navigation. We presume that the features of this magnetic system may improve the efficacy and safety of challenging neurointerventional procedures.

O21.6

CORRELATIONS BETWEEN HYPERSELECTIVE ANGIOGRAMS BEFORE GLUE INJECTION AND SELECTIVE CORRESPONDING GLUE CAST: A PROSPECTIVE/RETROSPECTIVE STUDY FOR EVALUATION OF A RECENT ACRYLIC GLUE (GLUBRAN2) IN THE TREATMENT OF INTRACRANIAL ARTERIOVENOUS MALFORMATIONS.

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PURPOSE

In the endovascular treatment of intracranial Arteriovenous Malformations (AVMs), the prediction of endovascular behaviour during glue injection, especially regarding nidus filling, can be difficult. The purpose of our study was to evaluate the endovascular results using a recent acrylic glue (Glubran2) in the endovascular management of intracranial AVMs.

MATERIAL AND METHODS

In our Department, during a 4 years period from 2002 to 2006, Glubran 2 was used in 309 endovascular sessions performed in 145 patients with an intracranial AVM. The total number of Glubran 2 injections was 820. A prospective and retrospective study was carried out in 75 AVMs sessions (226 Glubran2 injections). Only injections performed in the biplane angiographic suite with available hyperselective pre-injection angiograms and corresponding saved fluoroscopic roadmap biplane images at the end of every glue injection were included in the study for the retrospective evaluation. Results were compared with the same number of injections using another glue (Hystoacryl) currently used in clinical practise. Different concentrations of the Glubran2/lipiodol mixture in relation to the AVM angioarchitectural aspects are reported. Parameters analyzed were: AVM glue penetration (nidus, fistulous shunt, feeder occlusion); Significant pedicle reflux; Occlusion of normal branches; Venous migration; Unexpected glue distribution; Sticked catheter.

RESULTS

A better AVM nidus penetration and expected glue cast in relation to pre-injection angiographic information were obtained using Glubran2 glue. A slight increase concerning glue venous passage was considered clinically and angiographically no-significant in our population. The control in the management of the Glubran2, also regarding the glue reflux in the vascular pedicle and the respect of adjacent normal branches, was subjectively considered easier by the

operator in relation to previous available glue; although the angiographic results were slightly better, they were not statistically significant. No microcatheter was stucked in this series.

CONCLUSION

Although the use of acrylic glues in the treatment of intracranial Arteriovenous Malformations requires caution and experience, Glubran2 appears an efficient and relatively safe tool in the treatment of these lesions.

O21.7

ANGIOGRAPHIC COMPUTED TOMOGRAPHY AS IMMEDIATE CONTROL IN ONYX EMBOLIZATION PROCEDURES.

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PURPOSE

To review the efficacy of performing angiographic computed tomography (AnCT) controls for detecting immediate post-embolization complications in patients treated with EVOH (onyx) for AVM and AVF.

MATERIAL AND METHODS

Up to date, we have done eight treatments in six patients with onyx in cases of AVM or AVF. Each case has been studied immediately after the procedure with AnCT in order to detect any haemorrhagic complication. All patients have been studied during the next days or weeks by means of Magnetic Resonance as well.

RESULTS

AnCT did not show any haemorrhage and MR confirmed these data. In one case of DAVF, there was some material entering a drainage vein, over-enhancing the vessel which was angiographically patent, but helping to recognise the extent of the vessel attain. In the remaining cases the degree of artefacts was related to the amount of onyx administered.

CONCLUSION

AnCT can potentially detect immediate haemorrhagic complications clinically silent in anaesthetized patients. Material artefacts can represent a problem in the evaluation of small haemorrhages. AnCT helps to better understand the extent of venous filling in cases of untoward venous embolization.

O21.8

BRAIN AVM EMBOLIZATION WITH ONYX

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PURPOSE

To report the initial experience using Onyx for embolization of brain arteriovenous malformations (AVM).

MATERIAL AND METHODS

Between May 2000 and December 2005, 44 patients with brain AVMs were embolized with Onyx. There were 18 women and 26 men with a mean age of 42.4 years (median 44, range 14–71 years). Clinical presentation was seizures in 26 patients (59%), hemorrhage from the AVM in 13 patients (30%), subarachnoid hemorrhage from a concomitant aneurysm in three patients (7%), visual disturbances in one patient (2.3%) and in one patient (2.3%) the AVM was an incidental finding. Mean estimated size of the AVM was 3.9 cm (median 4, range 2–7 cm).

RESULTS

In 44 patients, 52 embolization procedures were performed with 138 feeding pedicles embolized, ranging from 1 to 7 per patient. Average estimated size reduction was 75% (median 80%, range 40–100%). Total obliteration was achieved in 7 AVMs (16%), partial embolization was followed by surgery in 10 patients and by radiosurgery in 20 patients. Complications occurred in 6 patients, leading to death in one patient (mortality 2.3%) and to permanent disability in 2 patients (morbidity 4.6%).

CONCLUSION

Onyx is feasible and safe in the embolization of brain AVMs. Complete obliteration can be achieved in small AVMs. Large AVMs can be adequately reduced in size for additional surgical or radiosurgical treatment.

O21.9**CAN INDIVIDUAL BRAIN AVM FACTORS PREDICT NIDUS OBLITERATION AFTER STEREOTACTIC RADIOSURGERY?**

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09:30 – 11:00

COFFEE BREAK: COFFEE BREAK

10:00 – 11:00

COFFEE BREAK: COFFEE BREAK SESSION

10:30 – 11:00

COFFEE BREAK: COFFEE BREAK

PURPOSE

There is limited data available in the monitoring of brain arteriovenous malformations (AVM) after stereotactic radiosurgery (STRS) due to the need for repeated catheter angiography. Using a combination of static and dynamic MR angiographic sequences we have studied the rate of AVM obliteration at 12 months and correlated this with baseline AVM characteristics.

MATERIAL AND METHODS

Forty patients (41 AVMs) consented to a dedicated 1.5T MR protocol 12 months after receiving STRS for a brain AVM. In addition to standard spin echo sequences, 3-D contrast-enhanced sliding interleaved Ky MR angiography (CE-SLINKY) and MR digital subtraction angiography (MR DSA) were performed. Nidal volumes were calculated using CE-SLINKY data in patients with a persisting arteriovenous shunt. Though the MR DSA was not used for the volume calculations, it was very useful in giving valuable flow information to help differentiate between a completely or partially obliterated nidus. The rate of change of nidus volume was computed by statistical methods using the planning angiographic data and the MR angiographic data. The AVM factors including 1) maximum linear dimension, 2) nidal volume, 3) AVM location 4) nidal morphology, 5) venous drainage numbers, 6) “high-flow angiographic change”, 7) prior embolisation, 8) venous drainer location and 9) dose reduction were used in the statistical analysis to determine their role in nidus obliteration. This information was obtained from the planning catheter angiograms carried out prior to treatment with STRS as is our standard practise.

RESULTS

Complete nidal obliteration was found in 9 patients, 26 showed greater than 50% nidal reduction and 6 had less than 50%. With the application of the Bonferroni correction for multiple comparisons no factor was found to be significant. However without the Bonferroni, only AVM venous drainage and AVM location were significantly correlated with rate of obliteration ($p = 0.018$ and $p = 0.032$ respectively, 2-sided Fisher’s Exact Test).

CONCLUSION

Certain AVMs show a rapid and complete response to STRS; early identification of limited response is important in order to consider further treatment options. Our data suggests AVM venous drainage and AVM location are possibly the only significant factors. However these factors need further scrutiny to confirm their role in AVM obliteration.

11:00 – 13:00

SS 14

Room: ESNR / Diagnostic

Main session: *Tissue characterization*

Chairs: O. Özsarlak, E. Radü

ML32

PERFUSION MRI IN STROKE

L. Ostergaard Aarhus University Hospital, Aarhus/DK

ML33

TISSUE SPECIFICATIONS THROUGH APPLICATION OF CONTRAST

H. Weinmann, Berlin/DE

ML34

MOLECULAR IMAGING (T.B.C.)

P.M. Jakob, Würzburg/DE

ML35

PERFUSION TECHNIQUES

M. Law, New York, NY 10016/US

11:00 – 13:00

SS 18

Room: ICS / Interventional

Main session: *Clinical Experience: Aneurysm*

Chairs: S. Cekirge, I. Sikora

ML36

STENT FOR ANEURYSMS

I. Wanke /DE

ML37

STENT FOR ANEURYSMS

C. Miranda, /AR

ML38

STENT FOR ANEURYSMS

P. Nelson, /US

ML39

STENT FOR ANEURYSMS

S. Cekirge, /TR

11:00 – 13:00

SS 22

Room: Free Paper

Free paper session: *Cerebrovascular / Aneurysm*

Chairs: A. Rovira, D. San Millan Ruiz

O22.1**CEREBRAL VASCULITIS: MRI IMAGING SIGNS REVISITED**

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PURPOSE

Inflammatory stenoses of the cerebral blood vessels are an important cause of cerebral ischemia. Rare compared to other causes in later life, vasculitis is frequently the cause of stroke in children and young adults. The diagnosis is difficult even with brain biopsy. Whereas the value of MRI has been established for brain parenchymal lesions, little is known about its value for the diagnosis of inflammatory vascular changes. The purpose of this study was to establish the value of MRI for the direct identification of vessel wall inflammation.

MATERIAL AND METHODS

24 patients with cerebral vasculitis were retrieved from the files of two University hospitals. Eight patients were children (2 to 12 years, 7 female, 1 male, mean age 4.8 years) and 16 were adults (18 to 68 years, 8 female, 8 male, mean age 38.5 years). Diagnosis was based on histological or serological proof of vasculitis or cerebral infarcts due to intracranial vascular stenoses not explained by any other pathology. Repetitive MRI examinations according to a standardised protocol were performed in all patients with 2 to 6 scans each and cerebral DSA was available in 6 patients. All patients had one or more examinations according to a standardised protocol including TOF MRA, DWI, high resolution T1 images after contrast injection and T2* images. Evaluated were the presence of ischemic brain lesions, vascular stenoses on MRA or DSA and vessel wall abnormality on T1 images. Patients were classified according to the location of the vasculitic changes (large, medium and small brain arteries).

RESULTS

All patients had brain parenchymal abnormalities on MRI. These included acute or chronic cerebral ischemia or oedema. Abnormalities of the brain vessels on MRA or DSA were seen in all but one patient. These comprised focal or disseminated stenoses, mainly of the basal brain vessels. In 21 patients, thickening of the vessel wall in areas of stenosis was seen and in 16 patients intramural contrast enhancement was demonstrated. Vessel wall contrast uptake was more prevalent in patients with large vessel vasculitis than in patients with medium or small vessel involvement.

CONCLUSION

Intramural contrast uptake is a frequent feature of cerebral vasculitis and may be the most reliable sign in patients with large vessel involvement. Inflammatory changes of medium sized vessels are better demonstrated on DSA or MRA whereas the diagnosis of small vessel vasculitis has to rest on biopsy.

O22.2**CORTICAL DISSECTIONS OF CEREBRAL ARTERIES. REPORT OF FIVE CASES**

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PURPOSE

To report five new cases of cortical dissections revealed by cerebral hemorrhage and to discuss about diagnostic criteria and therapeutic options.

MATERIAL AND METHODS

In 2005 we diagnosed five distal dissections in 4 female and 1 male, aged from 35 to 77 (mean 51). One patient was pregnant. No patient presented with either clinical or biological infectious disease. The dissections were located on cortical branches of anterior cerebral artery (1), middle cerebral artery (2), posterior cerebral artery (1) and vermian branch of inferior cerebellar artery (1).

RESULTS

Angiographic signs were classical: "pearl and string sign" (2), fusiform aneurysm (2) and irregular stenosis followed by artery occlusion (1). MRI was performed in 3 cases but no mural hematoma was seen probably due to the small size of cortical vessels. Diagnostic of cortical dissections relied on angiographic sign and lack of infectious disease to assume differential diagnosis with infectious aneurysms. Two patients were treated in the acute phase, one by endovascular occlusion of the parent vessel, the other surgically. Angiographic follow up in the 3 other cases showed a stable fusiform aneurysm in one case, which was consequently occluded by endovascular parent vessel occlusion at day 28, spontaneous healing in one other case and stable occlusion in the last case. Clinical evolution was favorable in all five patients with no rebleeding.

CONCLUSION

Diagnostic of cortical dissection is difficult and its frequency is probably under estimated. Parent vessel occlusion in the acute phase is the first therapeutic option. When not possible or too risky, early conventional or MR angiographic follow up is mandatory.

O22.3**ISOLATED CORTICAL VENOUS THROMBOSIS : MRI DIAGNOSIS AND FOLLOW-UP IN 7 CASES**

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PURPOSE

Isolated cortical venous thrombosis (ICVT) is a rare condition. Its diagnosis is difficult and based on indirect signs on digital angiography. Recently, T2*-weighted (gradient echo) MRI has been proposed to improve the diagnosis of cerebral venous thrombosis, mainly at the acute stage of the disorder. Herein, we

report 7 cases of ICVT which diagnosis was based on MRI including T2*-weighted images.

MATERIAL AND METHODS

MRI data were obtained repeatedly in 7 patients with ICVT on a 1.5 Tesla unit, both at time of diagnosis and during follow-up (6 months). MRI signal abnormalities (hypo, iso, hyperintensity) detected on SE T1, T2, FLAIR, T2*, Diffusion weighted images (WI) and/or occlusion on 2D-TOF venography were assessed by two readers. Data were analyzed both at tissue and venous level.

RESULTS

On T2*-WI, an enlarged hyposignal was detected at the site of a cortical vein in all subjects at first MRI examination. On T1-WI, no signal abnormality was detected at the same location in 3 patients, a typical hyperintense vein was present in only 4 patients. No significant signal changes were detected on Flair and DWI. In contrast to the disappearance of venous hyperintensity on T1-WI, persisting signal abnormalities were detected at the venous site on T2*-WI at last examination in all patients. Hyperintense T2 areas with increased ADC were detected in close vicinity of the thrombosed vessel in 6/7 patients. An hemorrhagic component was present on T2*-WI in 5/7 patients. Few residual signal abnormalities were observed in the cerebral parenchyma in only 2 patients at last examination. A complete clinical recovery was reported in the 7 patients. All underwent anticoagulant therapy.

CONCLUSION

Diagnosis of isolated cortical venous thrombosis is difficult. T2*-WI in addition to conventional MRI sequences allows its accurate diagnosis. The magnetic susceptibility effect of hemoglobin products within the thrombus easily detected on T2*-WI, is observed at the early phase of ICVT and is of crucial value for diagnosis. Digital angiography seems no more mandatory for confirmation of diagnosis in ICVT.

O22.4

CEREBRAL DEVELOPMENTAL VENOUS ANOMALIES: ANOMALY OR ABNORMALITY?

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PURPOSE

To report a retrospective series of 84 consecutive cerebral developmental venous anomalies (DVA). This report focuses on their clinical relevance and associated morphological abnormalities of the surrounding brain parenchyma, and the possible role of venous hypertension (VHT) as a causative condition.

MATERIAL AND METHODS

DVA were identified during routine diagnostic radiological workup, (60 MRI/A studies, 61 CT/CTA studies, 35 both CT and MRI).

RESULTS

2.4% presented with an intracranial hemorrhage imputed to the DVA;9.5% had a neighboring cavernous venous malformation (CVM), three of which produced neurological deficits;29.7% showed regional atrophy; 28.3% showed signal anomalies on MRI;18% showed hypodensity on CT;11.5% had dystrophic

calcifications. One case showed hypoT2* signal without signal abnormalities on other MRI sequences, compatible with hemosiderin deposition around the DVA. These findings were located within the DVA drainage territory. A stenosis was documented in 13%. A difference in caliber between the proximal and distal portions of the DVA collecting vein were documented in 28.5%.

CONCLUSION

DVA were found to be frequently associated with brain parenchymal abnormalities including atrophy, density or signal modifications on CT and MRI, and calcifications. Association with CVM was frequent. They rarely presented with intracranial hemorrhage. Venous hypertension (VHT) developing within the DVA system may be responsible for this spectrum of abnormalities. VHT may be explained by several factors. First, a stenosis of the collecting vein, which was infrequently documented, but likely underestimated by MRI/A and CTA. Then, DVA represent a zone of venous confluence draining an unusually large volume of brain parenchyma, converging into a single collecting vessel. Finally, DVA are known to demonstrate thickened walls on histology, which could possibly reduce vessel compliance. Combined, these factors could induce variable degrees of VHT, manifested chronically as loco-regional parenchymal alterations, or acutely as hemorrhage. The immediate proximity between the DVA and the CVM also suggests that CVM could result from a previous, and even repeated hemorrhage of some portion of the DVA exposed to VHT. This is suggested by one case in which hemosiderin deposition around the DVA was suspected, compatible with early stages of CMV formation. In conclusion, though generally asymptomatic, DVA are probably exposed to variable degrees of VHT and should no longer considered simple anomalies.

O22.5

CT ANGIOGRAPHY IN INTRACRANIAL DURAL ARTERIO-VEINUS FISTULAE

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PURPOSE

Purpose : to assess the diagnostic accuracy of multislice CT Angiography (MSCTA) in the investigation of intracranial dural arterio-venous fistulae (DAVF).

MATERIAL AND METHODS

Methods : 10 consecutive patients harboring a dural intracranial fistula underwent Digital Subtraction Angiography (DSA) and MSCTA by using maximal intensity projection (MIP) and volume rendering images. The following parameters were analyzed: identification of afferent arteries, anatomical localization of the fistula site, characterization of the retrograde venous drainage with gradation of its severity, and identification of stenosis or occlusion of the dural sinuses. Sensitivity, specificity and accuracy of MSCTA were calculated for each of these parameters, by comparison with DSA.

RESULTS

Results: MSCTA could correctly identify a retrograde cortical and deep venous drainage in all cases where it was present; the localization of the fistula site failed in one case of DAVF without

retrograde venous drainage. The identification of the afferent arteries by MSCTA showed a sensitivity of 81% for the afferent arteries tributaries of the external carotid artery, whereas it was only 23% for the afferent arteries tributaries of the internal carotid and vertebral arteries, because of their small size. The stenoses and occlusions of the dural sinuses were correctly identified in all cases.

CONCLUSION

CONCLUSION: Our preliminary study demonstrates that MSCTA with MIP and 3D reformatting is appropriate for a non-invasive assessment of intracranial DAVFs. Particularly, it allows a reliable depiction of a retrograde cortical or deep venous drainage, which is a crucial parameter in the identification of those DAVFs needing an aggressive treatment.

O22.6

ULTRAFast, NON-INVASIVE TIME-RESOLVED 3D MRA FOR THE VISUALIZATION OF DURAL VENOUS SINUSES

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PURPOSE

Recently, 3D time-resolved MRA techniques (TR 3D MRA) have been proven helpful foremost for analyzing arterial cerebrovascular diseases. The diagnostic quality of standard MR venography methods that are established in the diagnosis of dural sinus thrombosis can be impaired (e.g. chronic thrombus). Therefore, the analysis of venous phase images of TR 3D MRA may be a promising approach. The goal of this study was to analyze the visibility of dural sinuses in comparison to other venography methods, 2D TOF MRA and VIBE-MRA.

MATERIAL AND METHODS

The prospective study was approved by the investigational review board. 20 consecutive patients who were referred for contrast-enhanced cerebral MR for various clinical indications were included. Patients with cerebral venous thrombosis, or abnormalities that influence the venous outflow, e.g. brain tumors, were excluded. They were examined on a 1.5 T system using a twelve-channel head coil. The time-resolved 3D MRA technique is based on 3D FLASH sequence with a slab-selective rectangular rf pulse (TR/TE 1.74/0.64, flip angle 15°). Parallel imaging was utilized (GRAPPA, acceleration factor of 6). A nearly iso-volumetric dataset (2.0×2.0 mm in-plane resolution, 2.2 mm slice thickness) and a temporal resolution of 1.5 sec / 3D dataset were obtained. Automated inline-subtraction of acquired datasets from a mask was performed. The visibility of eleven predefined venous sinus structures was analyzed by two experienced neuroradiologists. Friedman rank sum test was used to compare scores of visibility between three MRA methods (p<.05). Weighted Kappa analysis was calculated to measure the observer agreement.

RESULTS

The torcular of Herophilii, both transverse sinuses, and the right jugular bulb were significantly better visualized on TR 3D MRA

compared to 2D TOF MRA. Solely the inferior sagittal sinus was better visualized on VIBE MRA and 2D TOF MRA. No significant difference was observed for the visibility of the superior sagittal sinus, the vein of Galen, straight sinus, both sigmoid sinuses, and the left jugular bulb. A very good agreement between both observers for all MRA sequences was demonstrated (Kappa 0.78 – 0.88).

CONCLUSION

TR 3D MRA proves to be a robust method to visualize the major dural sinuses. Their visibility was mostly superior to 2D TOF MRA. As it provides high temporal resolution the bolus passage through the venous system can be precisely followed. This may potentially improve the diagnostic quality in dural sinus thrombosis.

O22.7

ARTERY/VEIN SEPARATION AND FISTULA DETECTION IN MR ANGIOGRAPHY THROUGH DOUBLE-REFERENCE CORRELATION ANALYSIS

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PURPOSE

The goal of this work is to present a novel post-processing technique for the separation of arteries and veins in contrast-enhanced magnetic resonance angiography (CE-MRA), using a mathematical tool called correlation analysis (a measure of similarity) between the time course of each voxel in time-resolved datasets and the time course of two reference points selected from an artery and a vein. Also, a method for clear depiction of arteriogram and venogram, highlighting vessels containing mixed arterial and venous blood using true-color-coded images is proposed.

MATERIAL AND METHODS

Time resolved 3D-MRA datasets of both healthy volunteers and patients suffering from arterio-venous fistulas were acquired after injection of 0.5 molar Gadolinium-DOTA contrast agent. The system used was a Siemens Avanto 1.5T, the sequence a fast low-angle shot (FLASH) with parallel imaging, resulting in an in-plane resolution of 2 mm×2 mm with a slice thickness of 2.2 mm, and a time resolution of 1.5 s per 3D dataset. Reference points situated in an artery (carotid) and a vein (superior sagittal sinus) were manually selected from the dataset. An automated computer program calculated the correlation values between each voxel in the dataset and each reference according to the formula presented in the paper by Bock et al. ("Separation of Arteries and Veins in 3D MR Angiography Using Correlation Analysis", *Magn. Res. Med.* 43: 481–487 (2000)"). These values were then mathematically transformed taking into account the correlation value between the reference points, obtaining an index stating the probability that each voxel belongs to an artery or to a vein. Such probability was then color coded, assigning a blue color to venous vessels, red to arterial vessels, and purple gradations to vessels in which blood mixes.

RESULTS

The method presented showed an improvement in signal to noise ratio with respect to the image subtraction algorithm up to a factor of 8.4 dB and with respect to Correlation Analysis presented in

Bock et al. up to a factor of 5.2 dB due to a lower intensity of artifacts caused by imperfect vessel separation.

CONCLUSION

This post-processing method was proven to be useful in the diagnosis of cerebrovascular diseases, especially in the case of arterio-venous fistulas, that are effectively depicted by the implemented color-coded representation, a direct consequence of this approach.

O22.8

CLINICAL AND MORPHOLOGICAL RESULT OF THE ENDOVASCULAR TREATMENT FOR THE MIDDLE CEREBRAL ARTERY ANEURYSM

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PURPOSE

Endovascular treatment (EVT) for middle cerebral artery aneurysm (MCAN) is one of the discussible issues for their morphological characteristics with difficulty to be treated by EVT. To evaluate the feasibility of EVT for MCAN, the results of our institute were analyzed.

MATERIAL AND METHODS

From 1999 to 2005, 59 patients having 65 MCAN (46 ruptured aneurysms (AN) and 19 unruptured) were treated by EVT with detachable coils. All the procedures were performed in ordinary fashion without other technical assistance like balloon remodeling. Clinical results were evaluated after the modified Rankin Scale (mRS) and then simplified like as follows: mRS 1–3= good recovery (GR), 4–5= severe disability (SD), 6= death (D). For the evaluation of morphological results, the Raymond's classification was employed and modified as follows: Raymond A or B=good result (G), C or D= partial embolization (P).

RESULTS

In the clinical results of 46 ruptured AN (36 females and 10 males of average age 49.3 years old (between 30 and 80 y)), the cases for Hunt and Hess grade (HHG) 1–3 were 26 (56.5%) and for HHG 4–5 were 20 (43.5%). The cases of HHG 1–3 resulted in 22 GR (84.6%), 4 SD (15.4%) and 0 D and those of HHG 4–5 resulted in 2 GR (10%), 10 SD (50%) and 8 D (40%). All of the 6 cases of unruptured AN without SAH from another sites, resulted in GR without complications. The mRS of all of the 13 cases of unruptured AN with SAH from another sites, had not been modified after the procedures in spite of their having 2 procedural complications. Morphological results of EVT for ruptured AN were composed of 19 G (41.3%), 27 P (58.7%) at the end of procedures. The follow-up angiography showed 16 G (34.8%) and 16 P (34.8%). Fourteen cases were without follow-up (30.4%). Those for the unruptured AN, 9 G (47.4%) and 10 P (52.6%) were confirmed after EVT and follow-up angiography showed 8 G (42.1%) and 3 P (15.8%). Eight cases (42.1%) were without follow-up. The number of procedural complications for ruptured AN was 10 (21.7%) which consisted of 7 ischemic complications (15.2%) and 3 hemorrhagic ones (6.5%). For unruptured AN, two procedural complications were observed (1 ischemic (5.3%) and 1 hemorrhagic (5.3%)). Two cases (5.6%) of ruptured AN rebled in

few weeks after the initial EVT. Second EVT were needed in 7 cases of the ruptured AN (15.2%).

CONCLUSION

From our results, EVT is compatible for a therapeutic option for MCAN. To obtain the effective EVT, the employment of the balloon remodeling is one of the solutions.

O22.9

PROCEDURAL MORBIDITY AND MORTALITY OF ELECTIVE COIL TREATMENT OF UNRUPTURED INTRACRANIAL ANEURYSMS

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PURPOSE

To report morbidity, mortality and angiographic results of elective coiling of unruptured intracranial aneurysms.

MATERIAL AND METHODS

In a 10 year period, 176 unruptured aneurysms in 149 patients were electively treated with detachable coils. Seventy-nine aneurysms were additional to another ruptured aneurysm but were coiled more than 3 months following subarachnoid hemorrhage, 59 aneurysms were incidentally discovered and 38 aneurysms presented with symptoms of mass effect. Mean size of the 176 unruptured aneurysms was 10.6 mm (median 8 mm, range 2–55 mm). One hundred thirteen aneurysms (64%) were small (<10 mm), 44 aneurysms (25%) were large (10–25 mm) and 19 aneurysms (11%) were giant (25–55 mm). Thirty wide necked aneurysms (17%) were coiled with aid of a supporting device.

RESULTS

Procedural mortality of coiling was 1.3% (2 of 149, 95% CI 0.7–5.1%) and morbidity was 2.6% (4 of 149, 95% CI 0.8–7.0%). The 4 patients with permanent morbidity were independent on daily activities. Initial aneurysm occlusion was complete (100%) in 132 aneurysms, near complete (90–98%) in 36 aneurysms and incomplete (60–85%) in 8 aneurysms. Six months follow up angiography was available in 132 patients with 154 coiled aneurysms (87.5%) and partial reopening occurred in 25, mainly large and giant aneurysms (16.2%). Additional coiling was performed in 22 aneurysms and additional parent vessel occlusion in 1 aneurysm. There were no complications of additional treatments

CONCLUSION

Elective coiling of unruptured intracranial aneurysms has low procedural mortality and morbidity. For the management of unruptured aneurysms, endovascular treatment should be considered.

O22.10

PROCEDURAL COMPLICATIONS OF COILING OF RUPTURED INTRACRANIAL ANEURYSMS: INCIDENCE AND RISK FACTORS IN A CONSECUTIVE SERIES OF 681 PATIENTS

W.J. van Rooij, M. Sluzewski;
St Elisabeth Ziekenhuis, Tilburg/NL

PURPOSE

To report the incidence of procedural complications of coiling of ruptured intracranial aneurysms leading to permanent disability or death in a large consecutive series of patients. In addition, we tried to find risk factors associated with the occurrence of procedural complications.

MATERIAL AND METHODS

Between January 1995 and July 2005, 681 consecutive patients with a ruptured intracranial aneurysm were treated with detachable coils. Procedural complications (aneurysm rupture or thrombo-embolic) of coiling leading to death or neurological disability at the time of hospital discharge were recorded. For patients with procedural complications, Odds Ratio's (OR) with corresponding 95% Confidence Intervals (CI) were calculated for the following patient- and aneurysm characteristics: gender, patient age, use of a supporting balloon, aneurysm location, timing of treatment, clinical condition at the time of treatment and aneurysm size.

RESULTS

Procedural complications occurred in 40 of 681 patients (5.87%, 95% CI 4.2–7.9%), leading to death in 18 patients (procedural

mortality 2.6%, 95% CI 1.6–4.2%) and to disability in 22 patients (procedural morbidity 3.2%, 95% CI 2.0–4.9%). There were 8 procedural ruptures and 32 thrombo-embolic complications. The use of a temporary supporting balloon was the only significant risk factor (OR 6.55, 95% CI 2.82 to 15.22%) for the occurrence of procedural complications.

CONCLUSION

Procedural complication rate of coiling of ruptured aneurysms leading to disability or death is 5.9%. The use of a temporary supporting balloon in the treatment of wide necked aneurysms is the only risk factor for the occurrence of complications

O22.11

COILING VERSUS CLIPPING OF RUPTURED INTRACRANIAL ANEURYSMS AFTER SUB-ARACHNOIDAL HEMORRHAGE WITH HUNT AND HESS STAGE III-V.

U. Meier Unfallkrankenhaus Berlin, Berlin/DE

13:00 – 14:00

LUNCH SYMPOSIUM: LUNCH SESSION

14:00 – 16:30

SS 15

Main session: *Tissue characterization*

Chairs: S. Kollias, C. Ozdoba

Room: ESNR / Diagnostic

ML40

MRI AND CT IN CORRELATION WITH HISTOPATHOLOGY

K. Yen, Bern/CH

ML41

FMRI TECHNIQUES

S. Sunaert, Leuven/BE

ML42

MR ANGIOGRAPHIC TECHNIQUES

S. Wetzel, Basel/CH

ML43

NEW IMAGING TECHNIQUES: HARDWARE

O. Heid, Erlangen/DE

ML44

TISSUE SPECIFICATIONS THROUGH APPLICATION OF CONTRAST

D. Greitz, Stockholm/SE

14:00 – 16:00

SS 19

Main session: *Biomechanics of Wall*

Chairs: P. Nelson, B. Chopard

Room: ICS / Interventional

ML45

ARTERIAL WALL MECHANICS

N. Stergiopoulos, /CH**ML46**

ANEURYSM WALL MECHANICS (AORTA)

D.A. Vorp, Pittsburgh, PA 15219/US**ML47**

WALL MECHANICS: NUMERICAL SIMULATION

A. Robertson, Pittsburg/US

ML48

COMPUTATIONAL MODELING TECHNIQUES FOR THE PREDICTION OF GROWTH, CLOTTING AND EMBOLISATION OUTCOME OF CEREBRAL ANEURYSMS

Y. Ventikos, /GB

14:00 – 16:30

SS 23**Room: Free Paper****Free paper session:** *Cerebrovascular / Other*

Chairs: G. Abdo, R. Von Kummer

O23.1

CEREBRAL CT ANGIOGRAPHY WITH A REDUCED DOSE OF CONTRAST MATERIAL AT A HIGH IODINE CONCENTRATION USING A 16-DETECTOR ROW SYSTEM

K. Tsuchiya¹, H. Tateishi¹, K. Honya¹, M. Yoshida¹, M. Amagami¹, T. Nitatori²;¹Kyorin University, Tokyo/JP, ²Kyorin University School of Medicine, Tokyo/JP**PURPOSE**

We assessed the feasibility of reducing the dose (50 or 75 mL) and raising the iodine concentration (350 mgI/mL) of contrast material, as compared with the standard dose and concentration (100 mL, 300 mgI/mL), in cerebral CT angiography using a 16-detector row CT. At the reduced doses, we also determined the values obtained with a saline flush.

