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Invitational Lecture-1 MR Perfusion Imaging

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1. Definition of Perfusion Imaging

The term MR perfusion imaging encompasses several recently developed noninvasive techniques that measure various hemodynamic parameters such as cerebral blood volume, cerebral blood flow and mean transit time. Potential applications include the evaluation of tissue at risk after acute stroke, noninvasive histologic assessment of tumors, evaluation of neurodegenerative states, as well as assessment the effects of drugs used to treat these conditions [1].

2. MR Hemodynamic Imaging Techniques

Measurement of tissue perfusion requires the ability to serially measure concentration of a tracer agent in a target organ of interest. Hemodynamic imaging can be performed using

exogenous tracers (e.g., iodinated radiographic contrast material, paramagnetic contrast material and radionuclides) or endogenous tracer agents (e.g., magnetically labeled blood) [2]. This presentation will focus on use of exogenous contrast agents.

All techniques using exogenous tracer agents require a general model of the method by which that tracer passes through or distributes in the target organ in order to obtain serial tissue tracer concentration measurements.

3. Fundamentals of Imaging Techniques

During the passage of a bolus of paramagnetic tracer through an organ capillary network, transient changes are produced in the local magnetic field of the surrounding tissue. These changes in the local magnetic field are reflected in signal changes on MR imaging. Accurate measurement of rapidly varying signal changes due to the first pass of the bolus necessitates adequate temporal resolution such as is provided by ultrafast imaging techniques (e.g., echo-planar and spiral MR imaging). Signal-time course data can then be converted to relative tracer tissue concentration-time course data, which allows determination of various tissue hemodynamic parameters, such as tissue blood volume, blood flow, transit time and bolus arrival time [2].

4. Hemodynamic Parameters

MR hemodynamic parameters are dependent upon both (1) the specific features of the bolus injection (e.g., amount of contrast material injected, injection rate and paramagnetic properties of the contrast agent) and (2) variables within the subject being imaged (e.g., total body vascular volume and cardiac output). As a result, hemodynamic parameters cannot be directly compared between different subjects.

Relative cerebral blood volume

Cerebral blood volume refers to the volume of blood in a given region of brain tissue (typically measured in ml per 100 grams tissue). Relative cerebral blood volume parameters are obtained from tracer concentration-time data by integrating the area under the tracer concentration-time curve, which can be performed on the curve data points themselves. Alternatively, an analytical fit of the data points can be performed, which has the advantage of eliminating overestimation from the effects of tracer recirculation but the disadvantage of requiring high signal stability and faster imaging over time.

Relative cerebral blood flow

Cerebral blood flow refers to the volume of blood per unit time passing through a given region of tissue and is commonly measured in ml/minute per 100g of brain tissue. Determination of relative cerebral blood flow requires more extensive processing of the imaging data than that needed for relative cerebral blood volume. Deconvolution of an arterial input function from tissue concentration-time data to find the true brain clearance (mean transit time) through the cerebral capillary bed is necessary.

Other Hemodynamic Parameters

Various other hemodynamic parameters can be measured using MR hemodynamic imaging. Two parameters, mean transit time and bolus arrival time, are commonly used in assessment of cerebral ischemia. Mean transit time refers to the average time for blood to pass through a given region of brain tissue, commonly measured in seconds. Bolus arrival time refers to the time for an intravenous bolus of contrast material to arrive at a given region of the brain, also commonly measured in seconds.

5. Hemodynamic Imaging Techniques

Hemodynamic imaging can be performed either dynamically (rapid imaging over time during a bolus injection), or in the steady-state (imaging after a constant infusion has reached equilibrium concentration in the blood). The following discussion explains each technique and compares the relative advantages of each one.

I. Dynamic Imaging Techniques

Dynamic sequences require ultrafast imaging techniques to monitor the rapid first pass transit of a bolus of contrast agent through the brain, which is on the order of 18 seconds. Either T1-weighted or T2-weighted techniques can be used. The T2-weighted sequences are more commonly used in clinical practice.

T2- and T2-weighted pulse sequences*

T2- and T2*-weighted techniques rely upon susceptibility effects of MR contrast material. The term "susceptibility effect"

refers to shortening of T2 and T2* relaxation times leading to decreased signal on T2- or T2*-weighted images. T2/T2*-weighted techniques require imaging times on the order of 1.5 to 2 seconds. A single or dual slice dynamic study can be performed on a conventional MR scanner without specialized gradient hardware. However, specialized gradient hardware for echo planar imaging or spiral imaging allows greater anatomic coverage. The anatomic coverage available varies with the choice of echo-planar imaging (8 to 11 slices) or spiral imaging (18 to 20 slices).

T2-techniques utilize spin-echo imaging and T2*-weighted techniques utilize gradient echo imaging. The spin-echo technique has the advantage of minimizing artifact at brain/bone and brain/air interfaces and is more sensitive to signal changes from paramagnetic contrast material passing through small vessels such as capillaries, rather than large vessels such as cortical veins. However, this technique has the disadvantage of requiring a higher contrast material dose, often 1.5 to 2.0 times a standard dose, to produce signal changes equivalent to those of the gradient echo technique.

T1-weighted Techniques

T1-weighted hemodynamic imaging techniques measure relaxivity (rather than susceptibility) effects of an intravenously injected dose of paramagnetic contrast material. The relaxivity effect is due to the shortening of T1 relaxation time (leading to higher signal on T1 weighted images) produced by paramagnetic contrast material. Relaxivity effects of gadopentetate dimeglumine are much stronger than susceptibility effects. Therefore, T1-weighted pulse sequences require a smaller dose (approximately 10%) of contrast material than T2- or T2*-weighted techniques, allowing for multiple repeated studies.