MATERIAL AND METHODS

Our prospective study group was comprised of 28 consecutive patients (seven men and 21 women; age range, 32–84 years; mean age, 60.5 years) referred for cerebral CT angiography. They were assigned to one of four protocols: group A: 50 mL of 350 mgI/mL with a saline flush (40 mL); group B: 75 mL of 350 mgI/mL with a saline flush (40 mL); group C: 75 mL of 350 mgI/mL without a saline flush; and group D: 100 mL of 300 mgI/mL without a saline flush. The contrast material was injected into the right antecubital vein using a power injector. CT angiography was performed using a 16-detector row helical system with the following scanning parameters: pitch, 15; collimation, 0.5 mm; and reconstruction interval, 0.3 mm. We started scanning 20 seconds after initiation of injection of the contrast material. On source images, we measured the attenuation of regions of interest (ROIs) placed bilaterally on

the internal carotid artery (ICA), proximal middle cerebral artery (M1), and proximal anterior cerebral artery (A1 or 2). Additionally, on final volume-rendered or maximum-intensity-projection images, two blinded readers visually evaluated the degree to which intracranial arteries and veins were demonstrated using a three-point grading scale.

RESULTS

There were no statistically significant differences in attenuation of the ICA, MCA or ACA among the four groups, the only exception being a significantly higher attenuation of the ACA in group A than in group D ($p=0.02$). Neither were any significant differences noted among the four groups on the visual assessment.

CONCLUSION

By using a reduced dose (50 mL) and a higher iodine concentration (350 mgI/mL) in combination with a saline flush, it is possible to obtain cerebral CT angiograms comparable to those obtained with a standard dose and concentration.

O23.2

CONTRAST-ENHANCED MR ANGIOGRAPHY OF THE SUPRAAORTAL VESSELS AT 3 TESLA-AN INTRAINDIVIDUAL COMPARISON OF GD-BOPTA (MULTIHANCE®) AND GD-DTPA (MAGNEVIST®)

T. Naegele¹, G. Erb², U. Klose³, E. Bueltmann³;¹Eberhard-Karls-University of Tuebingen, Tuebingen/DE, ²Radolfzell/DE, ³Uniklinik Tuebingen, Tuebingen/DE**PURPOSE**

Contrast enhanced MR-angiography (ceMRA) at 3T shows improved contrast-to-noise ratio (CNR) at 3 T compared to lower field strengths because the T1-shortening effect of gadolinium

contrast media (CM) is greater. The aim of this study was to evaluate in an intraindividual comparison if high relaxivity CM (Gd-Bopta) provides improved image quality of ceMRA of supraaortic vessels at 3T compared to a standard CM (Gd-DTPA)

MATERIAL AND METHODS

Twelve healthy male volunteers aged 18–40 years underwent two ceMRA examinations of the supraaortic vessels at 3T (Magnetom TIM Trio, Siemens, Forchheim, Germany), one with Gd-BOPTA (MultiHance®, Bracco ALTANA Pharma, Konstanz, Germany) and the other with Gd-DTPA (Magnevist®, Schering AG, Berlin, Germany). The two CM were administered in randomised order at an equivalent dose of 0.1 mmol/kg bodyweight and at a flow rate of 2 ml/sec. The minimum interval between exams was 72 hours. The following scan parameters were used: TR=3.69; TE=1.21; FOV 160×320 mm; spatial resolution 0.8×0.6×1 mm³. Qualitative evaluation was based on blinded intra-individual matched pairs assessment of reconstructed maximum intensity projection (MIP). The following vessel segments were evaluated in terms of preference for one CM or the other, or equality: internal carotid artery (ICA), anterior cerebral artery (ACA), middle cerebral artery (MCA), posterior cerebral artery (PCA), basilar artery (BA), and vertebral artery (VA). An additional assessment of quantitative CNR was performed based on signal intensity measurements in each of the above vessels.

RESULTS

Blinded matched pairs assessment of image quality revealed preference for Gd-BOPTA in 10/12 patients for extra-cranial vessels and in 11/12 subjects for intracranial vessels and Circle of Willis. The overall preference for ceMRA with Gd-BOPTA was significant ($p<0.05$) for all evaluated vessel segments. Quantitative evaluation revealed a significant ($p<0.05$) increase in CNR for all vessels after ceMRA with Gd-BOPTA compared with Gd-DTPA. The CNR values for Gd-BOPTA and Gd-DTPA were 148.9±21.8 and 120.8±22.8, respectively, in the ICA, 106.8±17.8 and 84.3±21.2, respectively, in the MCA, and 117.6±19.9 and 91.49±21.45, respectively, in the BA.

CONCLUSION

ceMRA of the supraaortic vessels at 3T is significant improved in terms of image quality and CNR with the use of high relaxivity CM such as MultiHance.

O23.3

GADOVIST 1.0 M: TOLERANCE AND CLINICAL SAFETY

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PURPOSE

To determine the tolerance and clinical safety of Gadovist® 1.0 M (Gadobutrol, Schering AG, Berlin, Germany) for CE-MRI in the clinical routine setting of radiology practices in a large number of unselected patients.

MATERIAL AND METHODS

4 prospectively planned observational surveillance studies with gadobutrol (Gadovist®, Schering, Berlin, Germany) were conducted in Germany from 2000 to 2004 with one of the four focusing selectively on Gadovist-enhanced MR angiography.

Individual patient data, including medical status, demographic data, details of the diagnostic procedure, contrast agent administration, and occurrence of ADRs, were collected utilizing a standardized questionnaire.

RESULTS

A total of 6,463 patients were enrolled at more than 300 institutions. Body regions most frequently investigated by CE-MRI were head and neck (45%), followed by brain (19%) and spine (11%). 8% of the patients underwent CE-MRI of multiple body regions, including brain and intracranial vessels in 2% of the patients and pelvis and lower extremities in 1.5%. Gadovist-enhanced MRA was performed in more than 1200 patients (19%). The mean age of the patients was 53.3 years with a range of 10 months to 95 years. 3% of the patients were less than 20 years old, and 28% of the patients were more than 60 years old. The mean applied volume of Gadovist® was 11.8 ml, corresponding to a dose of 0.15 mmol Gd / kg BW. For CE-MRA, the mean applied volume was generally higher with a mean volume of 13.5 mL, corresponding to a dose of 0.25 mmol Gd/kg BW. The contrast quality was assessed in 2 of the 4 studies and was rated as very good/good in 95.3%, satisfactory in 3.2% and inadequate in 0.46% of all cases. 43 of the 6,463 patients reported at least one ADR, corresponding to an overall incidence rate of ADRs of 0.7%. One serious adverse drug reaction (SADR) was reported (rate 0.02%), which was an anaphylactoid reaction requiring hospitalisation and medical treatment of the patient. No individual ADR reached a frequency greater than uncommon (ie, more than 1%). The most frequently reported ADR was nausea, which occurred in 22 patients (0.34%; uncommon). Rarely reported ADRs (< 0.1%) included urticaria, emesis, injection site reaction, feeling of warmth, vasodilatation, and pruritus.

CONCLUSION

Gadovist® 1.0 M provides excellent contrast quality in CE-MRI of different body regions as well as in CE-MRA. The contrast agent is very well tolerated and has an excellent safety profile. The adverse drug reactions observed following the i.v. injection of Gadovist® 1.0 M are well comparable to the published data of Gadolinium-DTPA and other 0.5 M Gd-chelates, both regarding events and incidence.

O23.4

BLEEDING RISK ANALYSIS IN STROKE IMAGING BEFORE THROMBOLYSIS (BRASIL): A POOLED ANALYSIS OF T2*-WEIGHTED MAGNETIC RESONANCE IMAGING DATA OF 803 PATIENTS

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pital Vall d, Barcelona/ES, ¹³Universitaetsklinikum Erlangen, Erlangen/DE, ¹⁴Landes-Nervenklinik Wagner-Jauregg, Linz/AT

PURPOSE

Symptomatic intracranial haemorrhage (SICH) is a feared complication of thrombolytic therapy in ischemic stroke patients. Small hypointense lesions (cerebral microbleeds, CMBs) on T2*-weighted magnetic resonance imaging (T2*w MRI) may predict a higher risk of SICH.

MATERIAL AND METHODS

We analysed MRI data acquired within 6 hours after symptom onset from 803 ischemic stroke patients from 12 centres in Europe, North America and Asia. All patients received thrombolytic therapy. Initial T2*w MRI was evaluated for the presence of CMBs. Cut-off points for analysing the prognostic value of CMBs for SICH were >0, >1, and >5 CMBs. Primary endpoint was a symptomatic intracranial haemorrhage (SICH); specified as clinical deterioration with increase in National Institutes of Health Stroke Scale score by four or more points, temporally related to a parenchymal haematoma.

RESULTS

CMBs were detected in 159 patients (19.8%). A SICH was found in 34 of all 803 patients (4.2%). The proportions of patients having a SICH did not differ between those with and those without a CMB ($p=0.518$). The odds ratio for SICH was significantly increased only in the pooled analysis when the cut-off point was set at >5 CMBs (OR=5.95; 95% CI: 1.21 to 29.14) having a low sensitivity for prediction of a SICH (0.06, 95% CI: 0.01 to 0.20).

CONCLUSION

The data do not confirm the hypothesis that the risk of symptomatic haemorrhage after thrombolytic therapy is significantly increased in the presence of CMBs. Therefore, a general exclusion of CMB positive patients from clinical trials is not supported. A conclusion about the rare patients with multiple CMBs can not be derived.

O23.5

LONG-TERM EFFECT OF INTRA-ARTERIAL THROMBOLYTIC THERAPY IN ACUTE STROKE

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PURPOSE

Thrombolysis has been shown to improve the 3-months outcome of patients with acute ischemic stroke. Knowledge regarding the long-term effects of thrombolysis in stroke is limited.

MATERIAL AND METHODS

Monocenter, retrospective study comparing the long-term outcome of patients who were treated with intra-arterial urokinase (IAT) with that of patients receiving aspirin or heparin only (non-IAT). The long-term outcome was assessed using the modified Rankin

scale (mRS). 173 IAT and 261 non-IAT patients from the Bernese Stroke Registry were eligible for the study. A matching algorithm that took into account patients' age and initial stroke severity (as measured by the National Institute of Health Stroke Scale, NIHSS) was used to assemble a IAT and a non-IAT group. Matching was blinded for clinical outcome.

RESULTS

144 IAT patients (mean age 63 years, 50% women) and 147 non-IAT patients (mean age 62 years, 45% women) were included in the comparative analysis. The median NIHSS was 14 in each group. At 2 years, 57% of the IAT patients and 45% of the non-IAT had a favourable outcome when defined as mRS 0 to 2 ($p = 0.037$), or 41% and 26%, when favourable outcome was defined as mRS 0 to 1 ($p = 0.008$). Mortality was 23% in the IAT and 24% in the non-IAT group.

CONCLUSION

The present study provides evidence for a sustained effect of IAT when assessed 2 years after the stroke. The results support the more widespread use of IAT for treatment of acute stroke.

O23.6

TRANSPORTER-MEDIATED UPTAKE AND EFFLUX OF L-[14C]GLUTAMATE FROM NERVE TERMINALS UNDER BRAIN HYPOXIA SIMULATED MODELING.

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PURPOSE

Most of the research has shown that exposure of animals to centrifuge-induced loading leads to a changes in cerebral blood flow, arterial oxygen saturation etc. Since this alterations can cause a brain hypoxia, it is important to study the synaptic processes in brain under these extremal conditions. The effects of centrifuge-induced loading on the presynaptic events have been investigated in order to provide further insight into regulation of glutamatergic neurotransmission under brain hypoxia.

MATERIAL AND METHODS

The nerve terminals (synaptosomes) offer several advantages as a model system for the study of general mechanisms of neurosecretion.

RESULTS

Exposure of rats to centrifugation (10 G for 1 hour) has been found to cause changes in the synaptic processes of brain, in particular neurotransmitter release and uptake in rat brain synaptosomes. The effects of Na⁺ concentration and competitive nontransportable inhibitor DL-threo-beta-benzyloxyaspartate (DL-TBOA) on the unstimulated and depolarization-evoked carrier-mediated release of L-[14C]glutamate were evaluated under control and extremal conditions. The application of 10 microM DL-TBOA in low [Na⁺] medium resulted in the increase in L-[14C]glutamate release for control animals by 2.0+/-0.5% of total accumulated synaptosomal label and 100 microM DL-TBOA - 3.5+/-0.5%, respectively. The experimental data for centrifuge-loaded animals showed 4.0+/-1.0% and 9.0+/-2.0%, respectively ($\text{D} \leq 0.05$). The enhancement of the L-[14C]glutamate release would be expected to connect with the inhibition of L-[14C]glutamate reuptake process. It appears

that after centrifuge-induced loading DL-TBOA inhibited uptake more potently. The influence of DL-TBOA appeared to depend on a balance of the forward and reversed transport of L-[14C] glutamate. The effect of DL-TBOA on depolarization-induced L-[14C]glutamate release increased after centrifugation. Application of 10 microM DL-TBOA in low [Na⁺]-media caused a decrease in L-[14C]glutamate efflux by 37.0±2.5% and 45.0 ±/− 3.4% in control and centrifuged animals, respectively, and 100 microM DL-TBOA caused a comparable degree of efflux decrease under control and extremal conditions, namely 84.0±/−5.0%.

CONCLUSION

Our data of the glutamate uptake and carrier-mediated glutamate release demonstrated that inhibition caused by DL-TBOA increased after centrifuge-induced loading. The kinetic parameters of glutamate transporters seem to be altered as result of brain hypoxia simulated modelling.

O23.7

PROGNOSTIC VALUE OF CEREBRAL MAGNETIC RESONANCE IMAGING IN COMA WITHIN THE FIRST 6 TO 36 HOURS AFTER CARDIAC ARREST: A PILOT STUDY

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PURPOSE

Outcome in comatose patients with hypoxic-ischemic encephalopathy and preserved brain stem functions following cardiopulmonary resuscitation is difficult to predict. The objective of this study is to explore the prognostic value of early cerebral diffusion-weighted magnetic resonance imaging (DWI MR) in patients after cardiac arrest and successful resuscitation.

MATERIAL AND METHODS

Pilot study to observe the outcome of patients with hypoxic ischemic encephalopathy after successful cardiopulmonary resuscitation in a single center. In each patient a cerebral MR including DWI and perfusion-weighted imaging was performed according to a standardized protocol within 6 to 36 hours after cardiac arrest. Patient management including blood glucose and cardiopulmonary control was performed according to standard routine, and patients were assessed by a neurologist daily. Core body temperature was kept between 34.0°C – 37.0°C during the first 24 hours after CPR.

RESULTS

From January 2005 to January 2006 38 patients admitted to the ICU were eligible for the study. Of these, 14, (13 men and one woman, mean age 64.8 y), were included. 22 patients were not included because of contraindications to MR examination (6), rapid clinical improvement (8), missing consent of families (4) or death before the MR examination (4). Twelve patients died within 5 days, and two were discharged from the hospital alive. The two survivors had normal MR findings. Nevertheless, they showed a severe amnesic

syndrome 6 months later. Eight patients who died showed bilateral hyperintense signal on DWI MR in the basal ganglia and parietooccipital and mesiotemporal cortex. Four patients who died had a normal MR. MR angiography was normal in all patients.

CONCLUSION

All 8 comatose patients with signal abnormalities on DWI MR after cardiac arrest and successful resuscitation died. Normal DWI MR was seen both in 2 survivors and 4 patients who died. Therefore, abnormal signal on DWI MR may have prognostic value and indicate adverse outcome. These findings have to be corroborated in a larger number of patients. Based on our results, we elaborate a protocol for a multicenter study in order to collect an adequate number of patients to answer this question.

O23.8

TWO YEARS FOLLOW UP OF MR FINDINGS IN PATIENTS WITH PRIMARY ANTIPHOSPHOLIPID SYNDROME COMPARED TO HEALTHY INDIVIDUALS WITH ANTIPHOSPHOLIPID BODIES

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PURPOSE

To determine differences and similarities in MR findings and their progress in two similar groups of individuals and to find if there is any relationship of MR findings in clinically ill group and group of healthy patients when all examined persons have antiphospholipid bodies.

MATERIAL AND METHODS

A group of 45 patients with proven primary antiphospholipid syndrome (PAPS) had every six months control MR examination of changes in cerebral white matter. Group was formed to be of the similar age (45–60) and consisted of 10 men and 35 women. Second group was formed of healthy individuals to whom antiphospholipid bodies were found incidentally and consisted of 12 individuals age (49–62), 3 men and 9 women. In both groups MR scans were performed every six months and were measured for: a) cerebral atrophy and stroke types b) periventricular hyperintensity c) deep white matter hyperintensity. Statistical analyses were made as dependent variables and as independent variables with MR data for age, sex, arterial hypertension, steroid treatment, diabetes mellitus and special for neurological symptoms.

RESULTS

We found a significant correlation with cerebral atrophy and its progression with presence of antiphospholipid antibodies, and we did not find significant correlation of periventricular hyperintensity and deep white matter hyperintensity with antiphospholipid antibodies.

CONCLUSION

Cerebral atrophy and stroke subtypes significantly depend on antiphospholipid antibodies in healthy persons as well in persons with primary antiphospholipid syndrome. Neurological symptoms were always related with deep white matter and periventricular hyperintensities. Results show also that antiphospholipid antibodies in healthy persons in fact cause subclinical type of illness with invisible microembolisations and resulting cerebral atrophy.

O23.9

DIFFUSION-PERFUSION MRI OF ACUTE ISCHEMIC STROKE: THE INITIAL LESIONS ON PERFUSION-WEIGHTED MRI ARE BETTER ESTIMATES FOR THE INFARCTED PARENCHYMA AND THE ACUTE CLINICAL STATUS.

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PURPOSE

With the progressive improvement in neurointerventional techniques in the clinical setting of acute ischemic stroke, it is crucial to be able to guide such interventions. The cornerstone is to find the reversibly ischemic penumbra, which could benefit from an intervention. The classic model of defining the penumbra is the so-called “diffusion-perfusion mismatch. In such model, the bright lesion on diffusion-weighted images (DWIs) of restricted diffusion represents the irreversibly infarcted parenchyma. This lesion should be smaller than the area of perfusion abnormality to define a penumbra. The abnormality on the perfusion-weighted images (PWIs) is commonly assessed on the temporal maps, e.g. mean transit time (MTT). More and more reports doubt this model. A number of studies suggested that part of the penumbra is included in the DWI lesion. On the other hand, many trials attempted to correlate the clinical symptomatology with the diffusion-perfusion MRI findings. The aim of this study is to identify which imaging parameters / criteria on the initial DWI and PWI images in the clinical setting of acute ischemic stroke would be the closest estimate of the infarcted parenchyma and which ones would correlate best with the neurological deficits.

MATERIAL AND METHODS

We studied twenty-six patients with acute ischemic stroke with the standard stroke MRI protocol at our institution including DWI and PWI. Late follow-up MRI could be obtained in twelve patients usually 3 months after the ictus. The acute and followup lesion volumes as well as the clinical neurological status including the National Institute of Health Stroke Scale Score (NIHSS) were recorded.

RESULTS

The acute lesions on the cerebral blood -volume (CBV) and -flow (CBF) maps best correlated with the infarct size on the followup studies. The acute lesions on the PWI, especially the mean transit time (MTT) best correlated with the baseline clinical status (NIHSS). On the DWI the lesions on the Apparent Diffusion Coefficient (ADC) maps correlated with the infarct volume better than the diffusion-weighted (b=1000) images.

CONCLUSION

The acute lesions on the CBV and CBF perfusion maps appear to be the best estimate of the infarct core. The MTT maps reflect the hemodynamically affected brain tissue and thus correlate best with symptomatology in the initial phase. The information provided by PWI in this clinical setting is crucial for therapeutic decisions. Refinement of the concept of “diffusion-perfusion mismatch” seems necessary.

O23.10

CAN MRI BE CONSIDERED THE PRIMARY EXAMINATION IN THE AETIOLOGIC DIAGNOSIS OF INTRACEREBRAL HAEMATOMA?

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PURPOSE

To determine if MRI could become the first examination in the aetiological diagnosis of intracranial haematoma.

MATERIAL AND METHODS

From March 2005 to May 2006, 26 patients with an acute non hypertension-related hematoma were included in a prospective study performed in 2 Neuroradiology departments. Inclusion criteria were : - a good clinical status with a GCS > 10 - a lobar hematoma or a deep hematoma in a patient younger than 50 y. - an MRI in the first 2 days of clinical onset. The MRI sequences were DWI, Spin Echo T1 before and after injection of contrast agent, T2*, FLAIR, enhanced FSPGR T1. Digital subtraction angiography, or a second MRI, was performed as control within the next two months after the first examination when no lesion was initially detected. If a vascular shunt was diagnosed, it was secondarily treated by endovascular methods.

RESULTS

In 8 patients no underlying lesion to the hematoma was diagnosed by emergency MRI. Neither angiography nor control MRI secondarily performed contradicted the initial findings. In 18 patients, the first MRI diagnosed the cause of the intracranial hemorrhage: 1 dural arteriovenous shunt with cortical venous drainage, 8 arterio-venous malformations, 2 cavernomas, , 4 tumors , 2 amyloid angiopathies (associating a large acute hematoma with associated microbleeds or sequelae of previous hemorrhages), 1 haemorrhagic transformation of acute ischemic stroke . MRI made the proper diagnosis in each patient. No false positive or negative results were obtained.

CONCLUSION

MRI is a good tool for depiction of parenchymal haemorrhage and allows proper diagnosis in the aetiological research of intracerebral hematomas. It offers nowadays the immediate finding of a potential underlying vascular or tumoral lesion. It can replace CT, Angio CT and DSA as the first examination. Gadolinium injection in the first 3 days is the key to obtain this precise diagnosis.

O23.11

IN VIVO 1H MRS STUDY OF STALEVO-TREATED AND UNTREATED PATIENTS WITH PARKINSON'S DISEASE (PD)

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of Gerontology of the Academy of Medical Sciences of Ukraine, Kiev/UA

PURPOSE

We propose the quantitative indicators for the characteristics of the functional activity of the brain in patients with PD after single dose of STALEVO (Levodopa/Carbidopa/Entacapone (150/50/200)) treatment.

MATERIAL AND METHODS

Three groups of patients are studied by ^1H MRS with 1.5T Magnetom Vision (SIEMENS). The 1st group (TPG) includes 10 STALEVO-treated subjects with PD. The 2nd group (PG) includes 10 untreated subjects with PD. The 3rd group (VG) consists of 20 healthy volunteers. For all subjects spectra are recorded in the putamen with STEAM method: TR/TE=1500/135,155,175,200,270 ms. For subjects of TPG and PG the spectra are obtained in the putamen both ipsilateral and contralateral to the worst affected side.

RESULTS

We found a significant reduction in NAA/Cho ratios from the putamen contralateral to the most affected side in the PG, but not the STALEVO-treated TPG groups compared with VG. There were no significant differences in NAA/Cr or Cho/Cr ratios. In untreated patients of PG reduced putaminal NAA/Cho ratios may reflect loss of nigrostriatal dopamine terminals or alternatively indicate a functional abnormality of striatal putaminal neurons, such as membrane dysfunction due to striatal deafferentation.

CONCLUSION

This study suggests that NAA/Cho ratios may be affected by STALEVO-therapy and NAA/Cho values may provide an indicator (a reversible marker) of neuronal dysfunction in the striatum. This study gives a new insight into brain biochemistry in patients with PD.

O23.12

DETERMINATION OF REGIONAL DIFFERENCES IN CONTENT AND IN T₂ RELAXATION TIMES OF THE MAIN CEREBRAL METABOLITES IN PATIENTS WITH PARKINSON'S DISEASE (PD): IN VIVO ^1H MRS STUDY

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PURPOSE

From the analysis of ^1H MRS data and their echo-time dependence we propose the quantitative indicators for the characteristics of the brain state in patients with PD.

MATERIAL AND METHODS

Two groups of patients are studied by ^1H MRS with 1.5T Magnetom Vision (SIEMENS). The 1st group (PG) includes 70 patients with PD (48–74 y). The 2nd group (VG) consists of 20 healthy volunteers (50–73 y). Spectra are recorded in the temporoparietal cortex (TC), lentiform nucleus (LN), putamen

(P) and substantia nigra (SN) with STEAM method:TR/TE=1500/135,155,175,200,270 ms.

RESULTS

We introduce two indicators: the metabolite content A^M as the peak area and the concentration $C^M = A^M/S$. We describe the metabolic state in VOI by the triad $T^* = \{A^{\text{Cho}}, A^{\text{Cr}}, A^{\text{NAA}}\}$, where A^{Cho} , A^{Cr} , and A^{NAA} are the peak areas of the signals of metabolites. For each of the areas we assign three values: 1, 2, 3, to obtain six symbolic spectral configurations: $1^* = \{1,2,3\}$, $2^* = \{2,1,3\}$, $3^* = \{1,3,2\}$, $4^* = \{3,2,1\}$, $5^* = \{3,1,2\}$, $6^* = \{2,3,1\}$. In the VG triads 1^* and 2^* dominate in all VOI, 3^* and 4^* are often in elderly subjects. In the PG the most frequent configurations in TC are 2^* and 5^* and in LN, P and SN are 5^* and 6^* . In the PG a decrease of C^{NAA} and similar values of C^{Cr} and C^{Cho} in LN and in TC are obtained. The mean T_2^M values in all regions of the brain in PG are the following: $T_2^{\text{Cr}} = 220 - 230$ ms, T_2^{Cho} , $T_2^{\text{NAA}} = 380 - 400$ ms. From comparison of T_2^M values in P, LN and SN in the both groups the shortening of T_2^M in the PG are obtained. In the TC the T_2^M values are similar in PG and VG.

CONCLUSION

This study gives a new insight into brain biochemistry in patients with PD.

O23.13

MAGNETIC RESONANCE IMAGING IN PATIENTS WITH ACUTE BRAIN TRAUMA

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PURPOSE

The aim of our study was to evaluate diagnostic magnetic resonance imaging (MRI) abilities in patients with acute brain trauma.

MATERIAL AND METHODS

147 patients with intracerebral traumatic haematoma have been examined for 2 years. Mean age of the patients was 44.5 (range 14–72), 94 subjects were men and 53 were women. X-ray of the skull and MRI investigation were conducted within the first 2–6 hours after trauma onset. X-ray was performed to examine cranial bones fracture. MRI investigation was carried out on tomograph Ellipse 0.15 T (Russia) to assess the brain injury. The standard protocol of MRI investigation consists of axial Fluid Attenuated Inversion Recovery (FLAIR) images, coronal T2 and, axial and sagittal T1 images. All patients were operated within 14 hours after trauma. The repeated MRI investigations were performed all patients in 3–6 days after trauma for operation control, i.e. at the subacute period of the disease.

RESULTS

All MRI data have got an operative confirmation. The presence and the volume of intracerebral haematoma have been assessed precisely by MRI images. Furthermore, we have observed additional traumatic inoperable haematoma which also have been controlled on repeated MR images. These results refute arguments of low efficacy of the MRI for acute trauma diagnostics. All repeated MRI examinations we have used to assess self-descriptiveness of the acute MR images. This approach is based on well - known fact that the methemoglobin allows to reveal

presence, localization and volume of haematoma. We haven't found any additional cerebral contusion lesions on repeated MR images compared with MR images at acute period.

CONCLUSION

According to our study results we can presume that the MR investigation in patients with acute trauma is sensitive and precise method to verify the intracerebral haematoma. Besides, it reveals not only large haematoma but also small inoperable lesions even at the first hours after the trauma onset.

O23.14

POST-MORTEM DIFFUSION-WEIGHTED AND DIFFUSION TENSOR IMAGING

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PURPOSE

Diffusion-weighted MR imaging has been used mainly for the demonstration of acute ischemic stroke; only a few studies have investigated general hypoxic changes following brain death, and these have been performed in patients shortly before death. We aimed to explore DWI and DTI post-mortem.

MATERIAL AND METHODS

A total of 20 deceased (15 male, 5 female; aged 3 to 94 years, mean age: 45.1) were examined by Magnetic Resonance Imaging of the brain. Additionally, two healthy living volunteers were examined using the same imaging protocol. Standard autopsy was performed according to current autopsy guidelines by a board certified forensic pathologist. For DTI, a multi-slice line-scan sequence was used where for each slice 6 images with high b value in 6 different noncollinear directions [relative amplitudes: (Gx,Gy, Gz) = {(1,1,0),(0,1,1),(1,0,1),(-1,1,0),(0,-1,1)(1,0,-1)}] and two images with low b value (5 s/mm²) were recorded. The following parameters differed for the axial whole brain and the sagittal brainstem studies. Whole brain study: bmax 1000 s/mm², field of view: 24×18 cm; 22 slices (5 mm thick, 1 mm spacing); TR: 3808 ms, TE: 96 ms; matrix: 128×128 with 1 NEX. The images were exported to an external workstation and maps of the apparent diffusion coefficient (ADC) and fractional anisotropy were calculated on a pixel-by-pixel basis from these images; the diffusion tensors were reconstructed using homewritten software.

RESULTS

The post-mortem ADC values ranged between 0.18 and 0.26×10⁻⁵ cm²/s (mean: 0.22×10⁻⁵ cm²/s) without and between 0.28 and 0.41×10⁻⁵ cm²/s (mean: 0.34×10⁻⁵ cm²/s; SD = 0.034×10⁻⁵ cm²/s) with approximate temperature correction. The temperature corrected values are the ones used for the evaluation of the data in the rest of the paper. ADC values in the living volunteers were between 0.67 and 0.84×10⁻⁵ cm²/s (SD = 0.042 cm²/s). Thus, compared to the volunteers, the ADC values in the post-mortem brains were markedly decreased. The FA values were between 0.196 and 0.631 in the controls and between 0.121 and 0.604 in the post-mortem cases.

CONCLUSION

Diffusion-weighted MR shows decreased ADC values and a white brain appearance that correspond to deep ischemia. This is in contrast to the FA values that are not altered significantly when compared to living controls. Our results suggest new potential applications of these techniques to MR-forensic explorations of the human brain.

O23.15

TRAUMATIC EXTRA-AXIAL HEMORRHAGE: CORRELATION OF POSTMORTEM MSCT, MR IMAGING AND FORENSIC-PATHOLOGICAL FINDINGS

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PURPOSE

To evaluate the diagnostic accuracy of in situ postmortem MSCT and MR imaging in the detection of primary traumatic extra-axial hemorrhage.

MATERIAL AND METHODS

Thirty forensic neurotrauma cases and 10 non-traumatic controls (25 male; 15 female; age range, 22 weeks-87 years; mean age, 47 years) who underwent both in situ postmortem cranial MSCT and MR imaging before autopsy were retrospectively reviewed. The radiological data were independently read by two board-certified neuroradiologists who were blinded to all subject information. The extra-axial hemorrhagic findings were evaluated according to morphological criteria, anatomical localization and extent. Both imaging modalities were analyzed in view of their sensitivity, specificity and accuracy concerning the detection of extra-axial hemorrhage, with the forensic autopsy protocols and photographic documentation serving as reference standard. Statistical significance was calculated using the McNemar test. κ and prevalence-adjusted bias-adjusted κ (PABAK) values for interobserver agreement were calculated for both imaging modalities.

RESULTS

Forensic-neuropathologic examination revealed 1141 extra-axial hemorrhagic sites, from which 29 were located within the epidural, 331 within the subdural and 781 within the subarachnoid space, respectively. Analysis of the detection of epidural hemorrhagic sites using CT showed an accuracy, sensitivity, and specificity of 62.5%, 26% and 88%, which was 79.5%, 79% and 80% for subdural, and 85.5%, 85% and 86% for subarachnoid hemorrhage. For MRI the accuracy, sensitivity, and specificity were 60.5%, 22% and 99% for epidural hemorrhage, 80.5%, 77% and 84% for subdural, and 87.5%, 87% and 88% for subarachnoid hemorrhage. MR imaging was more sensitive than CT in the detection of subarachnoid hemorrhagic sites (P = .001), whereas no significant difference resulted from the detection of epidural and subdural hemorrhagic sites (P = .248 and P = .104, respectively). The specificity of MR imaging for the detection of non-hemorrhagic

epidural, subdural and subarachnoid sites was significantly better than that of CT ($P = .023$ and $P < .001$ and $P = .002$, respectively).
CONCLUSION

CT and MR imaging show their comparable potential as future postmortem diagnostic tools for the detection of acute extra-axial

hemorrhagic sites, even if the specificity of postmortem MR imaging is significant better than that of postmortem CT.

16:30 – 17:30

COFFEE BREAK SYMPOSIUM: COFFEE BREAK SYMPOSIUM

17:30 – 19:30

SS 16

Main session: *Tissue characterization / Spine*

Chairs: G. Dooms, J. Schneider

Room: ESNR / Diagnostic

O16.1

VALUE OF PERFUSION CT IN DIFFERENTIATING DEMENTIVE DISORDERS - A PRELIMINARY REPORT

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PURPOSE

To evaluate the usefulness of perfusion CT (pCT) in differentiating Alzheimer's disease (AD) from vascular dementia (VAD) and mixed dementia (MixD).

MATERIAL AND METHODS

pCT was performed in 41 patients with diagnosis of dementia based on clinical criteria: 24 with AD, 8 with VAD, and 9 with MixD. The subgroups of patients were age-matched, the mean age was 68,3 years. pCT was performed at the level of basal ganglia (contrast medium - 40 ml, 4 ml/sec., scanning - 1 scan/sec. for 50 sec.) and analyzed with deconvolution-based algorithm. Values of regional blood flow (rCBF), blood volume (rCBV) and mean transit time (rMTT) were calculated from 31 ROIs in the grey and white matter of frontal and temporal lobes, basal ganglia, and internal capsules bilaterally. The data obtained from the subgroups of the AD, VAD, and MixD patients were compared statistically using ANOVA and the post hoc Sheffe test.

RESULTS

Our study revealed some significant differences among the AD, VAD and MixD groups. rCBF and rCBV values in most of ROIs (21/31 and 27/31, respectively) in the grey and white matter of both frontal and temporal lobes were significantly lower in AD than in VAD ($p < 0.05$). rCBF and rCBV values were also significantly lower (In 11/31 and 19/31 ROIs respectively) in the MixD patients comparing to the VAD subgroup (mostly in the grey matter of both hemispheres). There were no significant differences in rMTT values between AD and VAD or between MixD and VAD as well as in values of rCBF, rCBV and rMTT between AD and MixD.

CONCLUSION

pCT seems to be a valuable method of distinguishing between AD and VAD on the basis of rCBF and rCBV values. However, it seems to be of little significance in differentiating VAD from MixD and of no usefulness in distinguishing MixD from AD.

O16.2

LEUKOARAIOSIS AND EXECUTIVE DYSFUNCTION: A MULTIMODAL MAGNETIC RESONANCE STUDY

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PURPOSE

Executive deficits are the most prominent cognitive characteristic associated with leukoaraiosis (LA) but their relationship to LA remains unclear. Magnetic resonance (MR) imaging now allows both three dimensional assessment of LA and accurate quantification of intracranial dynamics. Thus, our aim was to research structural and dynamic changes that could explain the significant neuropsychological heterogeneity in LA.

MATERIAL AND METHODS

75 elderly people with mild cognitive impairment underwent MR imaging including structural and phase contrast sequences. MR analysis included assessment of LA and entorhinal atrophy, flow measurements and determination of the amplitude transfer functions; from the blood and CSF waves providing "blood/CSF indices", from the CSF and venous waves providing "CSF/venous indices". Executive functions were evaluated with the Trail Making test (TMT) parts A and B, a difference score being calculated by subtracting the time taken in Trail Making A from the time taken in Trail Making B. Its median value from the whole study group was used to categorize patients with significant deep white matter changes as having worse executive function or not. Statistical analysis used Mann-Whitney test or Fisher's exact test according to the nature of the variables.

RESULTS

There was an increased frequency of traumatic LA including subependymal and subpial changes in the LA group with worse executive performance ($P=0.0069$). This group was characterized by MR profiles suggestive of altered brain perfusion ($P=0.0002$). These profiles included severe reduction of the total arterial inflow (below the 25th percentile cutoff of the whole study group), high pulsatility of the intracranial arterial pulse wave (high blood stroke, high index of arterial pulsatility and traumatic LA) and decreased dampening of the intracranial arterial pulse wave (hydrocephalus like dynamic profile and traumatic LA or association of both low blood/CSF and CSF/

venous indices). No significant difference in terms of age, education, frequency of confluent deep white matter changes or degree of entorhinal atrophy was observed between the two LA groups.

CONCLUSION

These data confirm the absence of linear relation between the extent of LA and cognitive impairment. They suggest that cognitive impairment related to LA and dementia in the arteriovenous fistula could share at least partly similar pathomechanism of increased pulse pressure on arterioles.

O16.3

1H MRS COMPARATIVE STUDY OF CEREBRAL METABOLISM IN PATIENTS WITH MILD COGNITIVE IMPAIRMENT (MCI), VASCULAR DEMENTIA (VD) AND IN NORMAL ELDERLY SUBJECTS (N)

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PURPOSE

The aim of our study is to characterize the metabolic changes in the brain of patients with MCI, VD, and normal elderly subjects on the basis of analysis of ¹H MRS data.

MATERIAL AND METHODS

Three groups of patients are studied by MRI and ¹H MRS with 1.5T Magnetom Vision (SIEMENS). The 1st group includes 65 patients (56–84 y) with MCI. The 2nd group consists of 40 patients with VD (52–73 y). The 3rd group (N) consists of 50 healthy volunteers (60–75 y). ¹H spectra are recorded in hippocampus (H), amygdala (A), frontal lobes (FL) and in entorhinal cortex (EC) with the SVS STEAM method: TR/TE=1500/135,155, 175, 195, 215 and 235 ms, VOI = 8 cm³, NS = 128.

RESULTS

In the ¹H spectra the following signals are identified: N-acetylaspartic acid (NAA)-2.02 ppm, total creatine (Cr)-3.03 ppm, choline (Cho)-3.24 ppm, and myo-Inositol (mIns)-3.56 ppm. From the spectra in all sampled regions of the brain the peak areas of main metabolites: NAA, Cr, Cho and mIns, and also the metabolite ratios are obtained. For the patients of the 1st versus the 3rd group the significant decrease of NAA and Cr and the increase of Cho peak areas in all regions and also significant decrease of NAA/Cr, and Cho/Cr in H and FL are observed. In the 1st group (NAA/Cr=1.01; mIns/Cr=0.82; Cho/NAA=0.96), in the 2nd group (NAA/Cr=1.14; mIns/Cr=0.58; Cho/NAA=0.86), and in the 3rd group (NAA/Cr=1.25; mIns/Cr=0.62; Cho/NAA=0.53) are obtained. There is the significant increasing in mIns/Cr (0.69) ratios in the patients of the 1st group compared with the patients of the 2nd group (0.52). Comparison ¹H data in the right and left FL and EC for the patients of the all groups a significant reduction of NAA/Cr in the left hemisphere and non-significant reduction of NAA/Cr in the right hemisphere are found. The ratios of Cho/NAA, mIns/NAA in H, FL and EC are the most accurate values for differentiation MCI, VD and N.

CONCLUSION

¹H MRS data are useful in predicting the progression of MCI and VD and also for identification of cognitively normal subjects at risk for developing MCI.

O16.4

IS ALZHEIMER DEMENTIA A HETEROGENEOUS AND PREDICTABLE SYNDROME? A STRUCTURAL AND PHASE CONTRAST MAGNETIC RESONANCE STUDY

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PURPOSE

Alzheimer type and vascular pathology are the major pathological correlates of late-onset dementia and both entorhinal atrophy, the hallmark of Alzheimer's disease (AD), and leukoariosis (LA), the main magnetic resonance (MR) substratum of vascular-related cognitive impairment, are predictors of dementia. But there is no clear structural or neuropathological threshold of Alzheimer type and vascular features that predict cognitive status. Additional dynamic features could help to determine their contribution to cognitive failure and thus to define specific therapeutic strategies. And our aim was to characterize the specific pathomechanisms which predict dementia using both structural and flow MR analysis.

MATERIAL AND METHODS

75 community-dwelling older subjects with mild cognitive impairment underwent baseline MR examination including structural and phase contrast sequences. Follow for at least 2 years through repeated neuropsychological testing and medical assessment was obtained for 62 patients. Diagnoses of incident dementia were independently made by experienced dementia clinicians using standard criteria.

RESULTS

During follow-up, 17 patients developed dementia of whom 15 fulfilled the criteria for AD. Baseline MR features identified four main subtypes that were only observed in the converters (P<.0001). The "AD like" subtype was characterized by a structural pattern of predominantly left marked entorhinal atrophy but no significant perivascular LA, a dynamic pattern of low brain pulsations (n=5). Characteristics of the "microvascular like" subtype included a) in the hyperdynamic form, at least larger deep white matter changes and dynamic changes suggestive of very high intracranial pulsations, (n=7), b) in the hypodynamic form, extensive LA and severely reduced intracranial pulsations (n=3). Entorhinal atrophy was inconstant in both forms of this subtype. There was no MR evidence of predominantly left entorhinal atrophy or larger deep white matter changes in the two last subtypes. One subtype associated MR indicators of marked atrophy and hyperdynamic brain pulsations (n=1), the other subtype was defined by both very low craniospinal compliance and severely reduced intracranial pulsations (n=1).

CONCLUSION

Additional dynamic criteria seem required for individual MR prediction of rapid conversion to dementia. Alzheimer dementia appears to be a heterogeneous syndrome, the most common sole or dominant cause being small vessel disease.

O16.5**MR VOLUMETRY AND DIFFUSION-WEIGHTED IMAGING AT 3T IN THE EARLY STAGE OF HUNTINGTON'S DISEASE**P. Demaerel¹, W. Vandenberghe², G. Wilms³, F. Maes⁴;¹University Hospitals K.U.Leuven, Leuven/BE, ²University Hospital K.U.Leuven, Leuven/BE, ³University Hospitals Gasthuisberg, Leuven/BE, ⁴Catholic Universities of Leuven, Leuven/BE**PURPOSE**

To assess the value of MR morphometry and diffusion-weighted imaging as biomarker in the early stage of symptomatic Huntington's disease.

MATERIAL AND METHODS

Brain MRI at 3T was obtained in 10 consecutive patients with a stage I Huntington disease, according to Shoulson and Fahn. For comparison 12 age- and sex-matched volunteers underwent brain MRI. A neuroradiologist, blinded to the diagnosis, used 3D gradient echo T1 weighted images for manual outlining of the caudate nucleus and the putamen on both sides. Subsequently these measurements were used to calculate the apparent diffusion coefficient. An unpaired t test was used for statistical analysis.

RESULTS

There was a significant decrease in the volume of the caudate nucleus and the putamen in the early stage of Huntington's disease. There was no significant difference in the ADC values between the patients with early stage of Huntington's disease and the controls.

CONCLUSION

Increased diffusivity has been reported in the putamen, globus pallidus, caudate nucleus and thalamus(1,2). These changes were considered consistent with the underlying neuropathology of Huntington's disease. In our study at 3T we were not able to confirm these observations. It seems therefore too early to claim the use of striatal diffusivity as surrogate marker for disease severity in early Huntington's disease. Despite possible shortcomings such as a small patient group, lack of longitudinal monitoring and lack of comparison with PET, the present study indicates that striatal diffusivity does not necessarily represent a quantitative measure of striatal damage. (1) Mascalchi M, Lolli F, Della NR, et al. Huntington disease: volumetric, diffusion-weighted, and magnetization-transfer MR imaging of brain. *Radiology* 2004; 232:867–873. (2) Seppi K, Schocke MFH, Mair KJ, et al. Diffusion-weighted imaging in Huntington's disease. *Movement Disorders* 2006, Mar 28 Epub.

O16.6**MAGNETIC RESONANCE SPECTROSCOPY IN PATIENTS WITH ALCOHOL-RELATED DEMENTIA**K.S.J. Ahn¹, D.J.B. Kim², Y.Y. Jung³, S.T. Hahn⁴;¹The Catholic University of Korea, Seoul/KR, ²Asan Medical Center, University of Ulsan College of Medicine, Seoul/KR, ³Catholic University Medical College, Seoul/KR, ⁴St.Mary's Hospital, College of Medicine, The Catholic University of Korea, Seoul/KR**PURPOSE**

Although the relationship between alcohol consumption and dementia is complex, it is generally accepted that alcohol dependence can lead to a syndrome of dementia. The aim of this study is to search for the proton magnetic resonance spectroscopy (MRS) findings of alcohol-related dementia (ARD), and to validate its usefulness in detecting ARD from other types of dementia.

MATERIAL AND METHODS

Twenty patients with ARD (twenty men, mean age 57.5±7.6 years) were included in this study. The mean duration of the disease was 3.5±1.9 years. The Mini-Mental State Examination (MMSE) was administered to all patients, and the mean score was 17.8. Fifteen age-matched normal controls (fifteen men, 55.6±6.7 years) were also recruited. The controls had no history of major neurological or psychological disease or severe medical illness. MR spectroscopic data were acquired at anterior and posterior cingulate gyral regions of the ARD patients and normal controls in a whole body 1.5 T MR system (Signa Excite, GE Medical System, Milwaukee, WI, US) with point-resolved spectroscopy (TR/TE 1500/35 msec, volume of VOI 2×2×2 cm³, number of acquisitions 128). From raw MRS spectra, NAA/Cr, Ch/Cr, Ins/Cr, and Glu+Gln (Glx)/Cr were calculated by using LCModel software program.

RESULTS

At anterior cingulate gyral region, patients with ARD showed statistically significant decrease in NAA/Cr (ARD 1.36 Vs control 1.49, p = 0.014). Other evaluating metabolite ratios including myoinositol did not show statistically significant difference between ARD and control groups. Although Glu+Gln/Cr did not show statistically significant difference (ARD 2.69 Vs control 2.54, p = 0.064), its average is higher than that of normal controls, and was well correlated with MMSE score (r = 0.72, p < .05) and calculated total amount of consumed alcohol (r = 0.75, p < 0.05). At posterior cingulate gyral region any metabolite on MRS spectra did not show significant difference between patients with ARD and normal controls.

CONCLUSION

We can conclude decreased NAA should be an important proton MRS finding in patients with ARD, same as Alzheimer disease. Glutamate-glutamine complex (Glu+Gln/Cr) can be another important metabolite to recognize ARD from other types of dementia, nevertheless of the statistically not significant difference between patients with ARD and controls. We think providing more increased recruitment of ARD patients and controls, better results can be produced.

O16.7**THE ROLE OF MRI IN THE EVALUATION OF SPINAL CORD INJURY WITHOUT SKELETAL ABNORMALITY**E. Testempassi¹, G. Katsou¹, K. Paulopoulou², D. Chondros¹, V. Vantali¹;¹Evangelismos Hospital, Athens/GR, ²Evangelismos, Athens/GR**PURPOSE**

The purpose of our study is to present cervical spinal cord injury without skeletal in patients with no evidence of vertebral fractures or malalignment.

MATERIAL AND METHODS

We present eight patients with cervical spinal cord injury ranged in age from 23 to 71 years, five male patients and two female patients. There was no evidence of skeletal abnormality neither on plain radiographs or CT images. All patients were examined with a 16 row multi-detector CT scanner and MPR images and 3D reconstructions of the cervical spine were performed in all patients. As all patients had neurological symptoms MR was performed during the first 72 hours of admission.

RESULTS

MRI showed spinal cord contusions and edema in six patients, intramedullary hematoma in one patient and there was no evidence of abnormality in one patient. Degenerative disease and minor disc prolapses of the cervical spine were evident in two patients. All patients showed improvement on MR imaging findings in follow-up MR images in a period of one to two months. There was a linear correlation between the improvement of symptoms and the imaging findings.

CONCLUSION

MRI can show significant abnormalities in patients with cervical spine injury with normal bony condition and there is a correlation with MR imaging findings and neurological symptoms.

O16.8

DIFFUSION-WEIGHTED MR IMAGING (DWI) IN EVALUATION OF EPIDURAL SPINAL LESIONS

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PURPOSE

Diffusion weighted MR imaging (DWI) has emerged from an experimental method to an important diagnostic tool in neuroradiology within the last few years. However, it is rarely used in the spine or spinal cord. However, it is rarely used in the spine or spinal cord. Epidural spinal cord compression is one of the most important emergencies and requires prompt and adequate treatment. The aim of our study was to assess the role of DWI in distinguishing epidural lesions.

MATERIAL AND METHODS

We have included three patients with epidural lymphoma, two with sarcoma, three with metastatic disease, and two with epidural abscess collection. Conventional sequences including sagittal T1-WI, T2-WI, STIR, and axial T2-WI MR images were performed in all patients. DWI was performed using navigated, interleaved, multi-shot echo planar imaging (IEPI). Imaging findings on conventional MR sequences and signal intensities on DWI were evaluated. On corresponding apparent diffusion coefficient (ADC) maps three measurements inside the lesions were performed and the mean ADC value was taken into analysis. The cellularity of tumors was determined as N/C ratio, which was calculated by dividing the percentage of nuclear area by the percentage of cytoplasmic area. The ADC values and N/C ratios of lesions were compared by using a Kruskal-Wallis test.

RESULTS

On T2-weighted MR images lymphomas were hypointense, sarcomas were hyperintense except for one, and metastases were hyperintense. Epidural inflammatory collections were intensely hyperintense centrally on long TR images. Mean ADC of lymphoma was 0.66×10^{-3} mm²/s, mean ADC of sarcomas was 0.85×10^{-3} mm²/s, and that of metastatic lesions was 1.05×10^{-3} mm²/s, however the differences were not statistically significant. Epidural abscess collections had a mean ADC of 1.95×10^{-3} mm²/s. Mean N/C ratios in lymphomas, sarcomas, and metastases were 4:1, 2:1, and 2.5:1 with statistical significant difference between the groups ($p < 0.025$). In patients with N/C ratios 3:1 and 4:1 higher ADC values were observed indicating higher restriction of diffusivity.

CONCLUSION

The data from our study suggest that DWI is a feasible and potentially useful technique in evaluation and distinguishing of epidural lesions causing spinal cord compression. Although not statistically significant due to small patient sample, the results clearly show tendency of diffusion decrease in neoplastic lesions with higher cellularity.

O16.9

DIFFUSION TENSOR IMAGING OF SPINAL CORD TO DIFFERENTIATE EPENDYMOMAS AND ASTROCYTOMAS. A STUDY OF 43 CASES

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PURPOSE

To assess the emerging role OF DTI indices and Tractography in spinal cord Intramedullary tumor characterization using high FA rind sign and FA value transition at cord tumor interface. A study of 43 cases.

MATERIAL AND METHODS

43 patients in the age range OF 28–62 years and M:F ratio OF 2:1 and 15 normal controls were included in the study. Clinical categories included spinal cord Astrocytomas (n=22), ependymomas(n=17),Haemangioblastoma (n=4) metastases(3). Normal controls were used to depict the normal anatomy of tracts as the reference standard. All patients were examined on a 1.5T system using DTI EPI sequence with a neurovascular multichannel coil with the sequence parameters as follows: TR 9772 TE 88 msec B value OF 0 and 1000 , directions 55, matrix 128×128 The data was then processed) using Fiber tracking software. ADC maps, Fractional anisotropy maps .andTracts were generated using single/double ROI methods by keeping seed point covering the whole OF the cord and cervico medullary junction on a midsagittal anisotropic reformatted image.

RESULTS

The cortico spinal tracts, The medullary decussations, anterior and lateral spinothalamic tracts fibers are visualized in all normal controls. Astrocytomas caused infiltration and interruption of spinothalamic tracts, posterior columns, Corticospinal tracts. Astrocytomas showed disruption High FA rind sign either at cranial or caudal margins showing advancing edge pattern. The FA values were reduced over a wide transition zone in Astrocytomas

(n=22) with the mean value of 0.23 at the cord and tumor interface. Ependymomas showed well circumscribed High FA rind sign with no disruption of the High FA border and hence a narrow transition zone with no advancing edge pattern. The FA values showed a sharp increase at the periphery of tumor suggestive of narrow transition of values with a mean FA value of 0.62 at the interface of cord and tumor. Hemangioblastomas showed a well defined High FA rind sign with sharp Transition of FA values at the interface of cord and tumor.

CONCLUSION

High well circumscribed FA Rind around intramedullary cord tumors favors a well encapsulated tumor contrary to infiltrating tumors with disruption of this Rind on FA maps with advancing edge pattern. DTI indices and tractography characteristics have an emerging role in intramedullary tumor characterization by using High FA rind sign, Advancing edge pattern, FA value transition at the cord and tumor interface specially so between ependymomas and Astrocytomas.

O16.10

DYNAMIC IMAGING OF THE SPINE WITH AN OPEN, UPRIGHT, FUNCTIONAL MRI (FMRI): WORKING TOWARDS A NEW GOLD STANDARD?

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PURPOSE

Imaging of the spine during axial loading and during kinetic maneuvers is now possible with a top-front open MRI unit. The purpose is to present first imaging studies obtained at the fmri center in Zurich, which confirm and further illustrate the positive statements made by the pioneers, as published by Jinkins et al.

MATERIAL AND METHODS

Patients with a history of recurrent positional or motion-dependent pain and/or neurologic dysfunction of the cervical and lumbar spine were investigated in the upright-seated or standing position, including neutral and flexion-extension imaging.

RESULTS

A position-dependent appearance or increase of posterior disc protrusions, a varying degree of central canal and foraminal stenosis, and of mobile spinal instability (spondylolisthesis) was demonstrated in cases with preceding less remarkable or even negative recumbent MRI examinations. Illustrative cases include Type I Chiari Malformation, cervical and lumbar unilateral and bilateral spinal instability, lateral, rotational instability, dynamic spinal cervical and lumbar stenosis and position-dependent disc herniations. In an ice hockey player, who suffered from a post-traumatic transient quadriplegia, a C3C4 disc protrusion increasing during retroflexion associated with posterior unilateral instability was identified. In a patient sent for a suspected C3C4 stenosis a missed odontoid fracture with C1 C2 instability was disclosed. Postoperative functional spinal imaging allows the detection of dynamic stenosis/disc protrusion and mobile spondylolisthesis at levels above or below a rigid fusion (provided the patients have no ferromagnetic implants). The proper function or

dysfunction of dynamic stabilizing implants, some of which are popular for their minimal invasiveness, can also be studied by fmri.

CONCLUSION

By visualizing position-related alterations in the bony structures and the underlying soft tissues in the upright weight-bearing position, fmri enables the physician to make more accurate decisions regarding treatment options and alternatives, as compared to recumbent MRI. FMRI could become the imaging modality required before performing complex spinal decompression, reconstruction and stabilization procedures, providing the surgeon with adequate anatomic informations, thus diminishing the risk of failed back surgery. This open MR imaging modality is free from the negative effects of radiation and is popular among claustrophobic patients. In present usage, fmri enables better correlation between patient complaints and imaging findings. The need for dynamic myelograms will decrease, this invasive technique being useful for patients with ferromagnetic hardware, but not adequate to demonstrate intra- to extraforaminal pathology. Apart from degenerative disc disease, juvenile scoliosis could potentially be followed benignly by serial fmri. Children, while sitting in their mothers lap, may undergo basic cranial or spinal imaging mostly without sedation.

O16.11

LUMBAR 5 HYPOPLASIA AND WEDGING AND (PSEUDO-) ANTEROLISTHESIS IN PATIENTS WITH SPONDYLOLYSIS. STUDY WITH MRI

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PURPOSE

To describe the findings on MRI in patients with spondylolysis and hypoplasia of lumbar vertebra L5 with regard to the presence and degree of anterolisthesis.

MATERIAL AND METHODS

We studied the MR-images of 22 patients with bilateral L5 spondylolysis and hypoplasia and posterior wedging of L5. The anteroposterior diameter of L4, L5 and S1 were measured and compared. The degree of posterior wedging of L5 was calculated. The degree of anterolisthesis was determined as well as the myelographic repercussion on MR-myelography.

RESULTS

The mean difference between the anteroposterior diameter of L4 and L5 was 3,75 mm or 10,6% shortening of L5 compared to L4. The mean difference between the anteroposterior diameter of L5 and S1 was 4,25 mm or 11,9% shortening of L5 compared to S1. The mean percentage posterior wedging was 24,5%. In 13 patients there was no anterior vertebral slipping. True anterolisthesis grade 1 was seen in 5 and anterolisthesis grade 2 in 4 patients. Myelographic repercussion of the "anterolisthesis" was only seen in the 4 patients with grade 2 anterolisthesis

CONCLUSION

It is confirmed that hypoplasia of L5 can be at the base of pseudospondylolisthesis. L5 hypoplasia seems another reliable sign of bilateral spondylolysis.

O16.12

FIRST CLINICAL EXPERIENCES OF MR IMAGING OF THE SPINE AT 3T

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PURPOSE

Besides SAR limitations, MR imaging at 3T is influenced by pulsatile flow, increased magnetisation transfer (MT) effects, and increased T1 relaxation times at reduced T2 relaxation times. As there is only limited experience in spinal MRI at 3T, the purpose of this study was to qualitatively assess all kind of spinal MR investigations at a clinical 3T whole body system.

MATERIAL AND METHODS

We investigated 60 patients on a 3T whole body system (Tim Trio, SIEMENS, Erlangen, Germany), including 37 males and 23 females (age range 1–79 years). Pathologies comprised 14 disc herniations with sequestration, 9 disc protrusions, 8 osteochondroses, 3 syringohydromyelia, 4 spinal canal stenosis, 5 tumours, 4 disseminated encephalomyelitis, 4 epidural metastases, 3 cavernoma, 2 non inflammatory myelopathies, 2 dural arterio-venous fistula, and 2 miscellaneous diseases. Cervical spine was investigated in 26, thoracic spine in 13, lumbar spine in 15, and more

than one region in 6 patients. Measurement parameters for hyper TSE T2w sequences were TR 4,000 – 4,400 ms, TE 107 ms, pixel size 1.0×0.8×2.0 mm³, and for TSE T1w sequences TR 700 – 750 ms, TE 8.4 ms. In all cases sagittal and axial T2 and T1w images were acquired. Diagnoses were proven by histological confirmation, laboratory analysis, electrophysiology, or follow-up. Quality ranking from 1 for “excellent” through 5 for “poor” was performed on sagittal images.

RESULTS

In the cervical spine, the quality of T2w images was ranked as 2.5 (standard deviation “SD” 0.99), and that of T1w images as 3.38 (SD 0.8). For the thoracic spine, quality of T2w images was 2.38 (SD 1.26), and of T1w images was 2.69 (SD 1.25). In the lumbar spine, the quality of T2w images was ranked as 1.8 (SD 0.94), and that of T1w images as 2.93 (SD 0.88). After proven normality, no significant differences for the particular regions could be shown.

CONCLUSION

The better overall quality of T2w sequences compared to T1w images is attributed to the prolonged T1 relaxation times and increased MT effects on T1w images at 3T. The contrast between CSF and myelon was sometimes difficult to depict on T1w images, and had led to a worse quality ranking. Hemorrhagic pathologies such as cavernomas, and other intramedullary lesions were clearly depicted due to stronger T2 effects at 3T. Spinal MRI at 3T could be fully applied in our in-house clinical routine and revealed a quite good image quality accompanied by a good spatial resolution.

17:30 – 19:30

SS 20**LUNCH SYMPOSIUM: Biomechanics of Fluids**

Chairs: M. Ohta, N. Stergiopoulos

Room: ICS / Interventional

ML49

PATIENT-SPECIFIC COMPUTATIONAL FLUID DYNAMICS MODELING OF CEREBRAL ANEURYSMS

J.R. Cebral, /US

ML50

4D MRI FLOW VISUALIZATION

M. Markl, /

ML51

US-MEASUREMENT-INTEGRATED SIMULATION

T. Hayase, /JP

ML52

LASER DOPPLER VELOCIMETRY

T. Liou, /TW

17:30 – 19:30

SS 24**Free paper session: Aneurysm**

Chairs: T. Krings, H. Yilmaz

Room: Free Paper

O24.1**VOLUME EFFECTS OF ANEURYSM EMBOLIZATION WITH LIQUID EMBOLIC AGENTS: AN EXPERIMENTAL CT ANGIOGRAPHY STUDY**

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PURPOSE

Iodine-containing polyvinyl alcohol polymer (I-PVAL) is a novel precipitating liquid embolic that allows for artifact-free evaluation of CT angiography (CTA). As accurate aneurysm volumetry can be performed with multidetector CTA, we determined volumes of experimental aneurysms before, immediately and 4 weeks after embolization with this liquid embolic of 14 porcine experimental carotid sidewall aneurysms

MATERIAL AND METHODS

An automated 3D software measurement tool was used for volumetric analysis of volume rendering CTA data. Furthermore, intra-aneurysmal pressure changes during liquid embolization were measured in 4 silicone aneurysms and potential polymer volume changes within 4 weeks were assessed in vitro.

RESULTS

Liquid embolic injection was performed during temporary balloon occlusion of the aneurysm neck resulting in a mean occlusion rate of 98.3%. Aneurysms enlarged significantly during embolization by 61.1±28.9% while a significant shrinkage of 5.6±2.7% was observed within the follow-up period. In silicone aneurysm models intra-aneurysmal pressure remained unchanged during liquid embolic injection, while balloon inflation resulted in a mean pressure increase of 31.2±0.7%. Histologic analysis revealed an inflammatory foreign body reaction with partial polymer degradation while no polymer shrinkage was observed in vitro.

CONCLUSION

The aneurysm enlargement noted was presumably due to pressure elevation after balloon inflation, which resulted in dilatation of the weak venous wall of the newly constructed aneurysm - another shortcoming of this experimental aneurysm model. The volume decrease after 4 weeks expressed partial polymer degradation.

O24.2**THE ROLE OF ROTATIONAL 3D ANGIOGRAPHY IN DIAGNOSTIC EVALUATION OF INTRACRANIAL ANEURYSMS**

S. Milosevic Medenica

Institute of Radiology, Belgrade/YU

PURPOSE

Introduction: Three-dimensional imaging of intracranial aneurysms is a relatively new possibility of modern technology which enables a visualisation of the aneurysm in space with all details of its angioarchitecture. This possibility is offered by all neuroradiological digital methods (CT, MR and DSA), but DSA remains still the most exact one.