II. Steady State Imaging

A T1-weighted steady state technique is an alternative to dynamic imaging techniques. The steady state technique can be used to estimate absolute cerebral blood volume with high spatial resolution through the entire brain. Such a method assumes the tracer is non-diffusible, i.e., does not extravasate from the intravascular space. A pre-infusion image is obtained, followed by a post-infusion "steady state" image many minutes (e.g., 20 minutes) later after the contrast material has reached a point of relative concentration equilibrium. A map of absolute cerebral blood volume in units of volume percent can be generated after subtracting the base line image from the steady state image and normalizing the pixel values to those of a pixel containing only blood.

Summary

Various techniques are available for hemodynamic measurements of the cerebral circulation. The choice of technique must be guided, in part, by the capabilities of the available imaging systems and the clinical or research problem to be solved. The choice of hemodynamic parameter must also be directed by the clinical or research question.

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Invitational Lecture-2

Diffusion Tensor Imaging: Clinical and Research Applications

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Diffusion-weighted (DW) MR imaging is an imaging technique that allows measurement of microscopic random motion of water. This technique is a potential means of assessing brain diseases based on differing rates of water motion in different types of tissue. Most DW imaging pulse sequences in clinical use employ diffusion gradients in three directions (termed isotropic diffusion images). Isotropic DW imaging allows measurement of the rate of water diffusion but does not provide a means to accurately measure directionality of water motion. Diffusion tensor imaging (DTI) is a more recently developed form of DW imaging that employs diffusion gradients in at least six directions. This technique allows assessment of water directionality because it provides a rotationally invariant measurement and an approximation of the full diffusion tensor. Microscopic water motion in highly organized tissues (such as cerebral white matter) is anisotropic, i.e., the directionality of water motion varies according to tissue orientation. Therefore, diffusion tensor imaging provides information about the integrity of WM structures. In this lecture, I will explain the principles of DTI and highlight 2 applications.

Investigation of Childhood White Matter Maturation and White Matter Diseases

The maturation of brain white matter in large part is dependent on myelination and is critical for the development of the central nervous system. The development of diffusion-weighted MR imaging offers the promise of a more sensitive technique for assessment of myelination patterns compared to routine spin-echo MR imaging. In particular, DTI appears to provide the ability to more completely and accurately evaluate the white matter maturation process. Using DTI, the MR signal is sensitized to microscopic movement of water molecules. Water motion in myelination WM matter is anisotropic (i.e., has a tendency to diffuse along one direction rather than in all directions), a quality that can be quantitatively and reproducibly measured using anisotropy maps. On such maps, anisotropy is shown to be higher in more compact WM structures (e.g., the corpus callosum) compared to less compact WM structures and gray matter. Anisotropy measurements of WM structures have been shown to increase with age to correspond to the degree of maturation and myelination of the CNS [1]. Therefore, DTI provides a unique marker for WM maturation. It appears reasonable to postulate that DTI could serve as a sensitive means for following changes in WM in diseases in which WM is primarily affected.

At our institution, we have used DTI to follow disease progress and effects of treatment in various pediatric white matter disorders such as Krabbe disease. In one study, we compared DTI findings in a small group of Krabbe patients who were treated with hematopoietic stem cell transplantation and untreated children with Krabbe disease [2]. That study compared anisotropy values in various WM regions in three groups: (1) untreated Krabbe children, (2) untreated Krabbe children, and (3) age-matched children with normal MR examinations who had no neurological disease. The study found that anisotropy values in treated Krabbe children were intermediate between values in untreated Krabbe children and values in normal children for all WM regions studied.

In another study, we assessed children with Krabbe disease using diffusion tensor imaging prior to stem cell transplantation

and after transplantation [3]. Clinical observation had shown us that children who underwent transplantation in the first month of life fared better than children in whom transplantation was delayed by even a few months. We set out to see whether anisotropy values on DTI reflected severity of neurological symptoms. Relatively good correlation between severity of anisotropy decreases and presence or absence of clinical symptoms was seen. Asymptomatic infants had near normal anisotropy values prior to transplantation but symptomatic infants all had decreased anisotropy values prior to transplantation in most WM regions studied. The differences in mean anisotropy values between the two groups were statistically significant for all WM regions studied except the genu of the corpus callosum, in which a normal mean anisotropy value was seen in both groups. These differences likely reflect dysmyelination and failure of myelination in Krabbe disease children during the first few months of life.

Multiple Sclerosis

Conventional MR imaging plays an important role in the diagnosis and management of multiple sclerosis (MS). However, it is well established that conventional MR imaging findings do not correlate well with the clinical course, specific pathology, or extent of histologic abnormality. Recent evidence from histologic and MR spectroscopy studies have shown that the pathologic processes in MS involve not only plaques, which are visible on conventional MR imaging, but also involve white matter regions which appear normal. In particular, some of these studies have suggested the possible extension of pathology beyond boundaries of plaques into peri-plaque white matter, which may be distinct from abnormalities in white matter remote from the plaque. The presence of pathologic changes in peri-plaque white is an important issue because quantification of disease burden by imaging is an important surrogate marker for assessing treatment response in trials of therapeutic agents. Therefore, development of new imaging techniques that could improve both sensitivity and specificity of MR imaging would be worthwhile. DTI is a very promising MR imaging advance that provides a potential means to assess important physiologic parameters in MS such as demyelination and axonal loss, which are not directly assessed by standard MR imaging techniques.

At our institution, we have focused on use of DTI to assess normal-appearing white matter in MS patients. Our findings have shown that normal-appearing WM adjacent to MS plaques is markedly abnormal compared to regions of white matter far away from plaques. However, anisotropy values in normal-appearing white matter far away from plaques are also substantially abnormal compared to individuals without MS who have normal MR examinations [4]. The decreases in anisotropy values in normal-appearing white matter are even more profound than abnormalities found by another technique used to study MS, i.e., magnetization transfer imaging [5]. In summary, the size of the abnormality within, and surrounding, MS plaques on DTI is much larger than the abnormality seen on conventional MR images. Therefore, DTI offers an important means to evaluate these patients as well as to assess therapeutic responses.

Future Developments

High resolution DTI allows depiction of white matter fiber tracts, which presently has only limited clinical applications. Our ability to analyze anisotropy values within fiber tracts is presently limited. However, as MR manufacturers develop such analysis techniques, fiber tract mapping will likely prove to be an important clinical and research tool.

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Invitational Lecture-3 New Tools for Endovascular Interventional Neuroradiology and Their Choice

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The technical possibilities of endovascular interventional neuroradiology have been quite stable for 15-20 years: the Magic catheter solved the problem of endocranial navigation and AVM embolisation, the Guglielmi detachable coils offered us the possibility to treat brain aneurysms in safety and with some easiness. Nowadays a large number of new tools is appearing on the market. Interventional neuroradiologists are under the pressure of different companies asking to test new tools and new procedures. On the other side, in Europe, we stopped using Hystoacryl because of the lack of CE mark, with then the need to find new tools.

In this situation between the need to progress, to change tools and to understand the real value of what is offered by the companies having a rationale for our choices, we see another big problem which is the need to train more and more interventional neuroradiologists. In the past, the number of procedures was quite limited and one or two physicians per department were sufficient to cover all the needs. In these days the number of procedures is increasing everyday and we need to prepare larger teams, if possible with the capacity to treat patients 24 hours a day.

Embolisation of arteriovenous malformation et similia, with liquid embolising material

We approached this problem with two different products: Onyx and Glubran 2.

Glubran 2 is a kind of acrylic glue (GEM Srl, Viareggio, Italy), with different characteristics vs hystoacryl, moreover it is recognized by CE Mark for endovascular neuroradiological uses. Because of the lack of experience we started with some animal studies: six sheep were operated on opening a fistula between the right common carotid artery and the jugular vein. This fistula modifies blood flow in the skull base rete mirabilis, which then functions as an AVM. The rete mirabilis was occluded by injection of Hystoacryl diluted with Lipiodol or by injection of Glubran 2 diluted with Lipiodol. The sheep were sacrificed immediately after the procedures and the rete mirabilis isolated for histologic examination. Embolization was obtained with

both kinds of glue. Glubran 2 diffused in a very similar way to Hystoacryl with an apparently more complete diffusion. Reflux in the ascending pharyngeal artery showed that Glubran 2 tended not to produce bubbles but diffused more homogeneously. Moreover Glubran polymerises at a lower temperature than Hystoacryl (about 40°C vs 70°C), being less traumatic for this reason.

Later we organised another trial with two Landrace Large White swine. In both cases, the superior left renal artery was embolised by injection of 2 ml of Glubran 2®, diluted with Lipiodol 1:1 thereby excluding the superior left kidney poles from blood flow.

During the follow-up period, neither pig presented any clinical symptom correlated to the embolization procedure. Case 1 was sacrificed after 30 days and case 2 after 60 days. Macroscopic and microscopic analysis was performed in both animals.

Long-term follow-up of the two cases after endovascular injection of Glubran 2® showed that the embolization procedure was well-tolerated by the swine in terms of clinical symptoms and histological findings. Arterial occlusion was stable and a reasonable quantity of scar tissue appeared between 30 and 60 days, surrounding the ischaemic tissue. This follow-up experimental study offered further evidence that Glubran 2® is a safe embolising material for human use as far as its chemical activity is concerned.

Then we started using Glubran in humans, first of all in the embolisation of spin and extracranial tumours and metastasis, then in intracranial tumours and eventually in AVM and fistulas. All the procedures were technically feasible and achieved partial or complete embolization of the vascularized lesion without periprocedural complications. Glubran 2 proved easy to use with excellent intravascular penetration achieving permanent embolization. The degree of presurgical embolization in terms of surgical field haemostasis was correlated with the degree of vascular occlusion achieved.

Onyx

It is non adhesive new embolising material (Onyx System MicroTherapeutics, Inc., MTI), was marketed some years ago as a "foam" with the theoretical feature of progressive occlusion rather than immediate gluing. We treated with Onyx in the last two years a number of patients, analysing the application technique and our impressions during treatment in relation to our past experience with cyanoacrylate glue. In two patients we have obtained complete angiographic occlusion of the AVM. In other cases we have reached an 80% occlusion and the patients completed the treatment with surgical approach, without any problem. In our experience Onyx gives good results and it seems easier to use in comparison with cyanoacrylate. It is injected slowly with an easy and continuous control. The easiest approach that seems possible, using Onyx to embolise brain AVM will probably allow a wider diffusion of these procedures and it is ideal to start this discipline and to train young neuroradiologists. The availability of a supposed "easier" embolising agent may have positive effects if used with the enormous amount of accuracy and prudence that AVMs impose. On the contrary it could have very negative effects if used in a less accurate approach without the deep evaluation of the AVM angioarchitecture and flow conditions.

Embolisation of brain aneurysms

The use of GDC for this purpose, with the large world experience and the safety and confidence we reached makes very difficult the adoption of new coils. The importance and the diffusion of this field, on the contrary, pushed many important companies to producing new coils. In my opinion it is not possible to choose a

new coil only because it is cheaper, it must be better or at least have a special characteristic. A rationale is absolutely needed in any of these changes.

So we have to evaluate the active coils, the easy to detach coils, the cheap coils, etc.

Till now we found important characteristics in a few different products:

The Cook coils, cheap, with special long non spiral design, good for venous embolisation of dural fistulas. The Micrus coils, because the Micrus 3D is very stable and allows to treat large neck aneurysms avoiding the need of complex procedures, such as the remodelling or the trispan protection. The active Matrix (Boston) coils interesting for the treatment of young people with the need of a stable and long lasting result.

Moreover, the endocranial stenting became recently possible with a completely new possibility to protecting the aneurismal neck. Eventually the possibility to occlude aneurysms with a special kind of very viscous Onyx has been successfully proposed.

These different products have to be chosen in different situations and allow us to significantly enlarge, with safety, the number of patients possible to be treated.