MATERIAL AND METHODS

Patients and methods: In short period from introduction of 3D DSA in our hospital (January – May 2006), we applied this method in 28 patients with proven intracranial aneurysms. There were 21 women and 7 men, ranging in age from 45 – 69 years (average age 55). All patients underwent CT in emergency and after that standard DSA, with additional 3D sequence on the vessel with proven aneurysm. The examination was done on the equipment Axiom Artis dFA by Siemens. The rotational sequence was realised by injection of 15 ccm of contrast medium, 2,5 ml/sec.

RESULTS

Results: We found 34 aneurysms in 18 patients. Ten of them were located on the carotid syphon, 7 on the posterior communicating artery, 6 on the anterior communicating artery, 5 on the middle cerebral artery, 3 on the tip of basillary artery, 1 on posterior inferior cerebellar artery, 1 on the vertebral artery and 1 on the pericallosal artery. There were 7 giant aneurysms, 10 big, 9 middle and 8 small aneurysms. In 4 patients 3D rotational sequence was of determining importance in differentiation of aneurysm from the vascular loop. In one postoperative case 3D DSA enabled a detailed visualisation of surgical clip and the residual pouch. In all other patients 3D reconstruction enabled an optimal visualisation of the aneurysmal neck, direction of the pouch and the relation with surrounding vessels, that was specially useful in giant and large aneurysms.

CONCLUSION

Conclusion: In spite of short period of the introduction of method, we found 3D DSA as very useful additional method which, thanks to unlimited number of oblique projections, enables a differentiation of aneurysm from the vascular loop and gives a valuable informations about morphology of the aneurysm and its relation to surrounding vascular branches. In the future work this method will contribute to reduction of number of exposures, that means lessening of radiation dose, as well as of the quantity of applied contrast medium.

O24.3**TREATMENT OF ACUTE RUPTURED ANTERIOR COMMUNICATING ARTERY ANEURYSM WHEN ENDOVASCULAR EMBOLIZATION IS CONSIDERED THE FIRST OPTION.**

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PURPOSE

The aim of this study was to evaluate the treatment results of acute ruptured anterior communicating artery (AcoA) aneurysm using endovascular coil embolization.

MATERIAL AND METHODS

One hundred seven consecutive patients were evaluated. The patients were managed prospectively according to the following protocol: the primary treatment modality was endovascular packing with GDC (Group CE). Surgical clipping was selected only for the patients with intra cerebral hematoma (ICH) or patients with aneurysmal domes of unsuitable form or size (Group NC).

RESULTS

Of 107 patients, 79 (74%) were treated with CE and 28 (26%) were treated with NC due to unsuitable shape in 11, small (less than 2 mm) in 9, with ICH in 6 patients. The surgical complications of the CE Group were intraoperative rupture in 1, and asymptomatic cerebral infarction in 3 patients. Post-op CAG showed complete embolization in 50, small neck remnant in 16, and dome filling in 5 patients. In the 5 patients with dome filling, 2 patients suffered from rerupture within a few days after CE and 3 underwent neck clipping. Symptomatic vasospasm occurred in five (6.3%) patients. The outcomes at discharge were GR in 57, MD in 6, SD in 2, VS in 3, and death in 10 patients. All patients were followed clinically and radiologically as outpatients (mean 1977 days). Although 5 of 69 (7.2%) patients showed aneurysmal recanalization and required neck clipping, no patients suffered from rebleeding of the aneurysm.

CONCLUSION

Over the 70% of acute ruptured AcoA aneurysms could be treated with coil embolization. This treatment was a useful therapeutic alternative for patients with ruptured AcoA aneurysm.

O24.4

HYPERFORM BALLOON ASSISTED OCCLUSION OF ANTERIOR COMMUNICATING, ANTERIOR AND MIDDLE CEREBRAL ARTERY ANEURYSMS.

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¹HACETTEPE ÜNİVERSİTESİ, ANKARA/TR, ²Hacettepe University, Ankara/TR

PURPOSE

We present our series of anterior communicating, anterior and middle cerebral artery aneurysms in which we use the supercompliant Hyperform bifurcation balloon (MTI-ev3, Irvine, CA) assisting endosaccular coil occlusion of to reconstruct the distal bifurcations.

MATERIAL AND METHODS

Data of 546 middle cerebral artery, distal anterior cerebral artery bifurcation and anterior communicating artery aneurysms treated with Hyperform balloon assistance in 504 patients in the last 4 years were reviewed. 397/504 pts were ruptured. 355 pts were Hunt and Hess Grade 0–2. 42 pts were grade 3–5

RESULTS

Thromboembolic complication occurred in 11 pts (2%), resolved completely with IA aspirin with no clinical consequence in 6 pts. In 5/11, the event caused neurologic deficit or mortality. 14 intraop perforation (2.8%) occurred in which Hyperform saved patients from a bleeding with no adverse event in 11. In the remaining, one patient died, two others had permanent morbidity. 19 patients died (4%) in the entire series. Among them, 10 pts who were grade 3 and 4 died due to consequences of SAH and 9 patients due to procedural complications. 35 pts had neurological deficits during discharge (7%) 16/35 had mRS 2 or lower (3.5%) in 6 month clinical control.

CONCLUSION

Balloon assistance has a great impact on expanding the indications of treatment as well as on the immediate and long term anatomical

and clinical results. Authors also suggest this technique enhance the safety of the procedure.

O24.5

USE OF REMODELING VASCULAR DEVICES (RVDs) IN TREATMENT OF ANTERIOR COMMUNICATING COMPLEX ANEURYSMS

D.K. Lopes

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PURPOSE

The endovascular treatment of intracranial aneurysms continues to evolve as more products and wider physician experience broadens the spectrum of aneurysms suitable for endovascular therapy. The development of flexible remodeling vascular devices (RVDs) allows for endoluminal reconstruction. Aneurysms arising from the anterior communicating complex typically require vessel reconstruction. We report our experience with endovascular reconstruction of this anterior communicating complex using RVDs.

MATERIAL AND METHODS

We report the feasibility of using RVDs alone or in conjunction with coils for the treatment of wide neck ACA aneurysms. The RVD used in this series of patients was the Neuroform™ stent from BSC. This report describes our experience with 11 patients who underwent endovascular RVD placement for anterior communicating complex aneurysms. The average age of these seven males and three females was 55 years (range: 40 to 68 years). All but one of the aneurysms in this population was unruptured.

RESULTS

Ten patients in this study received RVDs and coils as their endovascular therapy for securing of an anterior communicating complex aneurysm, while one patient received overlapping RVDs alone. In five patients the aneurysm was completely occluded during first treatment. All the partially treated aneurysms on follow up were found to be occluded or stable. No retreatments were documented on this population. Mean angiographic follow-up for these patients was seven months. There were no technical or clinical complications encountered in these patients. No presence of parent vessel stenosis on angiography.

CONCLUSION

The development of RVDs has increased the spectrum of aneurysms that may be safely treated endovascularly. Anterior communicating complex aneurysms that previously demanded open surgery are now amenable to endovascular repair. We present the techniques for RVD delivery that helped on the reconstruction of the A-complex such as Y-ACA.

O24.6

ENDOVASCULAR TREATMENT FOR BASILAR TRUNK ANEURYSM

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PURPOSE

To evaluate the efficacy of endovascular treatment for basilar artery trunk aneurysms in our institute.

MATERIAL AND METHODS

Seven patients with basilar trunk aneurysms (4 ruptured, 1 symptomatic, 2 asymptomatic) were treated. The size of aneurysms were 3 to 28 mm (mean 15.2) in maximum diameter. Five of them were side wall aneurysm and were performed coil embolization (neck remodeling in 2 cases). One comatous patient with symptomatic giant aneurysm was treated by proximal vertebral artery occlusion. One patient with ruptured giant fusiform aneurysm (WFNS grade V) was treated by a stent placement.

RESULTS

Coil embolization achieved complete occlusion in 4 aneurysms, small neck remnant in 1 aneurysm without clinical aggravation. The patient in comatous state who was treated by proximal occlusion had progressive mass effect and died. The patient with ruptured giant fusiform aneurysm treated with stent placement developed fatal rebleeding a few hours after treatment.

CONCLUSION

Most of basilar trunk side wall type aneurysm can be treated with coil embolization without difficulty. However, treatment using current modality for giant aneurysm with mass effect and giant fusiform aneurysm are limited.

O24.7**BASILAR ARTERY DISSECTING ANEURYSMS: ENDOVASCULAR TREATMENT**

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¹Ege University Hospital, Izmir/TR, ²Gaziantep University Medical School, Gaziantep/TR

PURPOSE

Dissecting aneurysms constitute less than 5–10% of all intracranial aneurysms. Although posterior circulation is the most frequent location, dissecting aneurysm arising from the basilar artery is very rare. The aim is to determine clinical course and to assess the role of endovascular treatment in patients with dissecting basilar artery aneurysms.

MATERIAL AND METHODS

During last 5 years, 8 patients with dissecting basilar artery aneurysm were treated by endovascular route. The patients' age range was 25–65 years (mean, 45 years). All patients presented with SAH. Initial clinical score (Hunt-Hess) was 4 in two patients, 3 in three patients, and 2 in the remaining three patients. Endovascular intervention was performed within two weeks after ictus in 6 patients, and at fifth week in the remaining two patients.

RESULTS

There were 5 aneurysms in basilar artery trunk, 3 aneurysms in superior cerebellar artery-basilar artery junction. Simple coil embolisation was performed in 3 acute cases, coil embolisation in conjunction with balloon remodeling in other 3 acute cases, and stent supported coil embolisation in the remaining 2 subacute cases. Mean follow up was 21 months (3–48 months). There was no technical complications. One acute case rebled within one month which resulted in exitus. One acute case developed neck regrowth

on follow up and clipped electively. One subacute case developed regrowth at one year follow up and was treated endovascularly by parent artery occlusion. Overall, mean Karnofsky score was 80 (50–90) among 7 living cases on follow up.

CONCLUSION

Dissecting basilar artery aneurysms are challenging clinical condition accompanied by difficult to treat vascular lesions. Endovascular route offers a good (may be the sole) treatment alternative with acceptable long term clinical results.

O33.6**FOLLOW UP OF COILED CEREBRAL ANEURYSMS AT 3 T: COMPARISON OF 3D TIME-OF-FLIGHT MR ANGIOGRAPHY AND CONTRAST-ENHANCED MR ANGIOGRAPHY**

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PURPOSE

To determine whether contrast-enhanced MR angiography (CE-MRA) at 3 T is superior to 3D Time-of-Flight (TOF) MRA at 3 T for the evaluation of coiled cerebral aneurysms and to compare it with previous reported data in which CE-MRA is compared to 3D TOF MRA at 1.5 T.

MATERIAL AND METHODS

Twenty-eight patients treated with detachable coils for 28 cerebral aneurysms were evaluated at 3 T (Philips Intera) using a SENSE coil. Three-dimensional TOF MRA (TR/TE = 23/3.5; sense factor 2.5) and CE-MRA with a 3D ultrafast gradient-echo sequence (TR/TE = 5.9/1.9; Sense factor 3) were performed in the same session. CE-MRA was performed with 0.1 mmol/kg (2 ml/Kg) bodyweight of gadobenate dimeglumine (Gd-BOPTA). Source images, 3D-MIP and 3D-SSD and/or 3D-VR reconstructions of the vessel of interest were evaluated to determine whether or not the treated aneurysm was completely occluded. In 10 patients results were compared with CE-MRA and 3D TOF MRA findings acquired at 1.5 T within 6 months previously.

RESULTS

Twenty-eight aneurysms were evaluated. The presence of coil artifact was evident at 3D TOF MRA but not at CE-MRA. Residual patency of the treated aneurysm was demonstrated in thirteen cases with both acquisitions while in the remaining fifteen cases both sequences demonstrated complete occlusion of the malformation. In 2/13 cases of residual patency the remnant aneurysm was better appreciated at CE-MRA. In six cases the parent artery or adjacent vessels were better represented at CE-MRA than at 3D TOF MRA. CE-MRA and 3D TOF MRA at 3 T were both superior to 3D TOF MRA at 1.5 T and equivalent to CE-MRA at 1.5 T in all 10 patients for which comparative data were available.

CONCLUSION

At 3 T both 3D TOF MRA and CE-MRA are effective at revealing residual patency or occlusion of coiled cerebral aneurysms although the definition of the remnant and adjacent vessels is better depicted on CE-MRA. Both CE-MRA and 3D TOF MRA at 3 T are similar to CE-MRA at 1.5 T and superior to 3D TOF MRA at 1.5 T.

O24.9

LONGITUDINAL PERFUSION AND DIFFUSION MR IMAGING IN PATIENTS WITH CEREBRAL VASOSPASM AFTER ANEURYSMAL SUBARACHNOID HEMORRHAGE

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PURPOSE

Determine the respective value of transcranial Doppler (TCD) and imaging, diffusion and perfusion magnetic resonance imaging (DWI and PWI) in case of aneurysmal subarachnoid bleeding

MATERIAL AND METHODS

twenty eight cases of aneurysmal SAH were treated early by endovascular route before day three and were evaluated with TCD, DWI and PWI within the first three days and the following sixth and tenth day after aneurysmal rupture. The first MR exam was used as a baseline study. For each patient, the apparent diffusion coefficient (ADC), the relative cerebral blood volume (rCBV), the relative cerebral blood flow (rCBF), the tissue mean transit time (tMTT), the regional Time to Peak (rTTP) were evaluated for each MR exam. Based on TCD results we determined three groups of patients: severe ($V_{max} > 200$ cm/s), moderate ($V_{max} \geq 120$ cm/s) and mild ($V_{max} < 120$ cm/s) vasospasm.

RESULTS

on DWI, territorial infarction was present in eleven cases and distal ischemic microfoci were observed in six cases. PWI studies showed impaired hemodynamic conditions in sixteen cases. TCD was inappropriate to evaluation intracerebral circulation in seven cases. Severe vasospasm was characterized in four patients; moderate vasospasm was found for ten and intracerebral velocities were in the subnormal range for others. In all the patients with severe TCD vasospasm, PWI and/or DWI abnormalities were found leading to territorial infarction in two cases. In cases of moderate TCD vasospasm, PWI and/or DWI abnormalities were present in seven patients. In the group with mild vasospasm no ischemic lesion or hemodynamic alteration were found. A single case of territorial infarction was noted. The longitudinal analysis of the rTTP value was the most sensitive parameters which was correlated with the deficit and with a risk of a lesion at six month.

CONCLUSION

TCD and functional MRI play a complementary role in cerebral vasospasm evaluation. Patients with mild alteration of TCD velocities do not benefit from MR studies. In moderate and all severe cases, MR shows a wide range of ischemic lesions and perfusion abnormalities. MR imaging could become a useful tool in clinical management of patients with SAH.

O24.10

BRAIN HAEMORRHAGIC EVENTS: IMPACT OF PSYCHOLOGICAL STRESS

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PURPOSE

Cerebral haemorrhage is an abrupt event. It is possible, then, to interrogate the patient if he or she felt subjectively a maintained stress lasts months before the bleeding. The purpose of this study is to assess if there is any relationship between the subjective feeling of stress and the haemorrhagic event.

MATERIAL AND METHODS

During the last year, 125 patients seen in our interventional neuroradiological consultation have been questioned for their degree of subjective stress. Demographic data as sex, age, socioeconomic status, profession, daily activity, have been recorded for each patient. A subset of these patients have passed, as well, a STAI test in order to detect their degree of anxiety and their natural tendency to anxiety. All these data are to be compared with a demographically similar healthy population in a case-control study.

RESULTS

Out of 125 patients, 70 cases corresponded to brain bleeding (subarachnoid or intraparenchymal). Eighty percent of these patients explained a substantial degree of stress before the event. Fifty-five other patients did not bleed, of them only forty-four percent expressed stress.

CONCLUSION

Subjective stress is a significant risk factor in cases of brain haemorrhages. This variable has to be taken into account when evaluating patients presenting incidental cerebro-vascular pathologies such as aneurysms or arteriovenous malformations that could potentially bleed.

O24.11

RUPTURE MECHANISM OF PARTIALLY THROMBOSED ANEURYSMS

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PURPOSE

Within the group of giant and large aneurysms the subgroup of the so-called "partially thrombosed" aneurysms can be differentiated according to clinical and neuroimaging findings. The present study was carried out to determine the site of bleeding of these aneurysms and what implications concerning their pathomechanism can be drawn from these findings.

MATERIAL AND METHODS

20 patients aged 2 to 77 (mean 44) years who exhibited a partially thrombosed aneurysm that had recently bled were included. Images (MRI including T1 pre- and postcontrast and T2 weighted images in multiple planes, CT and digital subtraction angiography) and patients' charts were reviewed.

RESULTS

MRI showed an onion-skin appearance of the thrombus in 19 patients, rim enhancement of the aneurysm wall (either partial or

complete) in 17, and a perifocal edema in 16 patients. The acute hemorrhage was typically crescent-shaped and located at the periphery of the aneurysm, distant from the perfused lumen of the aneurysm within the thrombosed part of the aneurysm.

CONCLUSION

The current denomination “partially thrombosed” intracranial arterial aneurysms leads to the presumption that thrombus is present

endoluminal whereas in fact the site of hemorrhage is within the vessel wall. A more accurate nomination would, therefore, be “aneurysms with intramural hemorrhage”. The enhancing wall and the edematous reaction of the adjacent brain parenchyma might be a sign for an inflammatory pathomechanism which is reinforced by histological and pathophysiological studies. This disease should be regarded as a clinical entity separate from saccular or non-thrombosed giant or large aneurysms.

Friday, September 15, 2006

08:00 – 10:30

SS 25

Room: ESNR / Diagnostic

Main session: *Paediatrics*

Chairs: T. Huisman, Z. Patay

ML53

MR IMAGING OF THE TERM INFANT WITH HYPOXIC ISCHAEMIC ENCEPHALOPATHY: PREDICTORS OF OUTCOME

M.A. Rutherford, London W12 0HS/GB

ML54

NEUROMETABOLIC DISEASES OF THE CEREBELLUM AND CEREBRUM

Z. Patay, Riyadh/SA

ML55

NON-ACCIDENTAL HEAD TRAUMA

O. Flodmark, Stockholm/SE

ML56

CNS INVOLVEMENT OF HEMOLYMPHOPROLIFERATIVE DISORDERS

A. Rossi, Genoa/IT

ML57

CHARACTERIZATION OF PEDIATRIC SPINAL CORD PATHOLOGIES USING MRI

P. Tortori-Donati, Genoa/IT

08:00 – 10:00

SS 29

Room: ICS / Interventional

Main session: *Intra-aneurysmal Thrombosis*

Chairs: S. Cekirge, F. Turjman

ML58

ANTICOAGULATION REGIMES AND THEIR INFLUENCE ON THE OCCLUSION RATE OF ANEURYSMS

I. Grunwald, Homburg/DE

ML59

CLOT SIMULATION WITHOUT DEVICE

P. Lawford, /GB

ML60

CLOT SIMULATION WITHOUT / WITH DEVICE

B. Chopard, Geneva/CH

ML61

FLOW DISTURBANCES IN ANEURYSMS

D. Steinmann, Toronto/CA

08:00 – 10:30

SS 33

Room: Free Paper

Main session: *Aneurysm*

Chairs: E. Boccardi, L. Guimaraens

O33.1

WHY ANEURYSMS NEEDED RETREATMENT IN ISAT

A. Campi, P. Summers, A. Molyneux, J.V. Byrne;
University of Oxford, Radcliffe Infirmary, Oxford/GB

PURPOSE

To determine frequency and causes of aneurysm retreatments in ISAT patients treated by clipping or coiling.

MATERIAL AND METHODS

Follow-up data were reanalysed for retreated patients in 1096 patients primary treated by coiling and 1012 patients treated by clipping. Follow-up angiograms were assessed by aneurysm characteristics and occlusion grade; patients by time, type of retreatment and clinical outcomes. Outcomes were separately analysed for patients retreated after rebleeding of the target aneurysm.

RESULTS

Retreatments were performed in 191(17.4%) coiled patients and in 39 (3.8%) clipped patients. After endovascular treatment, 94 (8.6%) patients were retreated for recurrent aneurysms. Eighty-seven were retreated after diagnosis of recurrence without rebleeding and seven patients after rebleeding (0.6%). At subsequent follow-up mRS scores did not change in 65 patients, who underwent endovascular retreatments, but increased in 22 patients who underwent neurosurgical retreatments. The majority of patients were retreated within 2 years, but beyond 3 years, recurrences were more common in patients with initially completely occluded aneurysms. After clipping late retreatments for aneurysm recurrence were performed in only nine patients, (0.9%). Three patients were retreated after rebleeding (0.03%). Six patients after diagnosis of recurrence without rebleeding underwent endovascular retreatment, and their mRS scores slightly improved.

CONCLUSION

Recurrences were ten times more frequent after coiling. Causes of retreatments were reopening, rebleeding or regrowth, rarely formation of the novo aneurysm in continuity with the target aneurysm. The most important determining factor leading to poor outcome was not retreatment but recurrent haemorrhage. Short-term follow-up angiographic studies are insufficient to detect all recurrences and prevent rebleeding.

O33.2

PACKING PERFORMANCE OF GDC 360 COILS IN INTRACRANIAL ANEURYSMS: A COMPARISON WITH COMPLEX CORDIS ORBIT/TRUFILL COILS AND HELICAL GDC 10 COILS

W.J. van Rooij, M. Sluzewski;
St Elisabeth Ziekenhuis, Tilburg/NL

PURPOSE

The purpose of this study is to compare obtained packing densities of aneurysms treated with the newly introduced GDC 360 coils with packing densities of aneurysms treated with either complex Cordis Orbit/TruFill coils or helical GDC 10 coils.

MATERIAL AND METHODS

Twenty-two aneurysms in 20 patients were coiled with GDC 360 coils. For each of the 22 aneurysms coiled with GDC 360 coils, two volume matched controls treated with either complex Cordis Orbit/TruFill coils or helical GDC coils were identified from our database. The packing of these matched controls was compared with the calculated packing of the 22 aneurysms treated with GDC 360 coils.

RESULTS

There was no difference in mean aneurysm volume between aneurysms treated with any of the three types of coils ($p=0.9$). Mean packing of 22.1% of aneurysms treated with GDC 360 coils was significantly lower than mean packing of 30.3% of aneurysms treated with complex Cordis Orbit/TruFill coils ($p=0.0015$). Mean packing of 22.1% of aneurysms treated with GDC 360 coils was not different from mean packing of 21.6% of aneurysms treated with helical GDC 10 coils ($p=0.81$).

CONCLUSION

The use of complex shaped GDC 360 coils does not lead to increased packing in comparison with helical GDC 10 coils. The use of complex Cordis Orbit/TruFill coils results in significantly higher packing than both GDC 360 coils and helical GDC 10 coils.

O33.3

ACUTE AND 12 MONTH ANGIOGRAPHIC RESULTS OF A MULTICENTER REGISTRY OF MATRIX TREATED ANEURYSMS

A. Bonafe¹, L. Pierot², S. Bracard³, X. Leclerc⁴;
¹Hopital Gui de Chauliac, Montpellier/FR, ²H, Reims/FR, ³CHU, Nancy/FR, ⁴CHRU, Lille/FR

PURPOSE

Endovascular treatment of intracranial aneurysms using detachable coils has become an accepted alternative to surgery. The most significant limitation of this technique is the incidence of aneurysm recanalization. To reduce the rate of recanalization, the biologically active Matrix detachable coils (Boston Scientific Neurovascular, Fremont, CA) have been proposed. A prospective, multicenter study was conducted in France to evaluate the safety, the mid-term and long-term efficacy of the Matrix coils. This first analysis is focused on the safety and mid-term efficacy of the Matrix coils.

MATERIAL AND METHODS

Two hundred sixty-one patients treated via endovascular approach were recruited in 16 French centers and included in our study. Clinical and angiographic analysis was conducted in 236 patients (149 females and 87 males, age : 21–78 years, mean age : 48.7 years) harboring 244 aneurysms. Clinical presentation was subarachnoid hemorrhage (SAH) in 138 patients (58.5%). Aneurysms were located in the anterior circulation in 227 cases (93%) and in posterior circulation in 17 cases (7%). The majority of aneurysms treated were <10 mm in size (84%). Wide neck aneurysms, as defined as a dome to neck ratio < 2, were observed in 57% of the cases.

RESULTS

12 month angiographic results obtained for 141 aneurysms (59.7%) were analyzed by an independent core lab using the modified 3 point J. Raymond grading scale. Complete occlusion was achieved in 47.4% of treated aneurysms, a neck remnant was present in 25.6% and an aneurysm remnant in 27.1%. A stable occlusion was obtained in 44% of the cases, a progressive occlusion was observed in 30% and major recanalization, as defined as a negative progression to a residual aneurysm was observed in 16.3% of the treated aneurysms. Complications related to the procedure included 10 thromboembolic events with a transient (4 patients) or a permanent deficit (6 patients) and 5 intraprocedural aneurysmal ruptures. Treatment related mortality was 0.8% (2 patients) and permanent morbidity was 2.6% (6 patients).

CONCLUSION

In our experience, the use of Matrix detachable coils for the selective treatment of intracranial aneurysms is safe and effective. Global morbidity and mortality rates are not higher than that reported with bare coils. Key Words : Aneurysms, Matrix

O33.4

ENDOVASCULAR TREATMENT OF 500 CEREBRAL ANEURYSMS WITH COILS AT THE INSTITUTO DE NEUROCIROGÍA, DR. ASENJO, CHILE.

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¹INSTITUTO DE NEUROCIROGÍA, SANTIAGO/CL, ²Instituto de Neurocirugía, Santiago/CL

PURPOSE

To show our experience of endovascular treatment of cerebral aneurysms with coils.

MATERIAL AND METHODS

We perform a retrospective study of the first 500 cerebral aneurysms treated at our institution between April 1997 and June 2005. The studied variables were age, clinical presentation, angiographic characteristics, aneurysm size and location, endovascular technique, immediately angiographic results, peri procedure morbidity and mortality, clinical status at discharge, and long term angiographic follow up. Variables were analyzed with frequency tables using SPSS 11 Software (SPSS Inc, Chicago, USA). The procedures were done in a Philips Allura Monoplane Angiograph (Philips Medical Systems, Best, The Neatherland). We used different kind and trademarks of coils with no preferences.

RESULTS

The female to male ratio was 4.3:1. The mean presentation age was 50.2 (+/- 14.71) years. The main presentation form was subarachnoid hemorrhage in 57%. 66% of the aneurysms were located at the anterior cerebral circulation and the remaining 34% at the posterior circulation. The most frequent location was the ophthalmic segment of the internal carotid artery in 17.6%, followed by posterior communicating artery (15.2%), anterior communicating artery (14.8%) and the basilar artery (10.6%). The mean aneurysm diameter was 6.68 mm. Coils were used in 83.7%, Remodeling technique was used in 8.1% of the aneurysms and a Stent was placed in 6.1% of the patients. We used the Raymond residual aneurysm classification to analyze our angiographic results. After the embolization a complete occlusion of the aneurysm was achieved in 67.4% (Raymond Type I). A residual neck was found in 22.2% (Type II), residual aneurysm resulted in 6.8% (Type III) and was undetermined in 3.6%. The complication rate was 9.75% and the procedure mortality was 2.6%. An angiographic follow was possible in 25.4% of the cases with 8.7% of recanalization. A phone follow up was possible in 27% with 85.6% of the patients caring and independent life.

CONCLUSION

Endovascular treatment of cerebral aneurysms is a growing up technique in our country. Our initial results are similar to international published data. We are encourage to increase angiographic controls in order to determined the real long term anatomic results of the treated aneurysms.

O33.5

LONG-TERM HISTOLOGICAL AND SCANNING ELECTRON MICROSCOPICAL RESULTS OF ENDOVASCULAR AND OPERATIVE TREATMENTS OF EXPERIMENTALLY INDUCED ANEURYSMS IN THE RABBIT

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PURPOSE

Treatment strategies of cerebral aneurysms include surgical clipping and endovascular therapies. To determine the long-term results of these therapeutic strategies, the vessel wall reaction close to the former aneurysm was studied according to the assumption that an intact endothelial layer over the former aneurysm neck constitutes complete vessel wall reconstruction and stable aneurysm obliteration.

MATERIAL AND METHODS

Aneurysms were created in 40 rabbits by intraluminal elastase incubation of the common carotid artery. Five animals each were assigned to the following groups: Untreated, Porous stents, Polyurethane covered stentgrafts, Porous stents and subsequent coiling. Ten animals were treated with coils alone, ten with clips. After six months, angiography, histology, and scanning electron microscopy was performed.

RESULTS

Porous stents did not obliterate the aneurysm, whereas stentgrafts did, in-stent stenosis of up to 60% was present due to neointimal multi-layer proliferation. After coiling, the aneurysm dome was occluded with fibrinous and collagenous material while the aneurysm neck was not covered by an endothelial lining. Coil loops lay bare within the vessel with fresh thrombus material on their surface. After clipping, a thin layer of endothelial lining bridging the two attached vessel walls was present thereby completely obliterating the aneurysm and reconstructing the vessel wall.

CONCLUSION

The study demonstrates complete and stable aneurysm obliteration with vessel wall reconstruction after clipping, a sufficient obliteration of the aneurysm dome employing endovascular techniques but a failed healing response of the aneurysm neck which might correlate to its associated higher risk of re-bleed. Whether or not this is counterbalanced by the better immediate outcome following endovascular treatment remains a matter of debate.

O33.6

FOLLOW UP OF COILED CEREBRAL ANEURYSMS AT 3 T: COMPARISON OF 3D TIME-OF-FLIGHT MR ANGIOGRAPHY AND CONTRAST-ENHANCED MR ANGIOGRAPHY

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PURPOSE

To determine whether contrast-enhanced MR angiography (CE-MRA) at 3 T is superior to 3D Time-of-Flight (TOF) MRA at 3 T for the evaluation of coiled cerebral aneurysms and to compare it with previous reported data in which CE-MRA is compared to 3D TOF MRA at 1.5 T.

MATERIAL AND METHODS

Twenty-eight patients treated with detachable coils for 28 cerebral aneurysms were evaluated at 3 T (Philips Intera) using a SENSE coil. Three-dimensional TOF MRA (TR/TE = 23/3.5; sense factor 2.5) and CE-MRA with a 3D ultrafast gradient-echo sequence (TR/TE = 5.9/1.9; Sense factor 3) were performed in the same session. CE-MRA was performed with 0.1 mmol/kg (2 ml/Kg) bodyweight of gadobenate dimeglumine (Gd-BOPTA). Source images, 3D-MIP and 3D-SSD and/or 3D-VR reconstructions of the vessel of interest were evaluated to determine whether or not the treated aneurysm was completely occluded. In 10 patients results were compared with CE-MRA and 3D TOF MRA findings acquired at 1.5 T within 6 months previously.

RESULTS

Twenty-eight aneurysms were evaluated. The presence of coil artifact was evident at 3D TOF MRA but not at CE-MRA. Residual patency of the treated aneurysm was demonstrated in thirteen cases with both acquisitions while in the remaining fifteen cases both sequences demonstrated complete occlusion of the malformation. In 2/13 cases of residual patency the remnant aneurysm was better appreciated at CE-MRA. In six cases the parent artery or adjacent vessels were better represented at CE-MRA than at 3D TOF MRA. CE-MRA and 3D TOF MRA at 3 T were both superior to 3D TOF MRA at 1.5 T and equivalent to CE-MRA at 1.5 T in all 10 patients for which comparative data were available.

CONCLUSION

At 3 T both 3D TOF MRA and CE-MRA are effective at revealing residual patency or occlusion of coiled cerebral aneurysms although the definition of the remnant and adjacent vessels is better depicted on CE-MRA. Both CE-MRA and 3D TOF MRA at 3 T are similar to CE-MRA at 1.5 T and superior to 3D TOF MRA at 1.5 T.

O33.7

FOLLOW-UP AFTER EMBOLIZATION WITH HYDROCOILS IN 160 ANEURYSMS

A.P. Narata, A. Rogopoulos, R. Chapot;
Hôpital Universitaire Dupuytren, Limoges/FR

PURPOSE

Hydrocoils® have been developed for embolization of aneurysms. The platinum coil is covered by hydrogel that expands in contact to blood to enable a higher rate of filling and avoid recanalization. We evaluate the angiographic results after 2 years.

MATERIAL AND METHODS

Hundred and sixty aneurysms were treated in 153 patients. The aneurysms ranged in size from 2 to 22 mm. The filling rate was calculated in each patient based on the volume of the aneurysm and the volume of the coils. Follow-up was evaluated on angiography that was performed between 3 months and 2 years after the procedure.

RESULTS

The mean filling rate was 79%, being significantly higher than in aneurysms treated with bare coils. Follow-up is available in 120 aneurysms and showed a stable result in 107 aneurysms and recanalization in 13 aneurysms, requiring reembolization in 2 patients.

CONCLUSION

Embolization with Hydrocoils enables to achieve an important filling rate and an occlusion that seems to be more stable than with platinum coils.

O33.8

DO HYDROCOILS ALLOW CHANGING THE CONCEPT OF COILING?

R. Chapot, A.P. Narata, A. Rogopoulos;
Hôpital Universitaire Dupuytren, Limoges/FR

PURPOSE

Hydrocoils are coated coils designed to allow a more stable result after embolization of aneurysms.

MATERIAL AND METHODS

Hundred and sixty patients were treated using Hydrocoils. The way of coiling in aneurysms was modified in 15 patients: Instead of attempting to achieve a dense packing of the whole aneurysm, coiling was reduced for the daughter sac or the aneurysm fundus, but maximal packing was achieved for the aneurysmal neck, in conjunction to a remodelling balloon.

RESULTS

Complete occlusion was achieved in all these aneurysms. The follow-up studies show a stable occlusion, without secondary displacement of the coils and recanalization of the aneurysm.

CONCLUSION

Hydrocoils seem to enable a change in the concept of coiling, by reducing the whole amount of coils placed in the aneurysm and packing densely only the aneurysmal neck.

O33.9

ENDOVASCULAR TREATMENT OF BIFURCATION ANEURYSMS WITH HYDROCOILS: INITIAL EXPERIENCE WITH 36 ANEURYSMS

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¹Hacettepe University, Ankara/TR, ²HACETTEPE UNIVERSITY, ANKARA/TR

PURPOSE

The aim of this study was to evaluate the stability of occlusion of bifurcation aneurysms after embolization with Hydrocoils.

MATERIAL AND METHODS

36 bifurcation aneurysms were treated with Hydrocoils in combination with platinum coils except one case. 17 were located at basilar, 18 were at ICA and 1 at DACA bifurcation. The patient population consisted of 22 women and 15 men whose ages ranged from 21 to 65 years (average years). 19 patients were presented with incidental aneurysms and 17 were presented with SAH. Twenty seven aneurysms were small, 9 were large and 1 was giant in size. 2 were partially thrombosed. All except two basilar tip aneurysms were treated with balloon remodeling technique. TriSpan was used in the remaining two basilar tip aneurysms.

RESULTS

1 year control obtained in 7 pts, 2 years control obtained in 11 pts, 3 years control in 18 patients. Post op angio showed Raymond A occlusion, in 29 pts, Raymond B occ in 7 patients. In 4 of these 7 pts, follow angiography showed regrowth (Raymond C) in 4 patients. In other 3, Raymond A occlusion was observed in follow-up angio. In patients who had Raymond A occlusion in post op angio, no regrowth was seen in follow-ups. Aneurysm recanalization developed in 4 pts (3 large, 1 giant) 11.1% observed in 6 months. In 2 patients regrowths were not retreated and decided to be followed but in other 2 were retreated.

CONCLUSION

The HES provides a favorably stable occlusion in endovascular treatment of bifurcation aneurysms.

O33.10

REMODELLING TECHNIQUE IN CEREBRAL ANEURYSMS ENDOVASCULAR THERAPY

L.C. Biscoito, P. Sequeira, L. Neto, J. Campos;
 Hospital Santa Maria, Lisboa/PT

PURPOSE

To describe the contribution of the Remodelling Technique (RT) in the treatment of wide neck aneurysm and aneurysm with difficult geometry.

MATERIAL AND METHODS

We treated 56 aneurysm in 53 patients; 36 female and 17 men. Thirty-nine patients bled, 16 accidental discover and 1 ischemic event. Forty-three aneurysm were from anterior circulation and 13 from the posterior circulation. All the aneurysms were treated under general anaesthetic and anticoagulation protocol. In 8 aneurysm we used Sentry balloon and in 48 either Hyperform or Hyperform balloon. The balloon was used each time an unfavorable sac/neck ratio was seen and also when the geometry of the aneurysm/parent vessel even with the 3D angio was difficult to understand.

RESULTS

We achieved to treat 54 aneurysm out of 56 with the R.T. In one aneurysm - anterior communicating - treatment was not possible by incapacity of micro catheterization of the sac, surgery was done. In 1 case - PICA aneurysm - rupture of the sac occurred before coiling during balloon micro guidewire manipulation and the patient died. In all the 54 aneurysm treated, a complete exclusion of the sac has been achieved with no definite morbidity - 2 TIA's -.

CONCLUSION

The R.T is an effective technique, that permit to treat aneurysm with a good packing with no significant increase rate in the morbimortality. It allow to treat aneurysm that depending of the morphology were not possible to reach the treatment without parent vessel protection, and so extend the indications for endovascular therapy. However special precaution must be taken when using the microballoon microguidewire inside the ruptured aneurysm -risk of a new rupture -.

O33.11

TREATMENT OF WIDE-NECK BIFURCATION ANEURYSMS USING A KISSING BALLOON TECHNIQUE IN 30 PATIENTS

R. Chapot, A.P. Narata, A. Rogopoulos;
 Hôpital Universitaire Dupuytren, Limoges/FR

PURPOSE

Wide neck aneurysms may be challenging for endovascular treatment, especially when located on small arteries. Remodelling balloons enable embolization of wide neck aneurysms, even in distal aneurysms. This treatment may fail if the neck is extending on both division branches. In such situation, we used simultaneously two remodelling balloons to enable endovascular treatment.

MATERIAL AND METHODS

Thirty aneurysms were treated, located at the MCA bifurcation (n=19), A com (n=7), carotid termination (n=2), P com (n=1) and

basilar artery (n=1). The aneurysms ranged in size from 5 to 25 mm. Two Hyperform® balloons (n=27) or one Hyperform® and one Copernic® balloon (n=3) were placed in each division branch and inflated simultaneously during coil insertion.

RESULTS

Complete aneurysmal occlusion was obtained in all attempted cases. An ischemic complication occurred in one patient due to delayed occlusion of one division branch. Thrombus extension without parent artery occlusion occurred in 2 patients and was managed by antiGPIIb/IIIa. Angiographic follow-up is available in 16 patients and shows a stable result.

CONCLUSION

The kissing balloon technique enables endovascular treatment of wide neck aneurysms involving both division branches that are usually not considered for embolization. This technique appears to be efficient and safe in our initial experience.

O33.12

ENDOVASCULAR TREATMENT FOR RUPTURED CEREBRAL ANEURYSMS IN ELDERLY PATIENTS

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¹Okayama University Medical School, Okayama/JP, ²Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Okayama/JP

PURPOSE

Surgical treatment of elderly patients having ruptured cerebral aneurysm is difficult, and their prognosis is generally not so good as that of younger patients. We report our results of endovascular treatment for ruptured cerebral aneurysms in elderly patients and discuss the indication of the treatment as compared with that of younger patients.

MATERIAL AND METHODS

Two hundred forty-eight consecutive patients with ruptured aneurysm for the last 5 years treated in our institute were retrospectively evaluated. They were divided into two groups. Group A includes the patients 70 years or older, and group B includes the patients less than 70 years old.

RESULTS

Eighty-six patients were included in group A, and 162 patients were included in group B. In both groups, the outcome was strongly correlated with the preoperative Hunt & Kosnik (H & K) grade, but significant risk factors (i.e. associated pathological condition such as pneumonia and existence of extracranial aneurysm) which made their prognosis poor were more commonly observed in the group A. Group A resulted in poor outcome in the H & K grade III patients, although there were no outcome differences between both groups in other H & K grade patients. H & K grade III patients in group A tended to have minor neurological problems including muscle power weakness and cognitive dysfunction.

CONCLUSION

Endovascular treatment for ruptured cerebral aneurysms in elderly patients seems useful. Their outcome was strongly correlated with

their preoperative condition. Associated general pathological condition should be evaluated before treatment especially in elderly patients. H & K good grade patients are good indication for endovascular treatment, but the outcome of preoperative poor grade patients was not so good despite the less invasive nature of endovascular treatment. Improvement of outcome in H & K grade III patients is desirable.

O33.13

CLINICAL OUTCOME FOLLOWING ENDOVASCULAR COILING FOR RUPTURED OR SYMPTOMATIC INTRACRANIAL ANEURYSMS IN THE ELDERLY: A SINGLE-CENTRE EXPERIENCE

C. Micallef¹, P. Keston², P.M. White³, R. Sellar³;

¹London/GB, ²Western General Hospital, Edinburgh/GB, ³Western General Hospital, Edinburgh/GB

PURPOSE

As experience in endovascular treatment continues to grow and coiling techniques improve, there has been an increasing demand for optimal treatment strategies to be adopted in elderly patients. In the light of an aging population with an increased life expectancy, definitive treatment is increasingly being offered to the above 70 age group. We present the experience at our tertiary referral centre over the past few years. Our aim was to assess outcome following aneurysm coiling in elderly patients with symptomatic or acute aneurysmal subarachnoid haemorrhage [SAH].

MATERIAL AND METHODS

32 patients over the age of 70 had coiling of an intracranial aneurysm between 01 Jan 2003 – 01 August 2005. Theatre and case notes were reviewed to determine their pre-morbid state, WFNS grade prior to coiling, clinical course and post-coiling outcome. A questionnaire based on the modified Rankin outcome scale was sent out to the respective general practitioner in order to obtain long term follow up.

RESULTS

Follow-up was obtained on every patient [median 10 months]. This showed that 25 [78%] had a good outcome [Rankin outcome scale 0–2]. 5 [16%] were dead but only 1 was related to the SAH/aneurysm. 29 out of 32 patients presented with a subarachnoid bleed. The majority 25 patients [75%] had a WFNS grade of 0–2 on admission. Only 3 patients [9%] were fit and well with no comorbid factors prior to admission. 30% remained well throughout their hospital stay, whilst 37% developed complications unrelated to their SAH. The median time taken from presentation to coiling was of 4 days with a median time from admission to discharge from the tertiary centre of 11 days. Although the numbers were small, there didn't appear to be a relationship between the pre-morbid state or WFNS grade on admission and outcome.

CONCLUSION

Good clinical outcome in the elderly treated with endovascular coiling for ruptured or symptomatic intracranial aneurysms supports this as being an effective treatment strategy to be considered early on in the management of this age group.

O33.14**INTRAVENOUS ADMINISTRATION OF ACETYL SALICYLIC ACID DURING ENDOVASCULAR TREATMENT OF CEREBRAL ANEURYSMS REDUCES THE RATE OF THROMBOEMBOLIC EVENTS**

T. Ries¹, J. Buhk², U. Grzyska¹, H. Zeumer¹, T. Kucinski¹, J. Fiehler³;

¹University Medical Center, Hamburg/DE, ²University of Göttingen, Göttingen/DE, ³University Hospital of Hamburg, Hamburg/DE

PURPOSE

To analyze the effect of a modified intraoperative anticoagulation strategy including acetyl salicylic acid (ASA) on complication rates during endovascular coil embolization.

MATERIAL AND METHODS

Two hundred and sixty one cerebral aneurysms were treated in 247 patients by endovascular coil embolization from January 2001 to

September 2004. Additional intravenous administration of 250 mg ASA was applied since January 2003. Patients treated prior (-ASA; n=102 aneurysms) and after that date (+ASA; n=159 aneurysms) were compared. Endpoints were rates of thromboembolism and severity of hemorrhages after intraoperative aneurysm rupture.

RESULTS

Thromboembolic events during the procedure were observed more often in the -ASA group (18/102 aneurysms, 17.6%) in comparison with the +ASA group (14/159 aneurysms, 8.8%, p= 0.028, Fisher's exact test). Aneurysm perforation events occurring during or immediately after the procedure were observed equally often in the -ASA group (7/102 aneurysms, 6.9%) in comparison with the +ASA group (10/159 aneurysms, 6.3%).

CONCLUSION

Intravenous application of ASA is feasible and safe during interventional aneurysm embolization. ASA seems to be associated with a significant reduction in the rate of thromboembolic events without increase in the rate or severity of intraoperative bleedings.

10:00 – 11:00

COFFEE BREAK SYMPOSIUM: COFFEE BREAK SYMPOSIUM

11:00 – 13:00

SS 30

Main session: *In-stent Thrombosis*

Chairs: A. Frangi, P. Lylyk

Room: ICS / Interventional

ML62

IN-STENT THROMBOSIS / ANEURYSMS

S. Cekirge, /TR

ML63

HOW TO PREVENT IN-STENT CLOT FORMATION

L. Thibault, Fremont/US

ML64

COMPUTATIONAL MODELING OF BLOOD CLOTTING

R. Guy, Salt Lake City/US

ML65

SURFACE REACTIONS ON METALLIC IMPLANTS

M. Textor, Zurich/CH

11:30 – 13:00

SS 26

Main session: *Pediatrics*

Chairs: K. Chong, P. Tortori-Donati

Room: ESNR / Diagnostic

O26.1**CONGENITAL DISORDER OF GLYCOSYLATION TYPE IA: CONVENTIONAL MR IMAGING, DIFFUSION-WEIGHTED IMAGING, AND MR SPECTROSCOPY FINDINGS**

A. Rossi, M. Di Rocco, R. Biancheri, A.E. Allegri, C. Gandolfo, G. Morana, P. Tortori-Donati;
G. Gaslini Children's Hospital, Genova/IT

PURPOSE

Congenital disorders of glycosylation (CDG), formerly called carbohydrate-deficient glycoprotein syndromes, are a group of inherited multisystem disorders characterized by defective glycoprotein biosynthesis. Patients have severe psychomotor and mental retardation. Based on isoelectric focusing of serum transferrin patterns and clinical symptoms, several forms of CDG have been classified. The most common form, CDG Ia, is caused by phosphomannomutase (PMM)-2 deficiency. We aimed to describe the conventional MR imaging, diffusion-weighted imaging (DWI), and MR spectroscopy (MRS) features of CDG type Ia.

MATERIAL AND METHODS

We studied five children with proven CDG type Ia. Four presented in early infancy (between 3 and 7 months) with a special physiognomy and neurologic problems including psychomotor retardation, ataxia, hypotonia, abnormal eye movements, and failure to thrive. The fifth patient had a long-standing history of epileptic encephalopathy. All patients had increased serum sialotransferrin. Deficient PPM-2 activity was measured in fibroblasts obtained from skin biopsy. Molecular genetic tests revealed compound heterozygosis for PMM-2 mutations. All patients underwent conventional MR imaging studies. Diffusion-weighted imaging and short-echo-time MRS (localized in the right cerebellar hemisphere) were performed in two cases.

RESULTS

Four patients had a markedly shrunken cerebellum; in one, interval development of cerebellar atrophy was seen. Hyperintensity of the cerebellar cortex on long repetition time images was detected in two. Increased ADC values were detected at level of the abnormal cerebellar cortex. MRS showed increased myo-inositol and reduced N-acetylaspartate concentrations in two cases, and a glutamine/glutamate complex at 3.75 ppm and increased scyllo-inositol concentration in one.

CONCLUSION

Progressive pontocerebellar atrophy (not hypoplasia) is the most characteristic finding of CDG type Ia. However, the cerebellum can be normal at presentation in patients with genetically proven disease. Hyperintensity of the cerebellar cortex on long repetition time images in the setting of cerebellar atrophy, once believed to be a distinctive feature of infantile neuroaxonal dystrophy and recently described in other entities including mitochondrial respiratory chain defects and Marinesco-Sjögren disease, is also found in CDG type Ia. Diffusion-weighted imaging and MRS could provide additional clues to the diagnosis in patients with otherwise unexplained cerebellar atrophy.

O26.2**THE DEVELOPMENT OF FETAL BRAIN CORTEX: AN IN VIVO STUDY OF SURFACE COMPLEXITY FROM 3D RECONSTRUCTED MR IMAGING**

W. Guo¹, H. Chen², Y. Wu²;

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PURPOSE

This study aims to quantify the in-vivo development of fetal brain by the complexity of cortical sulci and gyri derived from reconstructed fetal MR imaging.

MATERIAL AND METHODS

In an 8-year span (1998 to 2006) 294 fetal MR examinations were performed on 1.5 T scanners. For all examinations, three orthogonal planes scanning, i.e. coronal, sagittal and trans-axial, covering whole fetal brain was routinely used. Twelve fetuses, aged 29 to 37 gestational weeks without CNS anomalies, were recruited from the database. Single short fast spin-echo T2-weighted imaging sequences with an 8-channel phase-arrayed surface coil were applied on these 12 fetuses using GE 1.5T Twin EXCITE MR scanners. The scanning parameters were: 1500/90 (TR/TE in msec), 0.5 excitation, 28 cm field-of-view, 90 degree flip angle, 256×256 acquisition matrix, 5-mm-thick section with neither overlap nor space, and 41.67 kHz bandwidth. Fetal brains on the two-dimensional coronal images were manually segmented and their three-dimensional surfaces were reconstructed by using marching cube algorithm. Values of mean curvatures, which described the shape topology, were determined at each vertex on reconstructed surface. The negative values of mean curvature represented locally convex surface gyri while the positive ones represented locally concave surfaces sulci. The complexity of gyri (or sulci) was defined by the ratio of number of the vertices with negative (or positive) curvatures to the number of total vertices on a reconstructed surface.

RESULTS

Fetal brain cortex development over time was demonstrated by the three-dimensional surface reconstruction and well correlated with two-dimensional source images. The complexity of sulci, ranged from 0.1146 to 0.1399, was positively correlated with gestational age ($r=0.6019$, $p=0.0380$), whereas that of gyri, ranged from 0.3854 to 0.3601, was negatively correlated with gestational age ($r=-0.6047$, $p=0.0373$).

CONCLUSION

Cortical development of fetal brain at the third trimester is feasibly quantified in vivo from fetal MR imaging. The complexity of cortical sulci is positively correlated to gestational age, while that of cortical gyri is negatively correlated to gestational age. With the accumulation of more subjects, surface complexity derived from three-dimensional surface reconstruction MR imaging may be used as a quantitative reference for fetal brain cortical development.

O26.3**MR IMAGING EVIDENCE OF INVOLVEMENT OF THE ANTERIOR COMMISSURE IN X-LINKED ADRENOLEUKODYSTROPHY (X-ALD)**

Z. Patay, N. Al-Dossary, E. Rawah;
King Faisal Specialist Hospital, Riyadh/SA

PURPOSE

To present MRI evidence of involvement of the anterior commissure in patients with X-ALD and discuss its potential diagnostic and histopathological relevance.

MATERIAL AND METHODS

The clinical and imaging files of 13 male patients (age range: 4–16 years) with laboratory confirmed (elevated VLCFA levels) X-ALD were reviewed. All MR imaging studies were carried out on a 1.5 T MRI unit and included non-enhanced T1 and T2-weighted, as well as contrast-enhanced T1-weighted sequences.

RESULTS

Besides the characteristic parieto-occipital white matter abnormalities seen in all patients, in three patients we found MR imaging evidence of involvement of the anterior commissure, best shown on sagittal T2-weighted images. In two patients the post-contrast T1-weighted images clearly showed additional signal enhancement within the lesion area.

CONCLUSION

Involvement of the anterior commissure in X-ALD is an inconsistent but potentially useful MR imaging finding. To the best of our knowledge, this lesion pattern element has not been described in neuroradiological literature. Because of the demonstration of signal enhancement on post-contrast images in one of the cases, we believe that the lesion corresponds to primary inflammatory and/or demyelinating changes (Schaumburg zone 2 phenomena), rather than secondary axonal degeneration. It may be related to the extent of hemispheric white matter involvement and likely indicates poor prognosis. Identification of lesion involvement within the anterior commissure may have differential diagnostic implications too, in cases of X-ALD with atypical (asymmetrical, pseudotumoral) MR imaging presentation.

O26.4**ACCELERATED MYELINATION IN INFANTS WITH IMMEDIATE POSTNATAL ONSET OF SEIZURES AND CORTICAL DYSPLASIA**

Z. Patay, N. Al-Dossary;
King Faisal Specialist Hospital, Riyadh/SA

PURPOSE

To present unusual MRI signal changes in cerebral white matter underlying areas of cortical dysplasia in infants with early postnatal onset of seizures.

MATERIAL AND METHODS

Two female infants with qualifying imaging abnormalities and clinical manifestations are presented. All had immediate postnatal onset of seizures. Patients had initial MRI work-up using 1.5 T

MRI units at the ages of 5 days and 8 days. Studies included T1-weighted inversion recovery and T2-weighted fast spin-echo sequences. One of the patients also had diffusion-weighted imaging studies (b:1000). One patient had further follow-up MRI at ages of 2 and 6 years.

RESULTS

In both patients unusual, ill-defined T1 hyper, and T2 hypointensities in cerebral white matter underlying cortical areas with suspected dysplasia were found. Diffusion-weighted images showed abnormal restriction of water diffusion compared to corresponding areas in the contralateral hemisphere, suggestive of precociously developing anisotropy. Follow-up studies in one patient showed progressive “normalisation” of white matter signal changes.

CONCLUSION

The described early signal changes likely represent abnormal, accelerated myelination, possibly due to frequent ictal-interictal functional stimuli of neuroaxonal units due to repetitive electric activity in the epileptogenic cerebral cortex. One may even speculate that because of the presence of immediate postnatal changes in myelination, the pathological process, including seizures, may have started in the prenatal period. Recognition of these early signal changes may be helpful in diagnosing cortical dysplasia or perhaps in a broader sense, epileptogenic foci of any other nature in the often challenging neonatal period. Our observations also suggest that the signal changes may later undergo a “fogging” phenomenon, before the more typical T2-hyperintense chronic white matter damage develops. Based on these data we speculate that seizures may start in utero and the myelination process in the developing brain is at least partially function driven.

O26.6**DIFFUSION-WEIGHTED IMAGING IN NORMAL FETAL BRAIN MATURATION**

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¹University Children’s Hospital UKBB, Basel/CH, ²Facult, Marseille/FR, ³CRMBM UMR CNRS 6612, Marseille/FR, ⁴Université de la Méditerranée, Marseille/FR

PURPOSE

Diffusion-weighted imaging (DWI) provides informations about tissue organization and maturation that are not visible on conventional MR imaging. The aim of this study is to analyze the evolution over time of apparent diffusion coefficient (ADC) of normal fetal brain in utero.

MATERIAL AND METHODS

DWI was performed on 79 fetuses ranging from 22 to 37 weeks of gestational age (GA). All children showed at follow up a normal neurological clinical evaluation at birth. ADC values were obtained in the deep white matter (DWM) of the centrum semiovale, the frontal, parietal, occipital and temporal lobe, in the cerebellum, the brainstem, as well as in the deep gray matter of the basal ganglia (BG) and the thalamus.

RESULTS

Mean ADC values in all the supratentorial DWM areas ($1.68 \pm 0.05 \mu\text{m}^2/\text{ms}$) were higher compared to the cerebellar WM ($1.25 \pm$

0.06 $\mu\text{m}^2/\text{ms}$) and lowest in the pons ($1.11 \pm 0.05 \mu\text{m}^2/\text{ms}$). The thalamus and the BG showed intermediate values ($1.25 \pm 0.04 \mu\text{m}^2/\text{ms}$). In all areas, mean ADC values showed a strong negative linear correlation with the GA, beginning at week 28–30 of GA.

CONCLUSION

DWI in the fetal brain allows insights in the process of in utero fetal brain maturation that are not visualized by conventional MR imaging. This study provides a normative set of data that reflect the normal fetal brain maturation. The progressive reduction of ADC values after the 28th week of gestation is the result of a complex and coordinated change in cellularity, myelin deposition, and variation in water content.

O26.7

MRI OF THE BRAIN AND LEG MUSCLES IN MARINESCO-SJÖGREN SYNDROME

R. Raininko, O. Eeg-Olofsson;
Uppsala University, Uppsala/SE

PURPOSE

Marinesco-Sjögren syndrome (MSS) is a rare autosomal recessive multiorgan disorder characterized clinically by cerebellar ataxia, mild to moderate mental retardation, early bilateral cataract, progressive myopathy, and, in some patients, hypergonadotrophic hypogonadism. Genetically, the MSS locus has been mapped to the chromosomes 5q31 (classic type) or 18qter. We describe an MRI follow-up of two children with MSS and compare the findings to those reported earlier.

MATERIAL AND METHODS

A female twin pair was examined with MRI of the brain at the ages of 18 months and 4 years and with MRI of the thighs and calves at the age of 4. They had ataxia, muscle hypotonia, slightly raised serum creatine kinase, and psychomotor delay. EMG was myopathic. Muscle biopsy revealed rimmed vacuoles. They developed bilateral cataracts. The diagnosis has recently been confirmed genetically (5q31).

RESULTS

The most pronounced finding on brain MRI was a very high T2 signal intensity of the cerebellar cortex. The signal intensity was low on T1-weighted images. The vermis was very small but the cerebellar hemispheres were less hypoplastic. Both patients had a small arachnoid cyst in the cisterna magna. The pons was a little smaller than normal. No white matter abnormalities were revealed. The findings were unchanged three years later. Severe atrophy was found in the thigh muscles but no certain pathology was detected in the calves.

CONCLUSION

A high T2 signal in the cerebellar cortex has been described earlier in three pediatric patients having MSS. We detected the same abnormality. That finding may be of great diagnostic value. In addition to these five patients, it has been described only in infantile neuroaxonal dystrophy which is clinically entirely different from MSS. Cerebellar, especially vermian, atrophy or hypoplasia has been described almost in all patients with MSS.

Lack of progress in our patients and in three patients with reported follow-ups in literature indicates hypoplasia. Only one radiological study of muscles in MSS was found in literature. CT revealed changes in thigh and calf muscles at ages of 22–58 years but our pediatric patients had atrophy only in the thighs.

O26.8

DISCREPANCY IN PAEDIATRIC CT HEAD REPORTING AMONG SPECIALIST REGISTRARS.

S. Nagaraja¹, Q. Ullah², K.J. Lee¹, A. Raghavan³, D.C. Connolly²;
¹Sheffield University, 2JF/GB, ²Royal Hallamshire Hospital, 2JF/GB, ³Sheffield Children's Hospital, 2TH/GB

PURPOSE

To evaluate the discrepancy rate among specialist registrars (SPR) and to assess if the year of training has a bearing on the discrepancy.

MATERIAL AND METHODS

This prospective study was carried out over 9 months and 270 CT heads were reported during this period at the Sheffield Children's Hospital. Reporting in our department is carried out by a radiology trainee SPR, a general paediatric radiologist (GR) and also a specialist paediatric neuroradiologist (NR). The neuroradiologist (NR) was considered as gold standard for this study. Of the 270 scans, 124 scans were reported by the GR and NR only, 51 scans were reported by the SPR and the NR only, and 40 scans were reported by all three. Of the remaining 55 scans, 45 scans were reported by NR only, 7 by GR only, and 3 reported by the GR and the SPR only. Treating all scans seen by both the SPR and GR as being seen by GR, we performed a chi-square test to determine if there was a significant difference in the discrepancy between NR and GR vs. the discrepancy between NR and SPR. The reports of the SPR were further scrutinised as follows: the 51 scans reported by SPR and NR were reported by junior (year 1–3) and senior (year 4–5) trainees. Due to low numbers, a Fisher's exact test was performed to determine whether there was a significant difference in the discrepancy between NR and junior, vs. the discrepancy between NR and senior.

RESULTS

There were 26 out of 164 cases (15.9%) of discrepancy between GR and NR. There were 8 cases out of 51 cases (15.7%) of discrepancy between SPR and NR. The chi squared test (2-sided) showed a p value of 0.977 (not significant) between the two groups. There was a discrepancy in 5 out of 36 cases (13.9%) between junior SPR and NR, and 3 out of 15 (20%) between senior SPR and NR. The Fisher exact 2-sided test showed a p value of 0.679 (not significant).

CONCLUSION

The performance of the SPR was considered to be satisfactory and comparable to the general radiologist in this study. The year of training did not have a bearing on the discrepancy rates.

O26.9**THICK CORPUS CALLOSUM ASSOCIATED WITH POLYMICROGYRIA: A REPORT OF SEVEN CASES**R. Gocmen¹, K. Karli Oguz²;¹Hacettepe University Hospitals, Ankara/TR, ²Hacettepe University Medical School, Ankara/TR**PURPOSE**

Corpus callosum (CC) is the major white-matter tract that connects the cerebral hemispheres in the brain. Numerous studies have been performed to examine the morphologic features of the CC, including its agenesis or hypo-dysgenesis. But, only a few sporadic case reports regarding hypertrophy of the corpus callosum appeared in the literature. In this study, we present 7 cases with partially or diffusely thick corpus callosum and emphasize its association with polymicrogyria.

MATERIAL AND METHODS

Seven patients (3 females, 4 males; age 1–24 years) with thick corpus callosum were identified from neuroradiology database of our institution, and their magnetic resonance images were retrospectively reviewed. In all patients, morphometric analysis of the CC was done by using midsagittal T1-weighted image. Thicknesses at different parts (genu, midbody and splenium) and total area of the CC were

measured and obtained data were compared with normal values for age from studies in the literature.

RESULTS

All patients had seizures and mental retardation. In 3 patients CC was diffusely enlarged. In the remaining four, segmental hypertrophy of CC was observed. A patient with unilateral frontoparietotemporal polymicrogyria demonstrated thick genu, another patient with bilateral occipital polymicrogyria showed splenium hypertrophy. Third case with segmental enlargement of CC had a thick genu with unilateral polymicrogyria and subcortical heterotopia. Finally, fourth patient had unilateral extensive polymicrogyria sparing occipital lobe and thickened genu. patient with diffusely thick CC had unilateral frontotemporal especially perisylvian polymicrogyria and frontal heterotopia. All three cases with diffuse enlargement of CC had bilateral cortical developmental malformation. One of these cases with bilateral perisylvian abnormality had additional rotation abnormality of hippocampi and hypertrophic caudate nuclei. Caudate nuclei hypertrophy was also observed in another case with bilateral perisylvian polymicrogyria.

CONCLUSION

The etiology of the enlarged CC is unclear. Segmental enlargement could occur in presence of focal cortical developmental anomaly. The increased CC size in patients with polymicrogyria could result from abnormally thickened or increased number of axons. However, presence of gyration abnormality should be scrutinized in patients with thick CC and seizure.

11:30 – 13:00

SS 34**Free paper session: Carotid Stenosis**

Chairs: J. Berkefeld, J. Theron

Room: Free Paper**O34.1****ADC MAPPING REFLECTS CHRONIC ISCHEMIA IN CAROTID STENOSIS**P. Mosimann¹, K. Lovblad², G. Abdo³, F. Assal⁴, H. Yilmaz⁴, V. Rentsch Granges⁴, A. Alimenti⁴, D. Rüfenacht³;¹HUG, Geneva/CH, ²Neuroradiology, Genève/CH, ³University Hospitals of Geneva, Geneva/CH, ⁴HUG, Geneva/CH**PURPOSE**

Carotid stenosis is believed to cause neurological dysfunction through hypoperfusion by causing among others chronic ischemia to the white matter of the brain. We wanted to investigate this by performing ADC mapping in patients presenting with carotid stenosis.