In conclusion, the actual situation is of a large number, and continuously increasing, of different tools that have to be evaluated carefully to chose the best ones to solve different kind of pathological situations, without being influenced by companies and with the precise target to offer the right solution to our patients, if the treatment is possible, bearing in mind that endovascular interventional neuroradiology has to be compared with neurosurgery and its procedures have to be safer and offer at least the same level of results to be proposed.

0-01

Magnetic resonance imaging of the fourth ventricle

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Structures of the region of fourth ventricle and its surroundings involve complex anatomy, which have seldom been identified on magnetic resonance imaging. We attempted detailed identification of this region in normal and pathologic cases. 3D-images showed a general figure of the fourth ventricle. Multiplanar images revealed location of various structures including the fastigium, lateral recesses, posterolateral recesses, cerebello-mesencephalic and cerebellomedullary fissures, obex, posterior inferior cerebellar artery, choroids plexus of the fourth ventricle, and adjacent cerebellar structures including nodulus, uvula, pyramis, and tonsils. Supraolivary fossette and the lower end of interpeduncular sulcus between the superior and middle cerebellar peduncles (interpeduncular fossette) could be regarded as landmarks differentiating the inferior and middle cerebellar peduncles and the superior and middle cerebellar peduncles, respectively. Also in pathologic cases like Joubert syndrome, identification of anatomy helps in localization and interpretation of lesions or defects.

0-02

MR imaging of Virchow-Robin spaces in the midbrain

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For this report, we retrospectively assessed a frequency, age and sex differences of Virchow-Robin spaces (VRSs) in the midbrain on routine brain MRIs. Materials were images of 494 females and 506 males. A 1.5T imager was used for axial images with 5 mm slice thickness and a 1.5 mm gap. VRSs were identified as linear or oval structures that were hypointense on T1WI and FLAIR, and hyperintense on T2WI. We also assessed visualization of the vessels within the VRSs on 3D-TOF MRA. VRSs were detected in 73, in 49 of the males, and 24 of the females. The frequency was statistically significantly higher for males than for females. No age differences were found. However, these were frequently observed more than 40 years. Some indistinct vessels were detected in the peripheral portion. The VRSs on routine brain MRI need to be taken into consideration for differential analysis of some ischemic lesions.

0-03

Evaluation of the filling defects within the dural sinus on high-resolution contrast-enhanced CT images by multislice CT

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Arachnoid granulations in dural venous sinuses are often observed as the filling defects on contrast enhanced CT. We evaluated the incidence, size and location of the filling defects within the dural sinus on contrast enhanced CT studies using multislice CT imager. We evaluated 50 contrast enhanced CT studies performed for diagnosis of a brain aneurysm. The multislice CT examinations were performed on an Aquilion scanner (Toshiba) with the following parameters: 120 kV, 300 mA, detector collimation of 4 * 0.5 mm and 0.5 sec rotation speed. All studies were examined after the administration of 100ml of 370mgI/ml contrast medium. On contrast enhanced CT scans, the filling defects were most observed by high frequency within the transverse sinuses. The size and shape of filling defects were various. The filling defects within the dural sinus on contrast enhanced CT were frequently observed, and should not be mistaken for sinus thrombosis or intrasinus tumor.

0-04

Evaluation of the intracranial venous system of intracranial hypotension with MR venography

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To observe the configurations of the intracranial venous system of the spontaneous intracranial hypotension (SIH), MR venograms were obtained using Gd-DTPA enhanced 3-D field-echo method with fat suppression with a 1.5 T unit. The patients consist of four females, with age ranging from 31 to 39. We analysed the intracranial venous system on MR venograms at the onset, compared with the imagings at the recovery state. The characteristic intracranial MR findings of SIH reflect an increase in venous volume throughout the brain. Diffuse enhancement of the pachymeninx and dural thickening, dilatation of the dural venous sinus and superficial venous system and venous lacunae were observed in all cases. In two cases, persistent occipital sinus and falcial sinus also dilated. In conclusion, MR venography demonstrated a greater increase in intracranial blood volume in the form of dural venous hyperemia and dilatation of the whole intracranial venous system.

0-05 Inflow-related enhancement of jugular vein on time-of-flight MR angiography

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Purpose: Flow-related enhancement (FRE) of jugular vein can be, at times, seen on time-of-flight MR angiograms, of which findings can lead to unnecessary and at times invasive procedures. We investigated MR angiograms to determine the frequency and extent of FRE. **Methods:** 700 MR angiography were prospectively examined. When FRE was observed, extent of FRE were investigated. **Results:** FRE were observed in 11 left jugular veins (1.6%) in patients without vascular anomaly. FRE of one right jugular vein was observed, which was caused by right temporal AVF. Anterior condylar, posterior condylar, and inferior petrosal veins also showed FRE in nine, six, and three cases, respectively. **Conclusion:** FRE of left jugular vein as well as condylar and inferior petrosal veins is relatively rare, but can be observed in patients without vascular anomaly.

0-06 Subdural collection vs tight/loose posterior fossa

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Purpose: To investigate the posterior fossa cerebrospinal fluid space in chronic subdural hematomas, SDH, in order to differentiate them from SDH secondary to intracranial hypotension, IH. **Materials & Methods:** 12 cases with chronic SDH, who were operated on, were examined with MRI. Sizes of SDH, height of the top of the pons with relation to tuberculum sellae-internal occipital protuberance (TI) line, clivus-pons distance, extent of cerebellopontine cistern were investigated and compared with a case of SDH secondary to IH. **Results & Conclusion:** In three cases with downward herniation, the top of the pons was within 4 mm above TI line. In the other 9, it was far above TI line. Clivus-pons distances were more than 3 mm and CP angle cistern were easily identified in all. In a case with SDH secondary to IH, top of pons was well below TI line, clivus pons distance and CP angle cistern were obliterated.