MATERIAL AND METHODS

Nineteen patients with carotid stenosis underwent MR imaging on a clinical 1.5 scanner equipped with a head coil (Philips Intera). In addition to standard T1-weighted, T2-weighted and FLAIR imaging, the patients underwent single-shot whole brain echo-planar DWI of the brain. Diffusion-weighted MR was done with b values of 0 and 1000 s/mm² from which ADC maps were automatically generated. Regions of interest (30.5 mm²) were

defined in the periventricular grey matter, the thalamus and the occipital lobes on both sides and values were measured.

RESULTS

Five patients had left-sided carotid stenoses, five right-sided and 10 had bilateral stenoses. On the side of the stenosis, the mean ADC value in the periventricular white matter was: 835.88×10⁻³ mm²/s, whereas on the side without stenosis it was 787.66×10⁻³ mm²/s. In the occipital lobes, the values were 810,11 on the right and 787, 00 on the left; in the thalamus, the values were 765.26 on the right and 734, 65 on the left. In the cases with bilateral stenosis the differences were not found: the values in the periventricular white matter were 798.88×10⁻³ mm²/s for the right hemisphere and 801.90×10⁻³ mm²/s for the left hemisphere; in the right thalamus they were: 783,63×10⁻³ mm²/s and in the left 823,12×10⁻³ mm²/s; in the right occipital lobe they were: 779,58×10⁻³ mm²/s and in the left: 773, 51×10⁻³ mm²/s.

CONCLUSION

Mapping of the apparent diffusion coefficient reflects changes in the brain parenchyma secondary to chronic hypoperfusion induced by carotid stenosis. Higher ADC values were found on the side of the stenosis in the affected vascular territory when compared to contralateral or control regions. These reflect probably vasogenic changes.

O34.2**VENOUS REFLUX ON CAROTID CT ANGIOGRAPHY: RELATIONSHIP WITH LEFT-ARM INJECTION**C. Chen¹, Y. Tseng², H. Hsu²;¹ E-Da Hospital/I-Shou University, Kaohsiung County/TW,²E-Da Hospital/I-Shou University, Kaohsiung County/TW**PURPOSE**

We evaluated the relationship between image degradation due to the reflux of contrast agent into the major neck veins and use of a left-arm injection site during computed tomographic (CT) angiography of the carotid arteries.

MATERIAL AND METHODS

A total of 364 patients underwent four-section carotid CT angiography performed with an injection into the right (n = 183) or left (n = 181) arm. We calculated the volume of refluxed contrast medium and measured the retrosternal distance measured as the shortest distance between the sternum and the arch or its branches. Nine patients underwent follow-up CT angiography weeks later by using the side of injection not used before for comparison.

RESULTS

The amount of refluxed contrast medium was greater with left-arm injection than with right-arm injection ($P < 0.001$). With left-arm injection, the volume was significantly correlated with the retrosternal distance ($r = -0.514$, $P < 0.001$), even after we adjusted for age and sex in the linear regression model ($P < 0.001$). Five of the 9 patients who received injections in both arms had no reflux of contrast medium, whereas 4 patients had obvious reflux after left-arm but not right-arm injection.

CONCLUSION

Compression of the left brachiocephalic vein due to decreased retrosternal space may degrade carotid CT angiograms because of reflux of contrast material into the cervical veins. This degradation can be avoided if right-arm injection is used.

O34.3**GADOBENATE DIMEGLUMINE-ENHANCED MAGNETIC RESONANCE ANGIOGRAPHY OF CAROTID ARTERY STENOSIS: ASSESSMENT OF ACCURACY RELATIVE TO DIGITAL SUBTRACTION ANGIOGRAPHY (DSA)**N. Anzalone¹, G. Scialfa², R. Iezzi³, S. Thurnher⁴, R. Coulden⁵;¹Scientific Institute, Ospedale San Raffaele, Milano/IT, ²Ospedale Niguarda Ca Grande, Milano/IT, ³University, Chieti/IT, ⁴University of Vienna, Vienna/AT, ⁵Papworth Hospital NHS Trust, Cambridge/GB**PURPOSE**

To evaluate the accuracy of contrast-enhanced MR angiography (CE-MRA) with 0.1 mmol/kg gadobenate dimeglumine in the assessment of carotid artery disease (CAD) relative to digital subtraction angiography (DSA).

MATERIAL AND METHODS

248 (170 men/78 women; mean age 67.5 years) of 252 enrolled patients with suspected CAD underwent MRA and DSA within 2 weeks. MRA, performed at 1.5T from the aortic arch to the carotid siphons, comprised an unenhanced 2D-TOF sequence (TR/TE/FA: ≤ 30 ms/ ≤ 7 ms/ $\leq 60^\circ$) and a contrast-enhanced (gadobenate dimeglumine, Gd-BOPTA, Bracco; 0.1 mmol/kg BW administered at 2 ml/sec) 3D spoiled GRE sequence (TR/TE/FA: ≤ 7 ms / ≤ 3 ms / $\geq 30^\circ$). Images were evaluated on-site and by four experienced off-site blinded readers (three for MRA, one for DSA). Technical adequacy of the MRA techniques was determined and compared (chi-square test). Sensitivity, specificity, accuracy for detection of significant ($\geq 60\%$) stenosis compared to DSA were calculated for 2D-TOF and CE-MRA and compared (McNemar's test). Inter-reader agreement was determined using kappa (κ) statistics. Safety was assessed by means of vital signs, ECG, laboratory tests, and 24 h monitoring for adverse events (AE).

RESULTS

DSA revealed 196 vessels with significant stenoses and 108 vessels with occlusions. Significantly ($p < 0.001$; all readers) more technically inadequate images were noted for 2D-TOF (11.4–14.8%) than for CE-MRA (4.1–4.9%). Sensitivity for detection of significant disease ranged from 56.6–76.3% for 2D-TOF and from 57.9–86.3% for CE-MRA. All readers noted significant ($p < 0.001$) increases in specificity and overall accuracy on CE-MRA compared to 2D-TOF MRA. On-site investigators similarly noted significant ($p < 0.001$) increases in sensitivity, specificity and overall accuracy. Better three-reader agreement was noted for CE-MRA (84.7% agreement; $\kappa = 0.64$) than for 2D-TOF (77.1% agreement; $\kappa = 0.61$, $p < 0.0001$). Just 5.2% of patients experienced a mild or moderate AE that was possibly or probably related to injection of Gd-BOPTA.

CONCLUSION

CE-MRA with 0.1 mmol/kg Gd-BOPTA is accurate, safe and reproducible and provides better agreement with DSA than 2D-TOF MRA for evaluation of the carotid arteries.

O34.4**THE IMPACT OF CAROTID ARTERY STENTING ON THE ENDOTHELIAL INJURY**S. Ohno¹, T. Hashimoto², Y. Ikeda¹, J. Haraoka²;¹Tokyo Medical University Hachioji Medical Center, Tokyo/JP,²Tokyo Medical University, Tokyo/JP**PURPOSE**

Carotid artery stenting (CAS) is an alternative therapeutic option to carotid endarterectomy (CEA) and it has been recently shown that CAS is safe and effective. However, the difference in terms of vascular response in a molecular biological aspect is not clear between these therapeutic assaults. Our hypothesis is that endovascular procedure by CAS may lead to endothelial cellular dysfunction, contributing to the genesis of acute thrombosis and re-stenosis. We investigated serum endothelial markers to clarify the endothelial injury after CAS compared with CEA.

MATERIAL AND METHODS

Twenty-nine patients treated with CEA /CAS were enrolled in this prospective study. Twenty-one patients had experienced symptoms within 6 months prior to CEA/CAS. They had stenosis more than 70% on NASCET criteria. Twenty-four patients with high surgical risk treated with CAS, another five patients underwent CEA. Serum levels of the followings were assessed preoperatively and on day 1, 3, and 7 post surgery: plasminogen activator inhibitor-1 (PAI-1), von Willebrand factor (vWF), thrombomodulin (TM) and E-selectin as marker of endothelial cellular damage and interleukin-6 (IL-6) and C-reactive protein (CRP) of inflammatory reaction.

RESULTS

After CAS, levels of PAI-1 and vWF significantly increased, but remained within normal ranges. The level of E-selectin did not change significantly. In contrast, CEA did not induce any changes on the endothelial markers. CRP and IL-6 increased transiently following CAS and CEA, and both levels of day 7 were higher than pre-procedure in CAS group.

CONCLUSION

The present preliminary results suggest that CAS does induce endothelial injury in a short postoperative term. We will investigate further to determine a more suitable biomarker for the early prediction of restenosis after CAS procedure.

O34.5

EMERGENT STENT ASSISTED ANGIOPLASTY OF THE SEVERELY STENOTIC CAROTID ARTERY IN HYPERACUTE ISCHEMIC STROKE PATIENTS

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¹Yonsei University College of Medicine, Seoul/KR, ²Yong Dong Severance Hospital, Seoul/KR

PURPOSE

The feasibility and outcome of emergent stent assisted angioplasty with or without thrombolysis was assessed in hyperacute ischemic stroke patients with severely stenotic carotid artery.

MATERIAL AND METHODS

Between May 2004 and January 2006, stent assisted angioplasty was performed in 5 patients with significant carotid artery stenosis presenting within 6 hours of hyperacute ischemic stroke. The angiography, CT studies and the clinical charts were reviewed for assessment of clinical characteristics, lesion locations, pre and post stent findings, procedure related complications, hemorrhagic complications, and, clinical outcome.

RESULTS

The 5 patients consisted of 4 males and 1 female (mean age: 69.2 years, range: 58–77 years). The mean initial NIHSS score was 11 (range: 6–16). Initial IV thrombolysis (0.9 mg/kg tPA) was performed in 3 patients (mean: 140 minutes, range: 70–200 minutes) but did not show significant improvement of NIHSS score after complete infusion. The digital subtraction angiograms showed

significant stenoses (mean: 84%, range: 70–95%) in the ICA bulb (n=4) and the petrous ICA (n=1). The mean time to stent assisted angioplasty after symptom onset was 328 minutes (range: 260–395 minutes). One case showed tandem occlusion of the right M1 which was successfully recanalized by additional IA thrombolysis with urokinase (370,000 IU). Failure of stent assisted angioplasty occurred in one case after balloon angioplasty due to sudden blood pressure drop from retroperitoneal hematoma, which was corrected with blood transfusions. Stent insertions were successful in 4 cases with good outcome (3 month MRS: 2, discharge NIHSS scores: 0, 4, 10). No cases showed symptomatic hemorrhage.

CONCLUSION

Emergent stent assisted angioplasty of the stenotic carotid artery in hyperacute ischemic stroke patients seems to be a feasible method for carotid revascularization. Larger scale studies are necessary for further validation of this method in terms of complications and clinical outcome.

O34.6

FREQUENCY OF EMBOLIC EVENTS DETECTED BY DIFFUSION-WEIGHTED MR IMAGING AFTER CAROTID STENTING WITH PROTECTION: PROXIMAL VERSUS DISTAL PROTECTION DEVICES

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PURPOSE

Protective devices have been implemented in conjunction to carotid artery stenting (CAS) to prevent possible peri-procedural embolic events. Currently, the two popular methods of protection include the distal and the proximal devices. Recent studies demonstrated better results after CAS under distal protection than in unprotected cases. The purpose of this study is to compare the frequency of peri-procedural embolic events related to endovascular therapy (CAS) with proximal versus distal protection techniques. Such embolic events are documented by pre- and post- interventional MRI scans.

MATERIAL AND METHODS

We examined forty-four patients with hemodynamically significant and / or symptomatic carotid artery stenosis who underwent stenting with utilization of a protective device. Group 1 included twenty-five patients protected by proximal protection (MOMA Systems, Invatec, Innovative Technologies, Italy). Group 2 included nineteen patients with distal protection implemented. For the latter method, Filterwire (Boston Scientific, Natick, MA, USA) was used in 17 patients, Emboshield (Abbott Vascular, Redwood, CA, USA) in one patient and Neuronet (Guidant, CA, USA). The MRI scan performed before and after the intervention included, amongst other sequences, the DWI and T2-weighted images. In most patients the post-interventional MRI was performed within 24 hours after CAS. The

interpretation of DWI for recent embolic events was carried out blindly by three experienced neuroradiologists.

RESULTS

Post-procedural diffusion-weighted (b=1000) images depicted new hyperintense lesions in seven patients of the cases in Group 1 (28%) and in five patients from Group 2 (26.3%). The total number of “new” lesions was 18 and 17.7 for Groups 1 and 2 respectively. The lesion load per patient was thus lower for Group 1. The “new” lesions depicted on T2-weighted images were 3 and 5 lesions from Groups 1 and 2 respectively. In Group 1, complications were noted in two cases due to in-stent stenosis, with one of them manifesting clinically. In Group 2, two patients showed significant complications; one due to detachment of the filter membrane and the other in the form of massive bleeding due to hyperperfusion syndrome.

CONCLUSION

Proximal protection with CAS appears a potential alternative method to distal protection in preventing peri-procedural embolic complications. No device system could prove outstanding superiority over the other in terms of frequency of such embolic events.

O34.7

HYPERPERFUSION AFTER CAROTID ENDARTERECTOMY. POSSIBLE DISTINCT PATTERNS.

M. El-Koussy¹, R. Wiest², J. Slotboom³, C. Kiefer², H. Pihan⁴, J. Schmidli⁴, H.P. Mattle⁵, G. Schroth⁶;

¹University Hospital Bern (Inselspital), Bern/CH, ²Institute for Diagnostic and Interventional Neuroradiology, Bern/CH, ³Inselspital, CH 3010 Bern/CH, ⁴University of Bern, Inselspital, Bern/CH, ⁵University Hospital of Berne, Berne/CH, ⁶Inselspital, Bern/CH

PURPOSE

Hyperperfusion syndrome (HS) is a rare but devastating complication of revascularisation procedures, e.g. Carotid Endarterectomy (CEA) as well as angioplasty and stenting (CAS). HS is

thought to result from chronic cerebral ischemia due to a critical ipsilateral carotid stenosis with consequent loss of cerebrovascular autoregulation. It includes a spectrum of pathophysiological alterations, including the locally elevated cerebral blood flow. HS has been previously classified into three types on the basis of clinical presentation; 1) acute focal edema, 2) acute hemorrhage, or 3) delayed classic presentation at least 24 hours after intervention. The classic symptoms of HS include headache, seizures, nausea, confusion, and focal neurological deficits.

MATERIAL AND METHODS

The authors present two cases representing few of the extreme patterns from the HS spectrum.

RESULTS

The first case was a 72-year-old woman who developed a delayed type of HS. She underwent endarterectomy for an asymptomatic 85% stenosis of the right internal carotid artery. Four days after surgery she developed neurological deficits and seizures. Ipsilateral hyperperfusion was detectable on Perfusion CT and MRI studies and lasted till day 16 after CEA. A small hemorrhage was detected on the T2* MRI and CT images. Diffusion MRI initially revealed reversible changes, likely due to vasogenic edema, and days later demonstrated acute frank ischemic changes bilaterally. Transient ipsilateral MRI signal increase of cerebrospinal fluid (CSF) occurred on day 5. Conventional angiography presented evidence of disturbed vascular autoregulation. The second case was a 58-year old male, who underwent a CAS under distal protection for a symptomatic left-sided carotid stenosis. The MRI on the next day revealed evidence of hyperperfusion. Two days after CAS his conscious level deteriorated (GCS: 6) and an emergency CT revealed a disastrous ipsilateral intracerebral hemorrhage with intraventricular extension.

CONCLUSION

Diffusion- and perfusion- weighted MRI sequences are mandatory for careful assessment of HS. Observing rather subtle signs including “CSF hyperintensity” and closely following-up each case, provides valuable information about pathophysiology of HS, and can guide prevention of such complication in the future.

13:00 – 14:00

LUNCH SYMPOSIUM: LUNCH SYMPOSIUM

14:00 – 15:30

SS 27

Main session: *Spine Diagnostic*

Chairs: J. Delavelle, J. Van Goethem

ML66

MR DIFFUSION OF THE SPINAL CORD

V. Dousset, Bordeaux/FR

ML67

MR DIFFUSION OF THE BONE MARROW

A. Baur-Melnyk, Munich/DE

Room: ESNR / Diagnostic

ML68

SPECTROSCOPY AND FUNCTIONAL MRI IN THE SPINE

S. Kollias, Zürich/CH

14:00 – 15:30

SS 31**Main session:** Carotid Artery Stenting

Chairs: J. Theron, A. Uské

Room: ICS / Interventional**ML69**

INFLUENCE OF FLUID SHEAR STRESS ON LESION SIZE AND VULNERABILITY

R. Krams, Rotterdam/NL

ML70

THE VULNERABLE CAROTID PLAQUE

N. Nighoghossian, Lyon/FR

ML71

CAROTID STENTING

W. Taki, Mie/JP

14:00 – 15:30

SS 35**Free paper session:** ICS / Aneurysm

Chairs: S. Cekirge, J. Liu

Room: Free Paper**O35.1**

THE HANNOVER EXPERIENCE WITH THE CLOSED-CELL NITINOL STENT LEO IN THE TREATMENT OF INTRACRANIAL ANEURYSMS.

F. Goetz¹, W. Weber², B. Haubitz³, F. Donnerstag³, F. Logemann³, J. Krauss³, H. Becker⁴;¹MHH, HANNOVER/DE, ²Alfried Krupp Krankenhaus, Essen/DE, ³MHH, Hannover/DE, ⁴Dept. of Neuroradiology, Hannover/DE**PURPOSE**

In wide necked and complex intracranial aneurysms stent placement and coil embolisation is a proposed treatment option. We report our experience with a closed cell nitinol stent (Leo, Balt) for the treatment of 15 intracranial aneurysms.

MATERIAL AND METHODS

From September 2004 to March 2006, fifteen patients, 11 women and 4 men, 37 to 66 years old, were included. Treatment was elective in 11 patients. Symptoms were mass effect in 4 patients and subarachnoid hemorrhage in 6. Five aneurysms showed recanalisation due to coil compaction. The aneurysms were located in the carotid artery (C7 segment (3), C6 segment (4), C4 segment (2) C3 segment (1)), anterior cerebral artery (1), vertebrobasilar junction (2) and basilar tip (2). The diameter of the aneurysms

ranged from 2 – 25 mm. There were 4 fusiform aneurysms and 11 saccular aneurysms with unfavourable neck/dome ratio.

RESULTS

The interventions were carried out under general anesthesia after sufficient premedication with aspirin and clopidogrel. During the procedure 5000 I.U. of heparin were administered. Access to the aneurysm was gained using a Vasco+ microcatheter and a hydrophilic wire 0.016" (Silverspeed Ev3, Terumo 0.016"). 15 Leo stents were deployed. Positioning of the stent was successful in all cases but inadequate in one case due to insufficient stent expansion. In 8 cases immediate coil embolisation was done with complete occlusion of 4 and partial or incomplete occlusion of 4 aneurysms. On follow up (10 patients, 4 pending), 4 aneurysms were completely occluded, one presented with increased thrombosis, 1 residual neck was accepted and 3/4 residual aneurysms were treated successfully with coil embolisation (1 pending). One patient died unrelated to the stent procedure after SAH. One in stent thrombosis (insufficient anticoagulation due to acute subarachnoid hemorrhage) with subsequent total media infarction was recorded.

CONCLUSION

In wide necked, complex and dissecting intracranial aneurysms implantation of the Leo stent is feasible and effective. Immediate or delayed coil embolization is advised but dense packing of the aneurysm does not seem to be necessary. On follow up bleeding or recanalization were not evident.

O35.2**REMODELING VASCULAR DEVICES ON THE TREATMENT OF CEREBRAL ANEURYSMS**D.K. Lopes

Rush University Medical Center, Chicago/US

PURPOSE

The use of remodeling vascular devices (RVD) on the treatment of wide neck cerebral aneurysms has increased the number of patients that endovascular therapy can be offered. There are significant questions regarding procedural morbidity and mortality and long-term complications involving parent vessel stenosis. Our goal was to review intraoperative technical and clinical complications and angiographic stenosis on 6 month follow-up.

MATERIAL AND METHODS

We reviewed 150 cases that were treated with RVD (Neuroform, BSC). The protocol involved analysis of all the intraoperative information - RVD database, operative report, length of hospital stay (LOS) and SSEP/EEG report. All patients were examined pre and in 6 months after surgery (Barthel and Rankin scales obtained). The 6-month follow up angiogram was compared to preoperative study to determine presence of parent vessel compromise.

RESULTS

There were 11 (7%) clinical and 7 technical intraoperative complications. The clinical complications noted were groin hematoma, TIA and stroke. The average LOS was 2.8 days. There was no significant difference on Barthel and Rankin scores pre and 6 month postoperatively. Intraoperative neurophysiological monitoring (SSEP/EEG) was used in 119/150 patients. Changes in EEG/SSEP were noted in 18% of the cases. There were 3 (2%) cases of significant parent vessel compromise on angiographic follow up. Only one case was clinically symptomatic (0.6%).

CONCLUSION

The increase in use of RVDs has allowed the treatment of more complex wide neck aneurysms. We report our initial clinical and angiographic complication rates. This information may help during patient counseling and pre operative risk assessment.

O35.3**INTRAVASCULAR PLACEMENT OF STENT GRAFT TO EXCLUDE ANEURYSM FROM THE CIRCULATION AS A RECONSTRUCTIVE APPROACH**S. Geyik¹, K. Yavuz², O. Koc², O. Akca², G. Pamuk², I. Saatci², S. Cekirge²;¹Hacettepe University, Ankara/TR, ²HACETTEPE UNÝVER-SÝTY, ANKARA/TR**PURPOSE**

The purpose of this study was to evaluate the immediate and mid-term angiographic and clinical result of endovascular treatment of intracranial aneurysms by excluding the aneurysm from the circulation with a stent graft.

MATERIAL AND METHODS

Between 2001 and 2006, 54 patients with 58 aneurysms were treated with Jomed coronary stent graft placed across the aneurysm neck. 36 aneurysms were located in petrous/cavernous segment of ICA. Of the 22 intradural aneurysms, 15 were at the ophthalmic segment, 1 in the carotid cave, 5 at the vertebral artery, and 1 was mid-basilar. 25 of 58 aneurysms were post-traumatic. 14 patients were presented with cranial nerve palsies Follow-up angiographies were obtained ranging between 6 month and 4 years.

RESULTS

No procedural mortality occurred. Parent artery occlusion was performed in 3 patients due to treatment failure. Intraoperative ICA rupture occurred in one patient (2%) who salvaged with endo-saccular Onyx occlusion proceeded by-pass surgery followed by endovascular parent artery occlusion; and discharged with slight arm paresis. Cranial nerve palsies showed complete resolution in 9 patients, partial resolution in 4 and no change in one patient. All control studies but one revealed full aneurysm exclusion with no hemodynamically significant restenosis. Asymptomatic PAO was discovered in the follow-up in the remaining one patient who did not use plavix.

CONCLUSION

This technique would be very effective alternative treatment for the intracranial aneurysms located in the ICA below the level of ant. choroidal artery or for any side wall location which is free of branches or perforating arteries.

O35.4**TREATMENT OF WIDE NECKED INTRACRANIAL ANEURYSMS WITH A NEW FULLY RETRIEVABLE SELF EXPANDING NEUROVASCULAR SOLO STENT SYSTEM**K. Yavuz¹, S. Geyik², O. Koc¹, O. Ertugrul¹, G. Pamuk¹, I. Saatci¹, S. Cekirge¹;¹HACETTEPE UNIVERSITY, ANKARA/TR, ²Hacettepe University, Ankara/TR**PURPOSE**

We would like to present our initial clinical experience in using a new fully-retrievable self-expanding neurovascular stent in combination with coil embolization for the treatment of wide-neck aneurysms including 6-months follow-up.

MATERIAL AND METHODS

In April 2005, 14 patients with 17 wide-necked intracranial aneurysms were treated with Solo stent system and detachable platinum coils except one with stent and liquid polymer Onyx combination. They were wide-necked intracranial saccular aneurysms, having a dome-to-neck ratio less than 2.0 and/or a neck length of 4 mm or more; and the relevant parent artery with a diameter between 1.5 and 5 mm.

RESULTS

14 aneurysms were small in size while 3 were large. Aneurysms were located at posterior communicating artery (n=7), midbasilar (n=1), ICA at bifurcation (n=1), and paraophthalmic ICA (n=8) respectively. Only one was acutely ruptured. Three aneurysms

were recanalized ones after being treated with coil (n=2) and onyx (n=1) embolization previously. No difficulty was experienced in the delivery of the stents. Only one stent was retrieved and repositioned after being fully expanded. Follow-up angiograms at 6 month of 17 aneurysms demonstrated all stents being patent without any evidence of intimal hyperplasia or stenosis. Fourteen of the aneurysms showed stable occlusion. Two small aneurysms showed progressive occlusion while only one large aneurysm showed slight recanalization.

CONCLUSION

Our preliminary experience shows that the fully retrievable self-expandable Solo stent is a feasible, secure and effective system with high radial force and ease of delivery in treating wide-neck intracranial aneurysms in combination with coil embolization.

O35.5

OUR EXPERIENCE OF INTRACRANIAL STENTING IN TREATMENT OF WIDE-NECKED ANEURYSMS AND CCF

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¹Burdenko Neurosurgical Institute, Moscow/RU, ²Neurosurgery Burdenko Institute, Moscow/RU

PURPOSE

To evaluate efficiency of endovascular embolization of cerebral wide-necked aneurysms and CCF using stent-assisted technique.

MATERIAL AND METHODS

19 patients with intracranial aneurysms and 4 patients with direct carotid-cavernous fistulas (CCF), aged 7 years - 67 years (male - 13, female - 10) underwent endovascular interventions from 2004 to 2005. Clinical manifestation in patient with aneurysms were as follows: intracranial hemorrhage - 10 pts, 9 patients had various focal neurological symptoms because large size of aneurysms. Aneurysms were located at the internal carotid artery (ICA) - 11, the basilar artery - 5, the vertebral artery - 2, the posterior cerebral artery - 1 pts. Among the patients with CCF, 2 patient had ICA false aneurysms in cavernous sinus after first stage balloon occlusion of fistula, 2 - had incomplete occlusion of fistulas because complex rupture of ICA. For stent-assisted technique was used Neuroform2 (Boston Scientific) for treatment of aneurysms; BX Sonic (Cordis) and Jostent GraftMaster (AVD) for treatment of CCF. Occlusion of aneurysms we performed by microcoils Matrix (Boston Scientific) and MDS (Balt, France). Premedication with antithrombotic agents was available for unruptured cases of aneurysms and CCF. Postprocedural antithrombotic medication was prescribed for all patients during 4 month.

RESULTS

Complete aneurysms occlusion achieved in 14 pts, subtotal occlusion - 4. Only stent placement without coil embolization was performed in 1 case. Intraoperative complications have been presented by stent thrombosis on the level of ophthalmic ICA in one patient and stent dislocation in 2 cases. In the first case we have not received ischemic disorders because good arterial supply through communicating arteries. In the next two cases we have removed stents from lumen using microsnares device without any dissections and neurological complications. Again implantation of

another stents immediately has been made and aneurysms were coiled. In all cases with CCF we have achieved the full reconstruction of ICA lumen with complete occlusion of false aneurysms and fistulas. Postoperative results: two patients showed transient ischemic disturbances, there were no postoperative mortality and morbidity.

CONCLUSION

Intracranial stenting is considered as an affective and useful assisted technique for treating of wide-necked intracranial aneurysms. Stent-assisted disconnection of complex CCF will allow to enlarge the number of reconstructions of ICA.

O35.6

LONG-TERM ANATOMICAL RESULTS OF ANEURYSMS TREATED WITH REMODELING VASCULAR DEVICE

D.K. Lopes

Rush University Medical Center, Chicago/US

PURPOSE

The use of remodeling vascular device (RVD) has increased the number of wide neck cerebral aneurysms amenable to endovascular treatment. The long-term durability of wide neck cerebral aneurysm after endovascular treatment has been a challenging problem. We report our long-term anatomical results with RVDs in wide neck cerebral aneurysms.

MATERIAL AND METHODS

We reviewed our first 150 wide neck cerebral aneurysms treated with Neuroform RVD since 2002. All aneurysms and parent vessels were analyzed at time of treatment and in follow-up. The modalities used were cerebral angiography at 6 months from treatment and MRI/MRA/NOVA at 6 months and every year for three years and every three years thereafter. We documented at time of first treatment the ability to completely occlude aneurysm. In follow-up the aneurysms were analyzed for changes in appearance from post op. The aneurysms were divided in complete occlusion vs. stable residual vs. coil compaction vs. retreatment.

RESULTS

The series demonstrated 60% of all aneurysms were completely occluded at time of treatment. From the aneurysms with residual filling after treatment (62/150) only 26/150 (17%) remained not occluded and (9/150) required retreatment (6%).

CONCLUSION

The findings on the study suggest that the use of RVD in wide neck cerebral aneurysms may decrease retreatment rate and also stabilize aneurysms with initial residual neck filling.

O35.7

MID-TERM FOLLOW UP IN NEUROFORM STENT-ASSISTED COIL EMBOLIZATION OF WIDE-NECK ANEURYSMS USING DIFFERENT STRATEGIES IN STENT DEPLOYMENT

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PURPOSE

To evaluate the mid-term results of intracranial stent-assisted coil embolization in the treatment of wide-necked cerebral aneurysms, and to assess the efficacy of various strategies used in stent deployment.

MATERIAL AND METHODS

Retrospective study on a series of 42 patients with 46 wide-necked aneurysms enrolled on a prospective single-center registry of patients treated with a Neuroform stent, a flexible self-expanding stent. Twenty-seven aneurysms were unruptured, 14 were recanalized aneurysms and 5 aneurysms were ruptured. Thirty-nine lesions were located in the anterior and 7 in the posterior circulation. Mean aneurysm size was 9.8 mm. Stenting before coiling was performed in 13/45 aneurysms (29%), coiling before stenting in 27/45 aneurysms (60%) and stenting alone in 5/45 (11%). Follow-Up (FU) was available in 31 patients with 33 aneurysms and ranged from 6 to 24 months.

RESULTS

Neuroform stenting was attempted in 46 wide-necked aneurysms (42 patients). Stent was successfully deployed in 44/46 cases at the first procedure and at the second attempt in one case. Forty-nine stent sessions were performed including 3 re-treatment. In 46 stent sessions (94%) we obtained successful deployment of 47 stents for 45 aneurysms. In 40 aneurysms treated with stent-assisted coiling, angiographic results showed 14 (35%) aneurysm occlusions, 18 (45%) neck remnant and 8 (20%) residual aneurysms. In 5 recanalized aneurysms treated with stenting alone, no changes were observed in 4 aneurysms and 1 neck remnant reduced in size. Transient morbidity was observed in 2 of 42 patients and one patient died. Asymptomatic complications were observed in 3 of 42 patients. At angiographic FU in 30 aneurysms treated with Stent-assisted coiling, there were 17 (57%) aneurysm occlusions, 7 (23%) neck remnants and 6 (20%) residual aneurysms. In 3 recanalized aneurysms treated with stent alone, 2 neck remnants remained unchanged and 1 neck remnant decreased in size. Clinical FU was assessed by modified Rankin Scale, showing that 27 patients (87%) had a score of 0, three patients (10%) a score of 1 and one patient (3%) a score of 2.