0-07 Clinical study to evaluate the therapeutic usefulness of diffusion-weighted magnetic resonance imaging (DWI) and Proton MRS in the examination of gliomas

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Both DWI and MRS are clinically a useful technique for examining gliomas. This study included 15 patients with gliomas during recent 2 years. In MRS, high grade glioma showed high level Cho, but the territory that showed low level Cho existed in GBM, and this area was accompanied with low level NAA and high level Lac simultaneously. This territory reflected necrosis. In glioblastomas, area of tumors that showed significant enhancement on T1-weighted MR images after administration of contrast material were hyperintense on DWI. We can discover recurrent area early before it is enhanced by DWI every time. Even if perifocal edema enlarge and DWI is high signal, it is highly possible for radiation injury area that shows low Cho, high NAA and high Lac in MRS. We recognized a case of LA that

appeared pattern of way of high grade glioma in MRS, and MIB-1 of this case was 6.3% slightly high.

0-08 Brain mass lesions: differentiation by peritumoral ADC values on diffusion weighted imaging

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The aim of this study was to determine whether peritumoral ADC values on diffusion weighted imaging are useful for differentiation of brain mass lesions. A total of 25 patients were included in this study. They had glioblastomas in 7 patients, metastatic brain tumors in 7, malignant lymphomas in 6, and brain abscesses in 5. Peritumoral ADC values were measured on a ADC map. The mean ADC values were compared among four tumor groups. Mean ADC values of metastatic tumors and abscesses was significantly greater than those of glioblastomas. There were no significant differences between other tumor groups. Peritumoral ADC values on diffusion weighted imaging were useful for differentiation of some brain mass lesions.

0-09 Application of diffusion-weighted imaging to sellar and parasellar tumors

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Purpose: To investigate feasibility of line scan diffusion-weighted imaging (LSDWI) in the assessment of quantitative diffusion of sellar and parasellar tumors. **Method:** The MR study was performed in the patients with pituitary adenomas (n=23), meningiomas (n=5), malignant lymphomas (n=3), undifferentiated carcinoma (n=1), and pilocytic astrocytoma (n=1). The apparent diffusion coefficient (ADC) was measured and compared in each tumor type. **Results:** The ADCs in each tumor type were as follows; $0.81 \pm 0.12 \times 10^{-3} \text{mm}^2/\text{sec}$ in pituitary adenomas, 0.94 ± 0.02 in meningiomas, 0.51 ± 0.08 in lymphomas, 1.36 ± 0.06 in pilocytic astrocytoma, and 1.00 ± 0.04 in undifferentiated carcinoma. Lymphomas showed significantly lower ADC than other tumor types ($p < 0.01$). **Conclusion:** LSDWI is feasible in the assessment of diffusion of sellar and parasellar tumors. This method may be useful in the differential diagnosis of sellar and parasellar tumors.

0-10 Metabolic Diagnosis of Brain Tumors using Turbo Spectroscopic Imaging

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The purpose of this study is to evaluate the efficacy of Turbo Spectroscopic Imaging (TSI) in the diagnosis of brain tumors. TSI may provide 2 dimensional metabolite mapping information and is useful in the diagnosis of tumor infiltration. Thirty-two brain tumor patients have been investigated with Philips Gyroscan ACS-NT with TR/TE = 2000/136msec. The results revealed that Cho/Cr ratio in normal brain was 0.2-0.3 and in brain tumor it was over 1. However, in patients receiving radia-

tion therapy, the recurrence did not show the same tendency requiring other diagnostic modality. As conclusions, TSI may provide useful information for brain tumor diagnosis. However, the quantification method of each metabolite in TSI should be developed for more detailed analysis in the future.

0-11

Evaluation of perfusion MR imaging on brain tumors

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The different methods for perfusion study using MRI were proposed and used in the clinical setting. We examined brain perfusion for patients with brain tumors by the different two methods of MRI and compared the contrast of tumor between the two different methods. FAIR sequence was applied as a spin labeling method, and various parametric maps were calculated by the bolus tracking method after Gd-injection. The malignant lymphoma showed high signal by FAIR sequence in spite of low perfusion on rCBF and rCBV. The lesion/normal ratios were not highly correlated ($r=0.4-0.6$) between FAIR and parametric maps. Our result showed that the discrepancy of result was shown by the different methods of perfusion MRI study, but the perfusion MRI study may have potential of new contrast for differential diagnosis of brain tumors.

0-12

Evaluation of tumor vascularity by using arterial spin labeling technique

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Purpose: To estimate the usefulness of arterial spin labeling (ASL) technique for evaluating tumor vascularity. Subjects and Methods: 39 patients with intracranial mass lesions were studied with perfusion imaging using an ASL technique. A single slice 2D or multi slice 3D ASTAR technique was used with a TI of 1200, 1400 or 1600 ms. Relative tumor blood flow (rTBF) was calculated as follow; $rTBF = [\text{signal intensity (SI) of a tumor}] / [\text{SI of brain tissue in the territory of contra-lateral middle cerebral artery}]$. Results: All meningiomas but one showed high rTBF. Including atypical meningiomas, no significant difference of rTBF was observed between different histological types. High grade gliomas displayed rTBF greater than 1. Metastatic tumors and gliomas could not be discriminated by rTBF. rTBF of malignant lymphomas, low grade gliomas and abscesses was lower than 1. Conclusion: ASL techniques could be used to estimate tumor vascularity.

0-13

Early Imaging Diagnosis for Germinoma of the Basal Ganglia

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Purpose: To clarify early key imaging findings of basal ganglia germinoma. Methods: We retrospectively reviewed serial CT/MR and clinical course in 6 boys with pathologically proven basal ganglia germinoma. Results: Initial exams were CT in two, MRI in three and both in one patient. All MR studies revealed basal ganglial T2-prolongation and T1-shortening and all CT showed faint or dense high density in the basal ganglia.

In initial studies, all patients had atrophy of the ipsilateral cerebral peduncle but no apparent hemiatrophy and only 1/4 with contrast CT/MRI showed abnormal enhancement. Serial imagings revealed gradual increased signal abnormality with partial cystic formation, contrast enhancement and progressive hemiatrophy. It took 3 to 32 months between the initial imaging and final diagnosis. Conclusion: Early imaging findings for basal ganglia germinoma are T2 prolongation and T1 shortening on MRI and high density on CT with Waller degeneration. Hemiatrophy and tumor enhancement appear later.

0-14

Optic tract hyperintensity on T2 weighted image of Pituitary macroadenoma : Correlation with clinical symptom of visual loss

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Purpose: To evaluate the optic tract on T2 weighted image of the patients with pituitary macroadenoma. And to ascertain whether the visual loss correlate with the optic tract signal abnormality or not. Patients and Methods: 23 patients of pituitary macroadenoma were examined by MRI. Results: Coronal T2 weighted image demonstrated hyperintensity lesions in 7 patients along the unilateral optic nerves. Unilateral visual loss was recognized in 5 of 7 patients. One of them represented that hyperintensity in optic nerve disappeared after the tumor resection. Bialteral signal optic nerve signal abnormality was shown in 6 patients. Visual loss was associated in 3 of 6 patients. Conclusion: Hyperintensity of optic tract caused by pituitary macroadenoma tends to correlate with clinical symptom of visual loss. It is a useful information.

0-15

Double-phase multi-detector row CT of pituitary macroadenoma (initial experience): comparison with MR imaging

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The purpose was to evaluate the usefulness of double-phase MDCT over MRI in pituitary macroadenoma. Eighteen consecutive patients with surgically proven macroadenoma (9 women and 9 men; mean, 54 years) prospectively and preoperatively underwent double-phase MDCT (including CTA) and MRI (including dynamic study). In the assessment of cavernous sinus invasion, MDCT was superior to MRI in 3, identical in 15, and inferior in 0. In detecting the normal pituitary, MDCT was superior to MRI in 0, identical in 14, and inferior in 4. In visualizing the optic nerve and/or optic tract, MDCT was identical to MRI in 3 and inferior in 15. Sellar floor erosion was detected in 6 by MDCT, but in 4 by MRI. MDCT revealed a coincidental aneurysm in one case. Double-phase MDCT is superior to MRI in the assessment of cavernous sinus invasion and sellar floor erosion as well as in detection of coincidental aneurysm.

0-16**3D VIBE imaging of meningioma**

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Purpose: We evaluated whether postcontrast 3D volumetric interpolated breath-hold examination (VIBE) can provide additional information in diagnosing meningioma. **Methods:** Twelve consecutive cases with histopathologically proven meningioma were included. Postcontrast T1WI and postcontrast 3D VIBE images were obtained. Appearances of adjacent dura mater and dural sinus, and degree of enhancement on these two sequences were compared. **Results:** In nine of 12 cases there were no significant differences of visualization of thickness of dura mater between two sequences. In the rest two cases, postcontrast 3D VIBE images were superior to postcontrast SE T1WI. In all 12 cases the relationship between meningioma and adjacent dural sinus was more clearly visualized on postcontrast 3D VIBE images. **Conclusion:** Postcontrast 3D VIBE imaging is superior in the evaluation of adjacent dural sinus. Postcontrast 3D VIBE imaging is equal or superior to postcontrast SE T1WI in the evaluation of adjacent dura mater.

0-17**MR findings of angiosarcoma of the scalp**

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The purpose of our study was to investigate the MR findings of angiosarcoma of the scalp retrospectively. This study included ten patients whose MR images or reading reports were available. All patients were examined with 1.5T MR units. MR images revealed tumors in the scalp or thickened galea aponeurotica and occipitofrontal muscles with prolonged T1 and T2 relaxation times. Contrast-enhanced T1-weighted images with fat saturation technique and T2-weighted images with fat saturation technique demonstrated lesions very clearly. MR images showed skull invasion in two patients. We were not able to see the hidden invading tumor by inspection if it had spread into the surrounding subcutaneous fat and subcutaneous muscles. Therefore, the tumor extent was larger on MR images than on the inspections. However, at least two slice orientations were required for better delineation of the tumors. MR imaging was useful in demonstrating the extent of angiosarcoma of the scalp.

0-18**Clinical and angiographical outcome of GDC embolization for cerebral aneurysms**

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From January 1998 to date, we treated 102 ruptured cerebral aneurysms (97 patients) by using Guglielmi detachable coil (GDC) endosaccular embolization. We reviewed these patients focusing on the clinical and angiographic outcome. Immediate angiographical results are complete occlusion in 58, neck remnant

in 22 and body filling in 22. Coil compaction is occurred in 17 aneurysms, necessitating re-embolization in 10. Complications occurred in 11 patients, including aneurysm perforation in 3 (1 symptomatic, 2 asymptomatic) thromboembolism in 6 (1 symptomatic, 5 asymptomatic), and groin pseudoaneurysm in 2. There were no cases of hemorrhage or re-hemorrhage during follow-up period. GDC endosaccular embolization is a safe treatment for cerebral aneurysms with lower incidence of peri-procedural morbidity and mortality. Its stability is not solved, therefore chronological follow-up angiography is mandatory.

0-19**Hydrogel coil embolization of cerebral aneurysm**

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The hybrid coil, consisting from hydrogel polymer & platinum, is applied to cerebral aneurysm embolization. The hydrogel coil has several features such as 3 times volume expansion after absorbing blood and facilitating property of endothelialization. It can be delivered safely within 4 minutes to aneurysmal lumen. Full expansion of hybrid coil is obtained 20 minutes after exposed blood. The efficacy of hydrogel coil was established in experimental animal model. We have treated three patients using hybrid coil. All patients were treated without any complications followed by complete occlusion of aneurysms. The hydrogel coil proved to be potent tool for embolizing cerebral aneurysm.