CONCLUSION

Our results and mid term follow-up show that Neuroform stent-assisted coil embolization is a relatively safe and efficient technique in the treatment of wide-necked cerebral aneurysms. Further studies are needed in order to evaluate the long-term stability of the aneurysmal occlusion and the tolerance to the stent.

O35.8

INTRACRANIAL ANEURYSM STENTING: FOLLOW-UP WITH MR ANGIOGRAPHY

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¹Neuroradiology, Genève/CH, ²HUG, Geneva/CH

PURPOSE

Intracranial stenting is increasingly being used to treat intracranial aneurysms and stenoses. We wanted to assess the utility of magnetic Resonance angiography in the follow-up of patients treated with various types of intracranial stents and to assess the utility of performing Gadolinium-enhanced MRA.

MATERIAL AND METHODS

Nineteen patients having undergone intracranial stenting for aneurysms were imaged by MRI at 1.5T. Twenty stents were placed in 19 patients. In addition to conventional T2 and diffusion-weighted MRI, 3D time of flight MRA was performed before and after contrast administration

RESULTS

In the case of metallic INX stents (n= 7), there was a signal drop at the level of the vessel which did not allow to evaluating the parent vessel, whereas this was visible in Nitinol stents (n= 8). Additionally a stent with a wire had a small artifact (n = 3). Contrast-administration also improved vessel lumen visualisation.

CONCLUSION

In the case of Nitinol stents, MR angiography can be used to reliably demonstrate the vessel lumen after intracranial stenting. The use of post contrast 3D time-of flight imaging helps improve the intraluminal definition.

O35.9

VALUE OF ANGIOGRAPHIC COMPUTED TOMOGRAPHY (ACT) IN THE ASSESSMENT OF DEPLOYMENT CHARACTERISTICS AND CONFORMABILITY OF NEUROFORM STENTS

G. Benndorf, N. Ebrahimi, C.M. Strother, R.P. Klucznik;
The Methodist Hospital, Houston/US

PURPOSE

The purpose of this study was to evaluate the role of Angiographic computed tomography (ACT) for assessing the conformability and deployment characteristics of the Neuroform 2 stent during treatment of wide-neck aneurysms in comparison to conventional DSA and DR (non-subtracted DSA) imaging.

MATERIAL AND METHODS

Nineteen patients (42–76 years, 15 females, and 4 males) underwent treatment of unruptured wide neck aneurysms, using self-expandable Nitinol stents (Neuroform 2®, Neuroform Treo®, Boston Scientific) in curved vascular segments (7 BA/PI, 10 ICA, 2 ACA). Four were treated using the Y-stent technique. ACTs were obtained using an angiographic system with flat detector (AXIOM Artis dBA, Siemens Medical Solutions, Erlangen, Germany) with the following parameters: 20 sec. rotations, 0.4 increment, 220° total angle, 1024 matrix, 538 projections. In 5 patients low-contrast ACT was performed (20%, 40 ml, 2 ml/sec).

RESULTS

ACT imaging provided significantly improved visualization of stent structures in comparison to conventional DSA and DR. The configuration of the stent markers in orthogonal views of regularly

and fully deployed stents was observed to create a “Regular Four” figure. In some cases, an “Irregular Four” figure were observed, indicating an asymmetrical deployment of the stents, not identifiable on DSA or DR images. Using orthogonal projections and “in-stent” views, it was possible to assess the degree of deployment in curved vessel segments. Increased cell openings with outwards and inwards prolapse of struts were observed in curved vessels. In cases using Y-stenting technique, strut prolapse into the aneurysm neck, not identifiable on DSA/DR, were documented. Contrast application provided useful additional information on the relationship between stent lumen and parent vessel lumen or aneurysmal neck.

CONCLUSION

ACT provides excellent visualization of the Neuroform stents and was superior to conventional DSA and DR imaging. Detailed information of the deployment and documentation of adverse mechanics can be obtained. The “Regular Four” configuration of the stent markers represents an useful indicator for full deployment. Contrast enhanced ACT allows identifying stent orientation and deployment with regard to the vessel lumen. By improving knowledge and understanding of stent behavior and mechanics in intracranial vessels, ACT will increase safety and efficacy of stenting in the treatment of cerebral wide necked aneurysms.

15:30 – 16:30

COFFEE BREAK SYMPOSIUM: COFFEE BREAK SYMPOSIUM

15:30 – 16:00

COFFEE BREAK: COFFEE BREAK

16:00 – 18:00

SS 36

Free paper session: ICS / Flow

Chairs: C. Miranda, N. Sakai

Room: Free Paper

O36.1

PARTICLE IMAGE VELOCIMETRY AND NUMERICAL SIMULATION: A FIRST STEP TO VALIDATION SIMULATING FLOW IN IDEALIZED MODELS OF CEREBRAL ANEURYSMS.

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¹Geneva University Hospital, Geneva/CH, ²Swiss Federal Institute of Technology, Lausanne/CH, ³Federal Institute of Technology, Lausanne/CH, ⁴HUG, Geneva/CH, ⁵Swiss Federal Institute of Technology at Lausanne, Lausanne/CH

PURPOSE

Cerebral aneurysms are pathological dilatations of the artery wall that may cause severe injury and death when they rupture. Flow in the cerebral vasculature is at the moment not fully understood; several publications (1,2) propose to study and simulate numerically the flow in the cerebral aneurysm. We decided to investigate the flow in a simple model of cerebral aneurysm and to compare the results obtained by in vitro simulation by those obtained using numerical simulation.

MATERIAL AND METHODS

An idealized model of a sidewall aneurysm has been placed in a circulation system reproducing the human circulatory conditions; PIV (particle Image Velocimetry) has been used for assessing the flow in the aneurysm. The exact geometry could then be obtained by 3D-DSA (Digital Subtraction Angiography). A mixture of glycerin and water was heated at body temperature and used as fluid. Pressure and flow conditions were given by the sensors

placed over the circulation circuit. Numerical Simulations were performed using a commercial package.

RESULTS

Simulations were performed under steady and pulsatile flow. It appeared that there was a good match between both ways of simulation under steady flow at different Reynolds number.

CONCLUSION

PIV and numerical simulation appear to be a useful tools for assessing the flow behavior in simple cerebral aneurysms geometries. We plan now to validate numerical simulation in a real patient based geometry. References: 1 Computer Simulation of Flow Dynamics in Paraclinoidal Aneurysms, Kobayashi N, Miyachi S, Okamoto T, Kojima T, Hattori K, Qian S, Takeda H, Yoshida J, *Interventional Neuroradiology* 11: 197–203, 2005 2 Effect of arterial geometry on aneurysm growth: three dimensional computational fluid dynamics study, Hoi Y, Meng H, Woodward SH, Bendok BR, Hanel RA, Guterman LR, Hopkins LN. *J Neurosurg* 101:676–681, 2004

O36.2

COMPARISON OF 1-LAYER TO 2-LAYER STENTS

R. Ouared

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PURPOSE

Experimental studies with Cardatis bi-layer stents have shown no smooth muscle cell proliferation. Moreover, fluidity in collaterals increased unexpectedly. Numerical simulation of haemodynamics has been carried out to elucidate these striking observations. Two sets of numerical experiments have been achieved to: 1/ study the

effect of the inner layer on the shear stress profile at wall, 2/ study the effect of inner layer stent on the the flow pattern in the collateral. The results obtained with the bi-layer stent have been compared to the results obtained with a single-layer.

MATERIAL AND METHODS

To simulate the haemodynamics, a two-dimensional (2D) Lattice Boltzmann model has been used. In every experiment, four cases have been considered: no-stent, single-layer stent, bi-layer stent (asymmetric pattern), bi-layer stent (symmetric pattern). Several stent filament sizes have been considered: 25, 50 and 100 microns. For bi-layer stents, the radial distances between layers are: no gap and two-fold the filament size. In the first experiment, the shear loss at wall is compared to the total energy loss due to total viscous drag force under steady flow conditions in a 2 mm diameter tube. In the second experiment, vorticity at the entrance of the collateral (1 mm diameter) is analyzed in all cases under oscillatory flow conditions.

RESULTS

In the first experiment, the shear stress reduction at wall in bi-layer stents compared to 1-layer stents, ranges between 15% and 30% at wall, which added to other factors increase adherence to wall. The inner layer is responsible of a large part of a viscous loss. In the second experiment, vorticity of blood flow in the entrance area of the collateral vanishes in presence of 2-layer stents improving permeability secondary vessels. Such an effect is not reproduced with standard single layer stents.

CONCLUSION

The 2-layer stent has better therapeutic effects in both aneurysm and stenotic diseases than for 1-layer stent. The adjunction of a second layer reduces the effective porosity of the stent and improves consequently clotting capability in aneurysms, reduces the friction at wall for a better adherence, and reduces vorticity and stagnation of blood in collaterals towards better permeability of collaterals.

O36.3

ON THE WAY TO STENT-INDUCED ANEURYSM-CLOTTING CAPABILITY SCORING

B. Chopard
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PURPOSE

A new aneurysm-clotting capability metric induced by stents and based on the direct measurement of clotting fraction in the aneurysm is defined. An original numerical mechanistic low-shear thrombosis model that includes transport of idealized red blood cells and platelets adhesion-aggregation mechanisms is used. Consequently, a very simple clotting scheme appears to characterize variety of aneurysm-stent patterns coupling, hence opening the way for a proper and reliable stent-induced aneurysm-clotting capability scoring.

MATERIAL AND METHODS

To simulate blood flow a two-dimensional (2D) Lattice Boltzmann model has been used. Simple aneurysm geometries and simple generic stent designs in two dimensions are considered. Two types of aneurysm geometry are investigated, with the same neck size but with different aspect ratios. Both shapes are combined with

coarse and fine stents, each with two position offsets. In total we have eight stent-geometry combinations. For every combination, the temporal variation of the clotting fraction in aneurysm is captured. The clotting scheme coupling the stent pattern with the aneurysm geometry emerges naturally from the compilation of all these results. For aneurysms, two aspect ratios are considered: 0.5 and 1.25. For stents, two porosities are considered: 0.5 and 0.9. Stents are shifted by half a pore size.

RESULTS

First, it is found that the clotting dynamic is qualitatively matching some of the IRM/CTA observations and some of the platelets/clotting-factors dynamics. Second, the clotting scheme indicates that full occlusion of aneurysm occurs with low porosity stents, while partial occlusion likely occurs with high porosity stents at different degrees depending on aneurysm geometry: 80% occlusion for larger geometry (AR=1.25) and 50% occlusion for smaller geometry (AR=0.5). Moreover, in the latter case (AR=0.5, stent porosity=0.9), clotting is sensitive to stent positioning.

CONCLUSION

Our low-shear thrombosis model has allowed to develop an aneurysm-clotting capability metric that is sensitive to the aneurysm-stent system coupling that may lead in the near future to reliable clotting scoring.

O36.4

INTRACRANIAL ARTERIAL HEMODYNAMICS: IN-VIVO ASSESSMENT AND VISUALIZATION WITH FLOW SENSITIZED 4D MRI AT 3T

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¹Department of Neuroradiology, Basel/CH, ²University Hospital of Basel, Basel/CH, ³University Hospital Basel, Basel/CH, ⁴University Hospital Freiburg, Freiburg/CH, ⁵University of Basel, Basel/CH, ⁶University Hospital of Freiburg, Freiburg/DE, ⁷University Freiburg, 79106 Freiburg/DE

PURPOSE

The pulsatile blood flow through the arterial vasculature generates various types of hemodynamic forces that are believed to play an important factor in the pathogenesis and progression of vascular disease (e.g. atherosclerosis, aneurysms). We evaluated the feasibility of time-resolved flow sensitive 3D MR based on ECG synchronized 3D phase contrast MRI (flow sensitized 4D MRI) for the visual assessment and evaluation of local intracranial blood flow patterns in vivo with high temporal and spatial detail.

MATERIAL AND METHODS

ECG synchronized 3D phase contrast MRI with full three-directional blood flow velocity encoding (flow sensitized 4D MRI) was adapted to a dedicated 3T MR head system. In combination with advanced post-processing and 3D visualization strategies (e.g. to show stream-lines and particle traces) blood flow patterns were evaluated in healthy volunteers (n=5) and patients with steno-occlusive neurovascular disease (n=2). Different acquisition modes (targeted axial or sagittal volumes, full head and neck coverage), and post-processing strategies (stream-lines and particle traces) were appraised to illustrate the versatility of the technique.

RESULTS

Temporal and spatial evolution of intracranial blood flow in the large arteries was successfully visualized in all subjects. Peak systolic velocities as measured in eight vascular segments by Doppler sonography were slightly lower as determined by flow sensitized 4D MRI (on average $30.3 \pm 13.9\%$). The stream-line display revealed complex flow patterns with great detail, for example a helical flow pattern in the carotid siphon, and the inspection of particle traces allowed the assessment of vascular filling and the development of specific flow features over the cardiac cycle. In a patient with a unilateral proximal occlusion of a carotid artery, a cross-flow pattern to the contralateral site via a small anterior communicating artery was readily visible.

CONCLUSION

Results from volunteer and patient examinations demonstrate the feasibility of flow sensitized 4D MRI for the assessment and visualization intracranial vascular hemodynamics with high temporal and spatial detail. This novel strategy for the assessment and visualization of intracranial vascular blood flow might contribute to the understanding of cerebrovascular diseases. Future work has to focus, apart from technical improvements, on the exploration of cerebral blood flow patterns in patients with anatomic variants and pathologies (e.g. aneurysms) of the cerebral arteries.

O36.5

ANALYSIS OF INTRA-ANEURYSMAL FLOW DYNAMICS BASED ON LAMINA FLOW ANEURYSMOGRAPHY.

M. Tanaka, M. Indoh, Y. Sakata;
Kameda Medical Center, Kamogawa City/JP

PURPOSE

The long-term durability of the embolized aneurysm depends on the rigidity and coil density at the inflow zone of aneurysmal lumen. We retrospectively analyzed the mid-term outcome and clinical results of intracranial aneurysm based on the flow dynamics evaluation with aneurysmography and 3D-rotation angiography.

MATERIAL AND METHODS

We studied consecutive 30 cases of intracranial unruptured aneurysms that were treated with coil. All cases were performed aneurysmography to visualize the inflow zone and out flow zone of the lumen of aneurysm with the reference of endoluminal view obtained from the 3D-rotation angiography. Aneurysmography was performed with the lamina flow contrast injection through the microcatheter. All cases were observed with serial follow up angiography and MRA. Mean follow up period was 18 months.

RESULTS

Lamina flow angiography through the microcatheter could visualize the intra-aneurysmal flow condition. In 24 cases, complete obliteration at the inflow zone was achieved, and these group were stable in mid-term follow up with serial control angiography and MRA. In 6 cases, the density of coils at the inflow zone was relatively low and two cases of these group presented the partial recanalization of the lumen of aneurysm.

CONCLUSION

Durability of embolized aneurysm were well correlated with the packing density at the inflow zone of aneurysmal lumen. Lamina flow angiography is useful to visualize the intra-aneurysmal flow condition. Analysis of flow dynamics with lamina flow angiography facilitates more meticulous embolization and might improve the long-term durability of the aneurysm.

O36.6

EFFECT OF THE SEQUENTIAL DEPLOYMENT OF THREE STENTS IN A RIGID MODEL OF AN INTRACRANIAL ANEURYSM

P. Mora¹, G. Cantón², C. Geindreau³, P.K. Nelson⁴, D.I. Levy², J. C. Lasheras²;

¹University of California, San Diego, New York/US, ²University of California, San Diego, La Jolla/US, ³Université Joseph Fourier de Grenoble/FR, ⁴New York University Medical Center, New York/US

PURPOSE

To quantify the changes in the flow characteristics in the sac of a sidewall broad-necked aneurysm resulting from the deployment of one, two and three Neuroform stents across the aneurysmal neck.

MATERIAL AND METHODS

A polycarbonate rigid model with a spherically inscribed sidewall aneurysm arising from a 4 mm parent artery with a 90 degree bend was used. A rigid model was used in order to isolate the effect of the stents and to avoid the influence of the deformation produced by the stent in the geometry of the complex parent artery aneurysm. The characterization of the flow was done via digital particle image velocimetry (DPIV) techniques. The pulsatile velocity field at the mid plane of the aneurysmal sac was obtained along the phases of the cardiac cycle with a resolution of 15 measurements per second. These data were taken before and after deploying one, two, and three stents. The results of the stented cases were compared to the reference base case by computing the instantaneous and average circulation and kinetic energy in a region centered within the measuring plane. These two quantities characterize the strength of the rotational flow motion inside the aneurysmal sac.

RESULTS

The averaged circulation over the cardiac cycle was found to consistently decrease with increasing number of stents; achieving a 6.5% reduction after placing the first stent, a 20.81% after the second one and a 49.34% reduction after the third stent. In addition, the kinetic energy averaged over the cardiac cycle was reduced 57.79% with three stents. Although the averaged flow properties were found to decrease with the sequential deployment of the stents, a significant rotational motion inside the aneurysmal sac persisted throughout the whole cardiac cycle, even after placing three stents.

CONCLUSION

The sequential deployment of Neuroform stents across the aneurysm neck decreased the strength of the rotational motion inside the aneurysm dome. This effect is solely due to the net porosity and mesh structure of the stents.

O36.7**HEMODYNAMIC CHARACTERIZATION OF RUPTURED AND UNRUPTED CEREBRAL ANEURYSMS USING COMPUTER FLUID DYNAMICS.**

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PURPOSE

To determined the hemodynamic characteristics using computer fluid dynamics (CFD) of ruptured and unruptured cerebral aneurysms.

MATERIAL AND METHODS

We perform a non randomized prospective study of 50 ruptured and unruptured cerebral aneurysms diagnosed at the Instituto de Neurocirugia, Dr. Asenjo, Chile. We obtained cerebral aneurysm images from rotational digital sustractions angiographies using a Philips Allura Angiograph (Philips Medical Systems, Best, The Neatherlands). Images were exported in VRML format. Geometric edges were obtained with 3D Doctor (Lexinton, USA) and then rebuilt with Rhinoceros software (McNeel, Seattle, USA). A mesh model was built with Gambit software (Fluent, Libanon, USA) followed by CFD analysis with Fluent (Fluent, Lebanon, USA). Cardiac cycle pulse was obtained for each patient with color Doppler Ultra Sound of the cervical internal carotid or the vertebral arteries using a Philips HDI5000 sonograph (Phlips Medical Systems, Best, Neatherlands). The studied variables were: the inflow type, vortexes, blood jet impact area and wall shear stress.

RESULTS

We were able to standardized a methodology that allow us to calculate hemodynamic parameters in cerebral aneurysms. The flux inside the aneurysm was highly complex, with many vortexes and presented many variations during the cardiac cycle. A low shear stress pressure inside the aneurysm was related to bigger size aneurysms and more tendency to rupture.

CONCLUSION

Hemodynamic study of cerebral aneurysms using CFD could become a useful tool in the management of patients with this disease.

O36.8**IMPACT OF MORPHOLOGY ON FLOW PATTERN: THREE DIMENSIONAL FLOW SIMULATION IN HUMAN INTRACRANIAL ANEURYSMS.**

I. Szikora¹, A. Ugron², G. Paal², F. Nasztanovics², Z. Kulcsar¹, M. Marosfoi¹, Z. Berentei¹, I. Bojtar², I. Nyary¹;

¹National Institute of Neurosurgery, Budapest/HU, ²University of Techniques and Economics, Budapest/HU

PURPOSE

To study the impact of aneurysm morphology on the local flow dynamics and resulting shear stress and dynamic pressure in intracranial aneurysms.

MATERIAL AND METHODS

Based on the 3D dataset of rotational angiography, a finite element model consisting of 900 000 tetraeder elements was created using a proprietary software in 10 cases of side wall and terminal aneurysms. Flow within the parent vessel and within the aneurysm was than simulated using ANSYS CFX 5.7 software. Both the arteries and the aneurysms were considered as rigid tubes. Pulsatile flow was simulated with frequencies as measured during angiography and flow velocities as measured by Doppler ultrasound on the cervical arteries and by transcranial Doppler within the intracranial branches immediately prior to or following angiography. The circulating fluid was considered as having a specific density of 1050 kg/m³ and a viscosity of 0,003 kg/ms with a maximum Reynolds number of 840.

RESULTS

The finite element models closely resembled the original 3D model in each case. In 6 side wall aneurysms, the classic “distal inflow - proximal outflow” pattern could not be confirmed. Inflow and outflow tracks were found in different planes and in some cases inflow was proximal to the outflow. In 2 cases of terminal aneurysms with symmetrical side branches the dome of the aneurysm acted as a flow divider, with preferential outflow into one of the side branches. In another two cases of non-symmetrical side branches, one edge of the neck acted as a flow divider. One side branch was exclusively and directly fed by the parent artery, and the other through the aneurysm. The flow pattern within these later lesions was very similar to that of a side wall aneurysm. Shear stress was generally low within aneurysms but dynamic pressure was high at the flow divider points of terminal aneurysms.

CONCLUSION

Routine application of flow simulation significantly improve the understanding of local flow dynamics. Assymmetrical terminal aneurysms and side wall aneurysms have typical vortex flow with the flow divider located at the edge of the neck. Symmetrical terminal aneurysms have a flow divider within the dome of the aneurysms. Shear stress does not seem to play a significant role in aneurysm pathophysiology, but increased dynamic pressure at flow divider points may influence aneurysm growth/regrowth and rupture.

O36.9**FLOW PATTERN CHANGES IN ANEURYSMS WITH VARIOUS AMOUNT OF COILS - USING COMPUTATIONAL FLUID DYNAMICS WITHOUT MESH GENERATION -**

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¹RIKEN (The Institute of Physical and Chemical Research), Wako-shi/JP, ²Fujita Health University, Toyoake/JP, ³Kyorin University, Mitaka/JP, ⁴RIKEN (The Institute of Physical and Chemical Research), wako-shi/JP, ⁵Himon'ya Hospital, Meguro-Ku/JP, ⁶Kyorin University, mitaka/JP

PURPOSE

To simulate flow pattern change in the aneurysm sac while coil embolization. To obtain stable clinical result for brain aneurysm treatment by coil embolization, volume embolization ratio (VER) is an useful factor. Decrease of blood flow velocity may possibly

play an important role to produce thrombi in the aneurysms. We are trying to estimate flow velocity in aneurysm with coils by computational fluid dynamics (CFD) technique. However, direct visualisation is not easy as the coils are made to be radiopaque. Experimental visualisation also difficult as the coils are not transparent. CFD may be the only possible method to estimate flow pattern change while coil embolization.

MATERIAL AND METHODS

[Materials and Methods] We prepared models of aneurysm which had coil(s) in their lumen. Models had various VER. Three dimensional structures were obtained by three dimensional rotation angiography unit. Using these slice data, three dimensional models were built by finite volume styles, not finite element model. Reynolds number was set at around 800. Pulsatile flow pattern from Doppler flow wire was given. Flow patterns were calculated toward serial VER. CFD analysis was performed by a part of our supercomputer system (RSCC; RIKEN Super Combined Cluster). Computational analysis was calculated by our home blew software, which do not need mesh generation.

RESULTS

[Results] Decreasing of flow velocities according to VER was visualised by our simulation. Flow pattern change in side wall type of aneurysm and terminal type were well visualized. Assessment of flow pattern change depending on VER should be considered to have satisfactory result for aneurysms. Because over embolization can cause bleeding from the aneurysm and loose deposition would cause compaction. To have ideal clinical results, VER for each aneurysm could play important roles. Analysis for complex structure such as coils in aneurysm sac had been very difficult as mesh generation would be difficult or impossible. Our technique to analyse without mesh generation would be essential for analysis for structure from clinical imaging. At the same time, analysis without mesh generation can increase uses of computational analysis for clinical images.

CONCLUSION

In our simulation, increased VER could decrease flow in the sac of the aneurysm. Our CFD system could work well without detailed mesh generation.

O36.10

COMPUTATIONAL HAEMODYNAMIC MODELING OF COILING AN ANATOMICALLY ACCURATE CEREBRAL ANEURYSM

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PURPOSE

Computational fluid dynamics (CFD) allow the study of haemodynamic factors in aneurysms. It is now possible to simulate an anatomically accurate ruptured intracranial aneurysm and incremental embolization to demonstrate haemodynamic changes at each stage after coil placement.

MATERIAL AND METHODS

A recently ruptured anterior communicating aneurysm was accurately represented, using datasets from the rotational 3D DSA. The

detailed images were converted into a 3D geometric model and the discretized data loaded into a CFD- solver. Coiling embolization simulation was achieved by impediment of porous medium into the aneurysm volume, defining its parameters according to the characteristics of the coils used in clinical practice.

RESULTS

Haemodynamic parameters as pressure distribution, wall shear stress, blood velocity and flow patterns were studied and compared at various stages of the coiling process. Furthermore, changes in haemodynamic parameters after simulation of various end scenarios could be replicated e.g. leaving a remnant at the neck, allowing the evaluation and representation of the forces that may cause coil compaction, recanalization and further aneurysm growth.

CONCLUSION

CFD studies can simulate stages in coil embolization and become valuable tool in interventional planning and decision-making process to improve the safety and effectiveness of endovascular procedures.

O36.11

1-D MODEL OF THE ARTERIAL TREE INCLUDING DETAILED DESCRIPTION OF CEREBRAL CIRCULATION

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PURPOSE

The aim of this study is to develop a distributed model of the entire arterial tree, including a detailed description of the cerebral arteries. Although of general utility, the model will be particularly useful to provide realistic hemodynamic data on pressure and flow waveforms for the cerebral arteries. Also, the model allows the evaluation of the proximal and distal flow conditions in models of cerebral aneurysms. These data could be used as boundary conditions for CFD simulations of blood flow insight aneurysms in a variety of physiological or pathological situations.

MATERIAL AND METHODS

The model is based on the classical Noordergraaf-Westerhof tree but we used real patient geometries to take into account all the main cerebral arteries afferent and efferent from the circle of Willis. It also takes into account the structural and elastic properties of the arterial wall. Because the Noordergraaf-Westerhof model yielded excessive amount of wave reflections, the present model was optimised for the forward propagation of arterial pressure and flow waves, thus limiting reflections arising from arterial bifurcations. Further, we optimized the impedances at the terminal vessels to also give minimal reflections.

RESULTS

To validate the model, a comparison between predicted and measured type A and type C aortic pressure and flow waveforms has been done. Indeed, it was found that the modified tree generates at the aortic root pressure waves that are in very good agreement with measured ones. In addition, predicted pressure and flow waves in the cerebral circulation resemble in both form and amplitude measured waveforms in the human.

CONCLUSION

We conclude that this new and improved 1-D model of the arterial tree can provide realistic simulation of wave propagation in all systemic arteries and can be of particular use in simulating waves in the complex cerebral circulation network.

O36.12**QUANTITATIVE REPRESENTATION OF CEREBRAL ANEURYSM BY TREE GRAPH**

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PURPOSE

Our aim is to establish a new automatic method for constructing tree graphs of brain arteries which represents the 3D structure of brain blood vessels. Assessment of 3D structure of brain arteries is important as strokes, especially subarachnoid hemorrhages, occur there at the brain arteries. Recent development of imaging technologies can presentate three dimensional structure of brain arteries from 3D CT angiography, 3D MR angiography or rotation angiography. 3D images can give medical doctors more information than traditional 2D projection images. However, it is not very easy to observe 3D images. And diagnostic skills are depending on doctors' experience and subjectivity. To have objective diagnostic tool, we propose our quantitative representation of the shape of blood vessels.

MATERIAL AND METHODS

3D data were obtained from medical modalities such as 3D CTA, 3D MRA and 3D rotation angiography. From the slice data complex, our software performs sequential procedures of 3D image formation, preprocessing, segmentation, thinning and tree construction. Connections of blood vessels are represented as topological structure of the tree graph, and quantitative properties of blood vessels such as length and radius are also recorded in nodes of the tree graph. The tree structure constructed by this method which can quantitatively observe connections and properties of blood vessels. Several data sets of brain aneurysms before and after treatments were used to assess our technique. From the clinical data sets, we tried to detect the cerebral aneurysms, and whether it correctly detected the cerebral aneurysms was verified, by comparing pairs of data before and after treatments.

RESULTS

With a quite simple rule based on diameters, large aneurysms were correctly detected by the proposed method. This result suggests feasibility of the method. Most information except radius on our tree expressions are not used in the experiment at present, and there is a possibility of improved accuracy for smaller aneurysms. The calculation of one tree structure took about half an hour with a high-end PC (CPU 2 GHz, Memory 512 MB).

CONCLUSION

This paper reports a new automatic method for constructing a tree graph which represents the 3D structure of blood vessels. In this study, we tried to detect cerebral aneurysms by our method. As a result, our application could detect large aneurysms to see the radius of the blood vessels, however, small ones are difficult.

16:30 – 18:00

SS 28

Main session: *Spine Diagnostic*

Chairs: V. Dousset, W. Wichmann

Room: ESNR / Diagnostic

O28.1**ASSESSMENT OF SPINAL CORD BLOOD SUPPLY IN PATIENTS UNDERGOING THORACOABDOMINAL AORTIC ANEURYSM REPAIR USING BOTH MR-ANGIOGRAPHY AND INTRAOPERATIVE NEUROMONITORING**

R.J. Nijenhuis, M.J. Jacobs, W.H. Mess, T. Leiner, J.T. Wilmink, J.M.A. van Engelshoven, W.H. Backes;

Maastricht University Hospital, Maastricht/NL

PURPOSE

Preoperative knowledge of the blood supply to the spinal cord is of interest, as spinal cord ischemia, possibly leading to paraplegia, may occur during thoracoabdominal aortic aneurysm (TAAA) repair. The Adamkiewicz artery (AKA) is considered to be the most important blood supplier of the thoracolumbar spinal cord and has therefore been the focus in preoperative diagnostic imaging. However, the importance of preserving the segmental artery supplying the AKA (SA-AKA) is debated since the spinal

cord blood supply in TAAA patients may strongly depend on collateral circulation. Here it was investigated whether (i) the AKA and the SA-AKA can be imaged using MRA and (ii) aortic cross-clamping of the SA-AKA is of influence on intraoperative spinal cord function monitored by motor evoked potentials (MEPs).

MATERIAL AND METHODS

Preoperatively 60 TAAA patients underwent two-phase MRA to localize the AKA and its supplying SA, and to differentiate the AKA from the great anterior radiculomedullary vein (GARV). Spinal cord function was monitored during open aortic repair using MEPs. When MEPs declined, indicating spinal cord dysfunction, patent SAs were reattached till MEPs normalized. To test whether aortic cross-clamping of the SA-AKA was associated with a decline in MEPs the Fischer's exactness test was performed.

RESULTS

The AKA could be differentiated from the GARV in all 60 patients on the basis of differences in temporal enhancement or vascular morphology. The SA-AKA was for all patients localized between the vertebral levels Th8 and L2 (72% left sided). When the SA-AKA was outside the cross-clamped aortic area the MEPs remained stable. In 44

cases where the SA-AKA was cross-clamped, a MEP decline occurred in 14 cases (32%). Reattachment of the preoperatively localized SA-AKA re-established MEPs, and thus spinal cord function in 12 out of 14 cases. A significant association ($p < 0.01$) was found between aortic cross-clamping the SA-AKA and MEP decline.

CONCLUSION

The AKA can be preoperatively localized in TAAA patients using MRA. Localization of the SA-AKA outside the cross-clamped aortic area is attended with stable MEPs. Interestingly it was found that in the majority of patients, in which the SA-AKA was cross-clamped, MEPs were not affected, indicating sufficient collateral blood supply to maintain spinal cord integrity. Nevertheless preoperative knowledge of the AKA location is of importance since in 32% of patients spinal cord function was dependent on the SA-AKA.