0-20**Strategy for Perimedullary Spinal AVM & AVF (Endovascular Treatment vs Surgical Treatment)**

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(Object): Evaluation of efficacy and safety for the perimedullary spinal AVM& AVF embolization with NBCA. (Material & Method): Two cases of Spinal perimedullary AVF, seven cases of perimedullary AVM were treated by endovascular intervention only with NBCA. (Result): In two cases of conus medullaris AVM, endovascular intervention failed, and the surgical treatment was performed. In six cases, partial occlusion of 35~80% via embolization were obtained. Radical cure were clinically seen in four cases, and improvement with only minor dykinesia remained was obtained in one case. No clinical improvement resulted in one case. No recurrence of symptoms has been observed during follow-up. (Conclusion): The use of particles has regularly been emphasized for spinal arteriovenous malformation, but in our experience, acrylic glue represents the optimal material for embolization of spinal perimedullary arteriovenous shunts as it offers the best stable results.

0-21**The problem of diagnosis and treatment for sinus thrombosis-problem of Interventional procedure**

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Progress of MRI can perform sinus thrombosis at an early stage in non-invasive compared with before. We presented 23 cases (F: M=13:10). 8-81y/o (mean 56) in sinus thrombosis. A basic disease were followed unknown: 9, hematological disease: 4. Location; SSS: 9, Transverse sinus: 2, cortical vein: 2. Neurological abnormality: 7, loss of consciousness: 4. MRI / MRV can be diagnosed more easily. With others is good prognosis. Of 23 cases, GR; 19 MD 2, D2. CH is 5 cases. Of 23 cases, the treatment of patient with ICH, are craniotomy: 2, thrombolysis: 2. conservative 1. A result is GR1, MD2, and D2. It is problem how treatment in these case. In 8 cases, 5 cases measured a venous pressure. 1-case death. [Conclusion] Although sinus thrombosis, the early diagnosis became possible. In the thrombolysis venous pressure measurement was usefulness. Furthermore, the new instrument is developed, and it may be able to be usefulness.

0-22

Restenosis after carotid stenting: Result of serial follow-up study by cerebral angiography

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Recent development of stenting for extracranial carotid artery stenosis is outstanding. Issue of restenosis is inevitable in stenting, but few information are available regarding carotid artery at present. We analyzed the follow-up angiography in 42 cases in which follow-up angiography has finished 6 months after the procedure (follow-up period: mean 9.5 months). We have encountered no restenosis more than 50% in diameter. Factors leading to intimal hyperplasia less than 50% stenosis included insufficient initial gain, edge stenosis in kinked lesion, and Easy Wallstent in long lesion. In some cases, spontaneous regression of intimal hyperplasia was observed in successive study after the first 6 months follow-up. Our result indicates that restenosis ratio after carotid stenting seems considerably low, probably less than 5%.

0-23

Comparison of vascular echogram, MRA, CT, angiogram and pathohistological findings in stenosis of internal carotid artery at neck

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Purpose: We evaluated characteristics of echogram, MRA, CT scan and angiogram. We estimated the comparison between those neuroradiological findings and pathohistological findings. Materials and Methods: We performed echogram, MRA, CT scan and angiogram in 25 cases. Endarterectomy was underwent in 7 cases. We evaluated those neuroradiological findings and pathohistological findings of atheroma plaques getting in surgery. Results: In cases having stenosis rate as 50~80%, MRA and echogram had tendency of overestimate of stenosis rate. CT scan and angiogram had same stenosis rate in almost cases. MRI, echogram and CT reconstruction could describe the stenosis rate, shapes and properties of the plaques certainly and those findings coincided with the pathohistological findings. Conclusion: We should use those neuroradiological evaluation, understandings each characteristics.

0-24

Predict the Therapeutic Time Window using the perfusion CT at super acute phase cerebral ischemia

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Purpose: In this study, we examined the perfusion CT (PCT) immediate after plain CT and then performed thrombolysis. We predicted Therapeutic Time Window (TTW) using the PCT. Method: 7 cases studied PCT before thrombolysis from July 2002 to August 2003. These cases were estimated Cerebral Blood flow (CBF), Cerebral Blood Volume (CBV), Mean Transit Time (MTT) using PCT. Result: 3 cases obtained total recanalization. 3 cases obtained subtotal recanalization. A case obtained no recanalization. 2 cases obtained Good Recovery. 3 cases obtained Moderately Disabled. 2 cases obtained Severely Disabled. Discussion: More than 50% CBF, 100% CBV and less than 300% MTT compared with normal side brain of patients have longer TTW. Less than 100% CBV has short TTW. Less than 20% CBF, 100% CBV and more than 450% MTT have very short TTW. Conclusion: PCT is able to predict TTW of super acute phase cerebral ischemia.

0-25

Post-infarct secondary neuronal degeneration: Diffusion-weighted imaging (DWI) findings

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Post-infarct secondary neuronal degeneration was known as the Wallerian degeneration, and the transsynaptic degeneration, etc. The purpose of this study was to evaluate the DWI signal changes in these degenerations. We retrospectively reviewed 6 patients with post-infarct secondary degeneration. All patients underwent MR study including DWI within 2 weeks after onset. 5 patients showed the Wallerian degeneration (4 patients: corticospinal tract, 1 patients: pons-cerebellar tract) and one patient showed the substantia nigra degeneration after striatal infarction. All secondary degeneration presented the abnormal high signal intensity on isotropic DWI and one lesion was missed on T2WI. The ADC values were decreased in 5 patients. In patients with ischemic stroke, it was important not to mistake DWI abnormality related to secondary neuronal degeneration as additional infarctions.

0-26

Comparison with cerebral blood flow and electrophysiological neural activity of ischemic brain using positron emission tomography and magnetoencephalography

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We performed PET (positron emission tomography) and MEG (magnetoencephalography) for cerebrovascular disorder and considered whether MEG was useful for evaluation of cerebral blood flow. We had the subject with cerebrovascular disorder

that did not have large infarct in brain. We performed O15 gas examination in PET and put region of interest (ROI) in somatosensory area, and calculated cerebral blood flow (CBF). In MEG, we calculated a dipole moment in N20m (ECD) in somatosensory evoked field (SEF) by median nerve stimulation. As for the results, CBF and ECD did not have the correlation. We calculated Laterality Index in laterality of CBF ECD. We showed the positive correlation between both two parameters. ECD cannot use the absolute value for an objective index of a brain function, but that laterality may reflect CBF laterality.