O28.2

DYNAMIC RESOLVEMENT OF SPINAL CORD ARTERIES AND VEINS USING CONTRAST-ENHANCED MR-ANGIOGRAPHY

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PURPOSE

Differentiation of the spinal cord arteries from veins. To image the sub-millimetre sized arteries of the spinal cord high spatial resolution has to be employed. Since the great anterior radiculomedullary artery (i.e. Adamkiewicz artery (AKA)) has a spatial (hairpin) course very similar to the great anterior radiculomedullary vein (GARV) the only reliable manner to distinguish these two vessels is to use an imaging technique that dynamically resolves the time differences in contrast agent arrival. In this study we demonstrate the capabilities of Dynamic Contrast-Enhanced Magnetic Resonance Angiography (DCE-MRA) to achieve arterial-venous differentiation in healthy controls and thoraco-abdominal aortic aneurysm (TAAA) patients, the latter for whom the preoperative AKA localization is of clinical importance.

MATERIAL AND METHODS

6 TAAA patients and 5 healthy controls underwent DCE-MRA, utilizing keyhole k-space reconstruction. The image protocol (total duration 120 s) was performed on a 1.5 Tesla MRI system using a phased array spine coil and consisted of the following steps: (i) acquisition of the entire k-space (i.e. reference scan, duration 15 s), (ii) injection of 45 mL of Gadolinium based contrast agent at 3 mL/s, and (iii) simultaneous start of 15 sequential acquisitions of the centre of k-space only (i.e. keyhole acquisition, 7 s each). The obtained keyhole k-space acquisitions were reconstructed by completing the outer k-space with the data from the reference acquisition. The reference scan had a voxel size of $1.2 \times 1.2 \times 1.4$ mm and a field of view of 490 mm in the craniocaudal direction. Reconstructed 3D image data sets were analyzed using multi-planar reformations of the 15 different dynamic phases to display the AKA and the great radiculomedullary vein (GRV), which could be localized anteriorly or posteriorly.

RESULTS

The AKA could be dynamically resolved from the GRV in all subjects. The time delay between the enhancement of the AKA and GRV was found to be equal for both groups. In all subjects anterior midline enhancement of the spinal cord was found to occur at least one phase earlier (7 s) compared to posterior midline enhancement. Furthermore the dominant draining vein (i.e. the GRV) was observed anteriorly in 4 and posteriorly in 5 out of 9 subjects.

CONCLUSION

Keyhole based DCE-MRA is able to dynamically resolve the contrast enhancement of the spinal cord arteries and veins and allows to differentiate the AKA from the GARV in healthy controls and TAAA patients.

O28.3

SPINAL CORD INFARCTIONS. COMPARISON OF MR PULSE SEQUENCES

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PURPOSE

Spinal cord infarctions are rare and are often undetectable in their early stage. The purpose of our study is to compare T1 weighted images, T2-weighted images with different echo times, proton density images, T2 GRE images and fluid attenuated inversion recovery (FLAIR) images in the assessment of early diagnosis of acute spinal cord ischemia.

MATERIAL AND METHODS

Fourteen patients 10 male and four female ranged in age from 35 to 66 years, with clinical features of spinal cord ischemia were examined on 1.5 T MR unit. Sagittal T1 weighted images, sagittal T2 weighted images with TR/TE2500/90 and 3000/150 respectively, axial T1WI, axial GRE T2WI and sagittal FLAIR images were taken. Two examinations were performed, one within 24 to 48 hours after the onset of symptoms and one 10 days after the onset of symptoms. On the follow-up examinations sagittal T1WI after Gd-DTPA enhancement were also taken.

RESULTS

Results: The images were compared by three radiologists. Nine lesions were in the cervical spinal cord and five in the upper thoracic spinal cord. High signal intensity abnormalities were seen in all 16 patients and were better visualized on proton density images. The same lesions were faintly seen on T2WI images with short echo times and were almost not seen on T2WI images with longer echo times. Three patients showed high signal lesions on T1WI images due to hemorrhage. FLAIR images were of poor quality and had a lot of artifacts and lesions were not visible except in one patient with extensive lesions and cord edema. Lesions in patients without cord edema were almost invisible on axial images. On the second examination lesions were clearly seen on sagittal and axial T2WI FSE images and also on T2 GRE axial images.

CONCLUSION

Sagittal proton density images are the best choice for the evaluation of acute spinal cord ischemia and also T2WI with shorter echo times are more helpful than images with longer echo

ML72**NEW MRI TECHNIQUES IN THE SPINE**

J. Van Goethem, Edegem/BE

ML73**CTA AND MRA OF THE SPINE**

R.J. Nijenhuis, Maastricht /NL

16:30 – 18:00

SS 32**Main session: Carotid Artery Stenting**

Chairs: G. Schroth, W. Taki

Room: ICS / Interventional

O32.1

EVALUATION OF CEREBRAL BLOOD FLOW AND CEREBROVASCULAR RESERVE CAPACITY, IN CASES WITH SEVERE CAROTID STENOSIS FOR SURGICAL INTERVENTION, IN COMPARISON TO NEUROLOGICAL FINDINGS AND ANGIOGRAPHICAL COLLATERALIZATION

Y. Ono¹, K. Abe¹, N. Saito¹, Y. Okada¹, T. Higa¹, A. Kawashima¹, K. Yamaguchi¹, T. Hori¹;

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PURPOSE

For evaluation of surgical intervention to internal carotid (IC) stenosis, effects of collateralization and revascularization by surgical intervention are discussed in comparison to neurological symptoms, ischemic foci, and pre-/post-operative cerebral blood flow (CBF) and cerebrovascular reserve capacity (CRC) using Xenon inhalation CT (XeCT).

MATERIAL AND METHODS

157 cases (male 119, female 38, age 7–81) with carotid stenosis/occlusion were reviewed for surgical intervention (carotid endarterectomy, bypass anastomosis between superficial temporal and middle cerebral arteries, between subclavian and internal carotid arteries). MRI, MRA and XeCT for measurement of CBF and CRC (with acetazolamide administration) were performed in all cases and additional selective angiography in 64. In grouping of no symptoms (20) TIA (68), minor stroke (37) and moyamoya disease (32), neurological symptoms were compared to following subjects as follows, 1) ischemic foci on MR (cortex, white matter: WM, basal ganglia: BG) and collateralization in 64, 2) collateralization and CBF/CRC in 64, 3) pre- and postoperative CBF/CRC in 146 with follow-up symptoms.

RESULTS

No exact relation between complete collateralization and CBF/CRC in 39 cases. 21 cases with incomplete collateralization

times. Axial T2 GRE images are also helpful on follow-up examinations. FLAIR images do not yield in the evaluation of spinal cord ischemia.

presented decreased CBF/CRC, coincided with cortical infarction, but no exact relation between collateralization and lacunes in WM or BG. In 45 cases without neurological deficits or with TIA, involving moyamoya, 39 showed complete collateralization and unremarkable changes in CBF, but CRC was varied. In 19 cases with neurological deficits, collateralization and CBF/CRC were various. 11 cases were out of surgical indication because of enough circulation or too severe misery perfusion. Surgical intervention was effective in 114/147 (77%), and critical limit of CRC for effective revascularization was less than 19%. Postoperative hemorrhage due to hyperperfusion was not rare in moyamoya but not severe. Problematic complication was in other 3 cases (2%).

CONCLUSION

In cases with chronic IC stenosis, CBF/CRC measurement using XeCT is suggestive of consequence for ischemia and revascularization, to be useful for indication on surgical intervention.

O32.2

EXTRACRANIAL UNPROTECTED SELF-EXPANDABLE PRIMARY CAROTID STENTING: A FIVE YEARS RETROSPECTIVE ANALYSIS

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PURPOSE

Over the last decades stent placement of carotid stenosis has been introduced as an alternative to endarterectomy in symptomatic and asymptomatic stenosis. However the major risk of stent placement appears to be the possibility of periprocedural embolic strokes due to release debris during the several phases of endovascular manipulation. For this reason new techniques such as stenting with cerebral protection devices being already introduced. The aim of this work is to present the clinical results in our study population, 5 years experience, that have been received an alternative method consisting of unprotected self-expandable stenting, without pre and post dilatation.

MATERIAL AND METHODS

44 consecutive patients (33 men and 11 women, median age 72) have been studied from January 2000 to April 2006: 41 patients have been received monolateral carotid artery stenting and 3 patients bilateral stenting. All patients have had sonography detection of the carotid stenosis due to atherosclerotic disease or to postTEA restenosis. They have received angio-TC to well characterize the atherothrombotic plaques and to operate a selection between stenting and TEA. Carotid artery stenting procedures were established without pre and post ballooning and without protection device. Radiographic control was effectuated to detect the natural expansion of the stent. All patients have been followed clinically.

RESULTS

In all procedures stent was completed technically successfully and we had not major or minor stroke procedure-related. No patients had presented ipsilateral stroke or TIA during follow-up. One patient has had a restenosis after 4 months and he has been treated with TEA, one patient has died for IMA, 2 patients have had controlateral acute transient ischemic attack, 3 patients have been treated by controlateral thromboarteriectomy. We have given RX scale self-expandable stent dilatation (0=no dilatation, 1=little dilatation, 2=good dilatation and 3= complete vessel restoration) with these results: 7 cases have not had dilatation, 18 have had little dilatation, 8 have had good dilatation and 3 patients have had spontaneous complete vessel restoration.

CONCLUSION

Our experience suggest that in well selected group based on angio-TC, unprotected carotid stenting can be effectuated as a less invasive percutaneous methods durable and effective to prevent stroke. Our data suggest also the possibility to observe a significant natural remodelling of the vessel lumen with self expandable carotid stenting without pre or post dilatation.

ML74**CAROTID STENTING**

P. Lylyk, Buenos Aires/AR

ML75**LONG TERM RESULTS**

J. Theron, Caen/FR

O32.3**DUAL CEREBRAL PROTECTION TECHNIQUE DURING CAROTID STENTING**

Z.V. Milosevic¹, I. Kocijancic²;

¹University Medical Centre Ljubljana, Ljubljana/SI, ²University Medical Centre Ljubljana, Ljubljana/SI

PURPOSE

We reported technical possibility and result of carotid artery stenting (CAS) with dual cerebral protection technique. In patients with high grade stenosis of internal carotid artery (ICA) caused by huge soft echolucent atherosclerotic plaques we used both proximal occlusion and distal filter cerebral protection continuous during all steps of CAS procedure.

MATERIAL AND METHODS

We performed CAS with dual cerebral protection technique in three selected patients. In the first step proximal occlusion cerebral protection system (MO.MA) was placed and blockage of flow in ICA was established. In the second step distal cerebral protection filter (Spider) was delivered in distal ICA. After implantation and postdilatation of the carotid stent we aspirated the blood under circumstances of flow blockage (proximal cerebral protection) and filter still opened in place (distal cerebral protection). In all three patients we found huge amount of debris in aspirated blood. After aspiration we reestablished the anterograde flow with still opened filter. The next step was retrieving of the filter. We surprisingly found considerable amount of debris also in filter basket in two out of three patients.

RESULTS

Patients tolerated all steps of the procedure well and we achieved good procedural result without any complications.

CONCLUSION

In patients with high grade stenosis of ICA caused by huge soft echolucent atherosclerotic plaques, which have high embolic potential, dual cerebral protection technique during CAS procedure could be more effective than single cerebral protection strategy.

Saturday, September 16, 2006

08:30 – 10:30

SS 37

Main session: *Head and Neck*

Chairs: A. Valavanis, F. Veillon

Room: ESNR / Diagnostic

ML76

PERINEURAL SPREAD OF DISEASE IN THE HEAD AND NECK

M. Becker, Geneva/CH**ML77**

PREOPERATIVE MANAGEMENT OF COCHLEAR IMPLANTS

J. Casselman, Brugge/BE**ML78**

INFLAMMATORY DISEASES OF THE SKULL BASE

B. Schuknecht, Zürich/CH**ML79**

IMAGING OF THE NORMAL AND ABNORMAL LABYRINTH

F. Veillon, Strassbourg Cedex/FR

08:30 – 10:00

SS 39**Main session:** *Spine Intervention*

Chairs: G. Doms, G. Abdo

Room: ICS / Interventional**ML80**

ADVANCES IN VERTEBROPLASTY

M. Muto, Naples/IT**ML81**

CONTROVERSIES IN VERTEBROPLASTY

H. Fransen, Gent/BE**O39.3**

VERTEBRAL AUGMENTATION WITH CORTOSS (CORTOPLASTY) FOR THE TREATMENT OF VERTEBRAL COMPRESSION FRACTURES

H.P. Hatten, Jr.

Indian River Radiology, Vero Beach/US

PURPOSE

The purpose of this study is to compare the properties of Cortoss(1) to PMMA as well as to assess the safety and efficacy of Cortoss compared to a commercially available PMMA. This study is being conducted under an FDA Investigational Device Exemption (IDE).

MATERIAL AND METHODS

Among the advantages of Cortoss compared to PMMA are 1) Cortoss is bioactive whereas PMMA results in fibrous tissue encapsulation, 2) PMMA has lower mechanical properties whereas Cortoss properties are similar to bone, 3) Cortoss releases no leachates whereas PMMA releases up to 6% toxic monomer, 4) PMMA must be used all at once whereas Cortoss has infinite working time and allows using the ‘start-stop’ technique which aids in minimizing leakage. The total number of patients is 243 with a 2:1 randomization (162 Cortoss and 81 PMMA) at 19 sites. Patients are evaluated at pre-op, post-op, 72 hours, 1 week, 1, 3, 6,

12, and 24 months. Patient outcome will be assessed by VAS, ODI, SF-12 and maintenance of height and alignment at the level (s) treated. Among the inclusion criteria are a minimum VAS of 50, a minimum ODI of 30%, an osteoporotic compression fracture at one or two levels, presence of edema on MRI or bone scan and informed consent. Among the exclusion criteria are greater than 70% collapse, canal compromise, neurologic deficit at the level (s) to be treated and tumors. Post-operative CT and radiographs are used to assess and quantify leakage.

RESULTS

To date, 28 patients have been enrolled at this site; 13 treatment and 15 control. There were a total of 8 males and 20 females. A total of 41 levels have been treated; 22 in the treatment group and 19 in the control group. The average age is 77 in the treatment group and 78 in the control group. Improvement in VAS and ODI was similar for both groups out to 6 months. The average volume of material injected in the treatment group was 2.0 cc and 3.3 cc in the control group. Leakages were observed on post-op CT scans and found to be similar in both groups. All extravasations were asymptomatic with no cardio-pulmonary complications.

CONCLUSION

These preliminary results suggest that Cortoss provides similar pain relief compared to PMMA with 30% less material. This is due to the distinct interdigitated fill pattern obtained with Cortoss. These results are consistent with those obtained in the prospective

vertebroplasty study using Cortoss conducted in Europe(2). 1.Erbe E, et.al. Eur. Spine J.2001. 2.Palussiere J, et.al. Eur. Spine J. 2005.

O39.4

MINIMALLY INVASIVE OXYGEN-OZONE THERAPY FOR CERVICAL DISK HERNIATION: PRELIMINARY RESULTS.

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PURPOSE

Intradiscal oxygen-ozone therapy (O2–O3 therapy) is one of the mini-invasive treatments for disc herniation, that exploits the biochemical properties of a gas mixture of oxygen and ozone. This technique, since now, is mainly utilized in lumbar disc herniation. The aims of our study is to assess the therapeutic outcome of O2–O3 therapy in the treatment of cervical disc herniation.

MATERIAL AND METHODS

34 patients have been treated by a single session of O2–O3 therapy. All presented symptoms compatible with soft cervical disc herniation and MR evidence of contained cervical disc herniation. Patients received an intradiscal (0.8 – 1 ml) injection of an oxygen-ozone mixture at an ozone concentration of 27 µg/ml. Injection was administered by extraspinal antero-lateral approach using a 22 G×75 mm BD spinal needle, under fluoro guidance from the right side. Therapeutic outcome was assessed six months after treatment using a phone-call approach.

RESULTS

Treatment was a success (good outcome) in 24 patients (70.6%) of cases whereas it was deemed a failure (poor outcome - recourse to surgery) in the remaining 10 patients (29.4%). In no case surgery was adopted.

CONCLUSION

Our results, even if preliminary, are very promising. In our opinion the O2–O3 therapy is a useful treatment for cervical soft disc herniation which has failed to respond to conservative management, before recourse to surgery, or when surgery is not possible.

10:00 – 11:00

COFFEE BREAK SYMPOSIUM: COFFEE BREAK SYMPOSIUM

10:30 – 11:00

COFFEE BREAK: COFFEE BREAK

11:00 – 12:30

SS 38

Free paper session: Head and Neck

Chairs: B. Schuknecht, J. Casselman

Room: ESNR / Diagnostic

ML82

BONE TUMORS OF THE SKULL BASE

H. Imhof, Wien/AT

O38.2

SUPERSELECTIVE INTRA-ARTERIAL RAPID INFUSION CHEMOTHERAPY FOR PATIENTS WITH ADVANCED MAXILLARY CANCER: CHRONOLOGICAL EVALUATION FOR ORGAN PRESERVATION AND ONCOLOGICAL SURVIVAL

N. Tanaka¹, T. Abe¹, G. Suzuki¹, Y. Uchiyama¹, K. Kojima¹, I. Nakajima¹, N. Hayabuchi²;

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PURPOSE

Superselective rapid infusion intra-arterial chemotherapy combined with concurrent radiation therapy has potential for organ preservation in the treatment for patients with maxillary sinus carcinoma. However, whether IA rapid infusion chemotherapy improves organ preservation rate and oncologic survival, remains unproved. We designed retrospective trial to compare the organ preservation rate and survival rates after introducing IA rapid infusion chemother-

apy into the treatment of advanced maxillary sinus carcinoma with those of our previous cases treated from 1991 to 1999, when extended surgery was a main therapy.

MATERIAL AND METHODS

Chemotherapy was administered intra-arterially in the angiography suite via superselective transfemoral catheterization of the internal maxillary artery. Occasionally part of the dose was delivered through the facial artery, the transverse facial artery, middle meningeal artery or ascending pharyngeal artery. The patients received up to 4 weekly infusions of cisplatin (100 mg/body) with simultaneous intravenous administration of sodium thiosulfate, a neutralizing agent. The patients received external beam radiation therapy simultaneously with IA cisplatin infusion chemotherapy. Only patients who resulted in tumor volume reduction less than 80% were to refer to the salvage surgery. 27 patients were enrolled onto the protocol between 2000 and 2005 at our hospital. Seventeen patients were staged as T4 and 10 patients were staged as T3. The median follow-up period was 27 months ranging from 4 to 70 months. The results, which include survival rates, disease free survival rates, local control rates and organ preservation rates, were compared with those of 32 patients from 1991 to 1999.

RESULTS

The overall 3-year survival rate was 70%, disease free 3-year survival rate was 81%, and 3-year local control rate was 83% in this protocol. Preservation rate of the eyeball in patients with T4 disease at previous series (1991 – 1999) was 42% (11 of 26 patients); whereas that in recent series (2000 – 2005) was 94% (16 of 17 patients).

CONCLUSION

Our results show that superselective rapid infusion IA chemotherapy can conduce to good local control with extremely higher organ preservation rates for patients with advanced maxillary cancer.

O38.3

SUPER-SELECTIVE CATHETERIZATION OF THE INFERIOR PETROUS SINUS IN CUSHING'S SYNDROME: INDICATION, TECHNIQUE AND RESULTS IN 18 PATIENTS

C. Ozdoba¹, L. Andereggen², L. Remonda¹, C. Brekenfeld³, R. Seiler², L. Mariani², G. Schroth³;

¹Institute for Diagnostic and Interventional Neuroradiology, Bern/CH, ²Inselspital / Universität Bern, Bern/CH, ³Inselspital, Bern/CH

PURPOSE

We describe the use of super-selective catheters in bilateral petrous sinus sampling performed in patients with clinical Cushing's syndrome and ambiguous MR findings and discuss the role of this method in comparison to MR imaging.

MATERIAL AND METHODS

We performed bilateral inferior petrous sinus sampling (BIPSS) in 18 patients (14 women, 4 men; mean age 47 [7–65] years). All patients fulfilled clinical and biochemical criteria of Cushing's syndrome. MRI studies were either normal (two) or not sufficiently unambiguous to plan an operation based on imaging findings. BIPSS was used to obtain information about lateralization of pituitary pathology prior to subtotal hypophysectomy. BIPSS was performed by bilateral insertion of a 6F guiding catheter in the femoral vein. The tips of these catheters were placed in the internal jugular veins. The inferior petrous sinus was catheterized bilaterally with a Hi-Flow Tracker catheter. A third catheter was placed in a peripheral vein. ACTH blood concentration was measured in two baseline samples that were taken from each of the three catheters, further samples were taken 3, 5, and 10 minutes after i.v. stimulation with ovine corticotropine releasing hormone.

RESULTS

In 16 patients, a central/peripheral ACTH gradient was found, and lateralization could be made. Another patient didn't show signs of an adenoma in histology after surgery; adrenalectomy was performed. In the last patient, who had a suspicious finding in MRI, a microadenoma was found at surgery. Retrospective analysis of the MRI studies after BIPSS showed erroneous reports in 50%. In 13 of 15 cases where transsphenoidal partial hypophysectomy was performed based on BIPSS findings, adenoma was histologically confirmed. Technically, BIPSS was successful in all cases. In summary, MRI yielded a correctly positive result in 44%, BIPSS in 94%.

CONCLUSION

Bilateral inferior petrous sinus sampling is an intricate procedure. It is, however, far superior to MR imaging in the accurate detection of pituitary pathology in cases of central Cushing's syndrome.

O38.4

TREATMENT OF VENOUS MALFORMATIONS: FIRST EXPERIENCE WITH A NEW SCLEROSING AGENT - A MULTI-CENTER STUDY

M. Schumacher

Sektion Neuroradiologie, Freiburg/DE

PURPOSE

To show the advantage of high-viscous ethanol in comparison to simple pure alcohol.

MATERIAL AND METHODS

Though absolute ethanol has been proved to be highly effective in treatment of venous malformations it remains difficult to manipulate as a result of its diffusible feature due to the low viscosity with diffusion into surrounding uninvolved vessels and tissue with a significant risk of major adverse effect. To avoid these risks but exploiting the efficacy of ethanol the pure 96% substance (3,8 g) was mixed with ethylcellulose (a long-chain polymer) at a concentration of 5,88% (0,2 g) generating a higher viscosity of 330 cps. In vitro testing showed a prompt participation in NaCl or full blood but no gluing effect. Animal testing demonstrated that the material is not suitable for arterial injection because of it passes the capillary bed. The substance was tested in a prospective non randomized multicentric ongoing study.

RESULTS

To date, 77 patients (age 4 – 46 y) have been treated in 158 sessions with different volumes ranging from 0.2 to 10 ml. The maximum number of single sessions was 4 in 4 patients with a mean of 1.8 sessions per patient. The systemic concentration of ethanol was measured in all patients not exceeding a maximum of 0.50 g/L fulfilling in no case the criteria for legal intoxication. All patients suffered from venous malformation mainly facial and in the neck as well as body and extremity malformations. More than 80% showed a significant reduction of the venous pouches. Adverse events happened locally in 12 patients (15%) permanently being only in one patient ongoing (facial paresis). Systemic transient reactions were bradycardia in one patient and nausea in 4 patients.

CONCLUSION

The preliminary results show in summary an easy handling of the substance, save application, low rate of systemic effects and high efficiency due to good target injection.

O38.5

OTOSCLEROSIS: HIGH-RESOLUTION CT FINDINGS IN A REVIEW STUDY

U. Lachmund¹, A. Pangalu², A. Huber², A. Valavanis¹;

¹University Hospital of Zurich, Zurich/CH, ²University of Zurich, Zurich/CH

PURPOSE

To examine the CT findings and classifications in patients with otosclerosis.

MATERIAL AND METHODS

We reviewed all consecutive patients with the presumption diagnosis of otosclerosis between 01.01.1995 and 28.02.2006 in the data base of the department of otorhinolaryngology.

RESULTS

291 patients were listed in the data base. In our institute 36 of 291 patients underwent CT examinations. In 11 of 291 patients we found the characteristic findings of otosclerosis. One male patient had findings of osteogenesis imperfecta. The ratio male to female was 10/1. In 9 of 10 the otosclerosis was bilateral, in 1 of 10 unilateral. In 6 of 10 patients the otosclerosis was retrofenestral, in 4 of 10 patients the otosclerosis was fenestral. 2 out of 10 patients had an unilateral implant.

CONCLUSION

Otosclerosis is a rare disease. In our study the typical findings of otosclerosis with otospongiotic and otosclerotic changes could be demonstrated reliably with high-resolution CT. Bilateral otosclerosis is present in about 85% of patients, which is similar to our study. There is normally a female predominance of 2/1, which could not be confirmed in our small group. In our study the retrofenestral type was found in 6 out of 10 patients and the fenestral type was present in 4 out of 10 subjects, contrary to the literature where the fenestral type makes up to 80%.

O38.6**ULTRA LOW DOSE 3D CT FOR CEPHALOMETRY: IS IT ACCURATE ENOUGH?**

N. Chaudhary¹, S.E.J. Connor²;

¹King's College Hospital, LONDON/GB, ²King's College hospital, London/GB

PURPOSE

It was proposed to design a series of ultra low dose 3D CT protocols with an effective dose similar to that of the conventional radiographic series used to assess craniofacial asymmetry. It was then aimed to assess the precision and accuracy for cephalometric points recorded ex vivo using these CT protocols.

MATERIAL AND METHODS

Four ultra low dose CT protocols were constructed on the basis of published data, dose calculations and measurements. A high dose CT protocol was used as a gold standard. The protocols were used to scan a skull in air (AIR) and immersed in water (WATER). For each protocol and for both AIR and WATER, two observers evaluated seventeen cephalometric points on two separate occasions.

RESULTS

Accuracy and precision of cephalometric points measured using ultra low dose CT scanning of AIR was similar for all protocols. The accuracy and precision of cephalometric points measured using ultra low dose CT scanning of WATER was lower, particularly for the 5 mAs protocols. However the 10 mAs pitch 1.375 WATER protocol enabled one observer to achieve 2D accuracy of <1.5 mm for 16/17 points, 2D intraobserver precision of <2 mm for 13/17 points and an interobserver precision equal to the gold standard.

CONCLUSION

It is possible to achieve acceptable cephalometric point accuracy and interobserver precision with an ultra low dose CT protocol (10 mAs, pitch 1.375) even when scanning a skull immersed in water. Although the estimated effective dose of 0.035 mSv is slightly greater than that of the conventional radiographic series (0.011 – 0.032 mSv), there is the benefit of a 3D data set.

11:00 – 12:30

SS 40

Main session: *Spine Intervention*

Chairs: A. Kelekis, V. Dousset

Room: ICS / Interventional

ML83**ADVANCES IN PERCUTANEOUS BACKPAIN MANAGEMENT**

A. Gangi, University Hospital of Strasbourg, Strasbourg/FR

ML84**CONTROVERSIES IN PERCUTANEOUS BACKPAIN MANAGEMENT**

C. Andreula, Anthea Hospital, Bari and Citta di Lecce Hospital, Lecce, Puglia/IT

O40.4**ENDOVASCULAR METHODS IN THE TREATMENT OF CERVICAL SPINAL CORD ARTERIOVENOUS MALFORMATIONS**

T.P. Tissen, A.V. BOCHAROV, S.B. IAKOVLEV;

Neurosurgery Burdenko Institute, Moscow/RU

PURPOSE

The purpose is to determine the optimal endovascular methods in the treatment of cervical spinal cord arteriovenous malformations (AVM) and to investigate neurological symptoms in patients before and after this treatment.

MATERIAL AND METHODS

Over a period of 20 years (from 1983 till 2005) 51 patients with cervical spine cord AVM (male-23, female-17, children-11) were treated in Burdenko Neurosurgical Institute. All subjects underwent

MRI and selective spinal angiography (SSA). The endovascular methods used for occlusion of afferent AVM's vessels were balloon-occlusion method by F. Serbinenko, occlusion with PVA-fragments, occlusion with Hystoacryl glue.

RESULTS

During our work the indications to application of this or that endovascular method were developed. Basen on MR study and especially SSA datas we could take the decision of the optimal endovascular method. In 35 cases (68%) occlusion of afferent vessels was performed with PVA-fragments (size ranged from 50 till 300 mkm), in 10 cases (20%)- with Hystoacryl glue. The ballon-occlusion method by F.Serbinenko we used in 4 cases (8%), with combain methods -2 cases. In general 95 feeding arteries of cervical spinal cord AVM's were occlusived. Occlusion with PVA-fragments we prefer to perform for AVM with fine looped vessels and fast blood flow. At first we performed occlusion of the afferent vessel of AVM, followed by thromboses of vessel's conglomeration. The artery occlusions with glue Hystoacryl were performed, if the recanalisation of afferent vessel occurred during some days after occlusion, and for large AVM, localized on dorsal side of spinal cord mainly and was supplied only by small curved root artery with slow blood flow. Neurological symptoms in patients before and after endovascular treatment of AVM were studied. Essential regress of neurological symptoms was marked in 43 cases (85%). Patients of this group had complex of neurological symptoms: paraparesis, paraplegia, tetraparesis, tetraplegia and hypostesia. We have seen practically total recovery of all functions after treatment in 30 patients. No changes - 6 patients (12%) and only 2 (3%) of 51 patients had negative dynamic.

CONCLUSION

All developed methods of the endovascular AVM's treatment are optimal and permit to eliminate pathophysiological charges of the spinal cord with high efficiency. Different endovascular ways of occlusion is the method of choice for the treatment of cervical spinal cord AVM.

O40.4

ENDOVASCULAR METHODS IN THE TREATMENT OF CERVICAL SPINAL CORD ARTERIOVENOUS MALFORMATIONS

T.P. Tissen, A.V. BOCHAROV, S.B. IAKOVLEV;
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O40.5

DISSECTION OF VERTEBRAL ARTERY RESULTING IN SPINAL EPIDURAL HEMATOMA: A CASE REPORT

Z. Kulcsar, I. Szikora, M. Marosfoi, Z. Berentei, W. Lee, I. Nyary;
National Institute of Neurosurgery, Budapest/HU

PURPOSE

Spontaneous spinal epidural hematoma (SEH) is uncommon and neither the cause nor the pathogenesis of this entity is currently clear. We present a case of thoracic epidural hematoma caused by dissection of the vertebral artery at the cervical segment.

MATERIAL AND METHODS

A 32 year old woman presented with neck and chest pain followed by headache, back pain and nuchal rigidity. The patient did not suffer any traumatic injury before symptom onset. Lumbar puncture resulted xanthochromic CSF, but brain CT-scan demonstrated no subarachnoid bleeding. No vascular malformation was proved by brain MR-angiography. Spinal thoracic and cervical MR-scan showed an epidural hematoma at the level of vertebrae Th 2–5.

RESULTS

Thereafter spinal and brain angiography was performed demonstrating two aneurysm-like dilatations on the right vertebral artery at the level of C6 and C2, with vasospasm on the intermediate segment of the artery. The diagnosis of vertebral artery dissection was suggested to be the cause of the epidural bleeding and hematoma formation. No invasive procedure was performed due to improving symptoms. During the follow up both the vertebral artery abnormalities and the epidural hematoma disappeared.

CONCLUSION

The dissection of the vertebral artery as a cause of SEH is not mentioned in the relevant literature. In a high percentage of cases the etiology is not cleared. Vertebral dissection should be taken into consideration when planning the diagnostic and therapeutic steps of such cases.