0-27

Analysis of perifocal edema volume by using MR imaging to predict outcome in patients with deep intracerebral hemorrhage

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We examined the relationship between perifocal edema volume in deep intracerebral hemorrhage patients and outcome. Twenty-one patients with deep intracerebral hemorrhage were studied three times (First MR scan within 72 hours of ICH onset., Second MR scan 7 days later, third MR scan 14days later from ICH onset) by 1.5-T MR imager. We measured hematoma and perifocal edema volumes on T2-weighted images. We statistically evaluated the correlation between modified Rankin scale (mRS) of 4-weeks later from the ICH onset and each volume. First, second and third perifocal edema volumes were better correlation with mRS than hematoma volume. Second perifocal volume (7 days later from the onset) was superior to first and third perifocal volumes to predict mRS. Perifocal edema volume analysis by using conventional MR imaging can predict of outcome in patients with deep cerebral hemorrhage.

0-28

The separation of arterial phase and veous phase on 3D-CT angiography

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Subject: The aim of this study is to assess whether the separation of arterial phase (3D-CT arteriography) and venous phase (3D-CT venography) on 3D-CT angiography can be developed. Methods: Six healthy volunteers and twenty-seven patients were studied. The dynamic CT scan was performed to determine the optimal scan timings for arterial and venous phase. Helical scanning using a multi-detector row CT (MDCT) underwent during arterial phase for 5 seconds and venous phase for 5 seconds after a single bolus injection of contrast medium. Results: In all cases, 3D-CT arteriography and venography were successfully produced. The 3D-CT arteriography and venography facilitated the understanding of the anatomical relation of artery, vein, bony structures and a lesion, providing useful information for surgical planning and orientation. Conclusions: MDCT with a single bolus injection was able to develop the separation of 3D-CT arteriography and venography, providing precise and detailed information on central nervous disorders.

0-29

Evaluation of intracranial and cervical arteries by 3D-CT angiography - One-session scanning of the head and neck using multi-detector row CT

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To detect cervical vascular lesions in 15 patients with intracranial cerebrovascular diseases, we performed three-dimensional CT angiography (3D-CTA) of the head and neck using multi-detector row CT (MD-CT). All patients received 3ml/sec of contrast medium (total 100 ml) and head and neck were scanned in one session. We obtained excellent intracranial and cervical 3D-CTA in all cases except one. Full evaluation of the carotid arteries from their origin at the aortic arch to the M3 portion of the middle cerebral arteries was possible. Because of the high CT number of the carotid arteries, it was possible to differentiate arteries and veins upon setting a threshold CT number. This method is simple and suitable for screening for vascular lesions of the whole length of the carotid arteries as well as intracranial arteries.

0-30

Severely hypo-plastic unilateral vertebral artery versus acquired occlusive disease: differentiation by basi-parallel anatomical scanning (BPAS)-MRI in asymptomatic persons

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Introduction: Basi-parallel anatomical scanning (BPAS)-MRI means heavily T2-weighted thick coronal scanning with gray-scale reversal in post-processing, which we designed for visualization of the surface appearance of vertebrobasilar artery within the cistern. Purpose: To calculate the frequency of hypo-plastic unilateral vertebral artery and acquired occlusive disease in the asymptomatic persons. Methods: From April 2003 to September 2003, 90 asymptomatic persons (49 male, 41 female, 30–67, mean 56.7 years) underwent brain MRI, MRA and BPAS-MRI as Brain Check-up Examination in our hospital. Comparing BPAS-MRI with MRA, we differentiated severely hypo-plastic unilateral vertebral artery from acquired occlusive disease. Results: Severely hypo-plastic unilateral vertebral artery was found in 7persons (7.8%). Acquired occlusive disease was proved in 6 (6.7%). Conclusion: Both hypo-plastic unilateral vertebral artery and acquired occlusive disease appeared in similar frequency (about 7%). BPAS-MRI was necessary for the accurate diagnosis in 14% of our series.

0-31

Clinical application of shared-arm spiral 2D-MRDSA in patients with cerebrovascular disease

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2D-MRDSA using spiral sequence (spMRDSA) shows good S/N, and high time-resolution, but still behind IADSA. We employed view-sharing method for spiral sequence, sharing equally divided arm sets, and aimed at enhanced apparent time-resolution in post-processing fashion. We used clinical 1.5T MR scanner in 8 patients with AVM (6), moyamoya (1), and left

MCA occlusion post STA-MCA anastomosis. Arm-shared spMRDSAs (1/6 up to 1/8 frame per sec) were obtained successfully in all the patients. Arm-shared spMRDSA is suitable for demonstrating rapid inflow of cerebral AVM. Whereas, no evident benefits were shown in major steno-occlusive disease. We conclude arm-shared spMRDSA is much effective technique for cerebrovascular diseases, especially for analyzing high-flow pathologic vasculature.

0-32

Signal changes of intervertebral disc following compression fracture of the spine: evaluation by MR imaging

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Purpose: To evaluate signal changes of intervertebral disc following compression fracture of the spine by MR imaging. **Methods:** We retrospectively evaluated spine MR images obtained for 61 cases (30–91 years old, mean age 68.9) with compression fracture, with paying attention to the signal changes of intervertebral discs adjacent to the compression fracture of the spine using MR imaging. **Results:** We could analyze 120 compression fractures and 195 intervertebral discs adjacent to the compression fracture. Thirty-nine intervertebral discs showed hyperintense signal on T1WI, while 100 intervertebral discs showed hyperintense signal on T2WI. This signal elevation on T2WI was often found in the border of intervertebral discs. **Discussion:** Signal changes of intervertebral disc following compression fracture of the spine can be observed frequently. To appreciate this finding is important for the differential diagnosis of discitis.

0-33

Tractography of the cervical spinal cord with diffusion tensor imaging using SENSE

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We evaluated the feasibility of tractography of the cervical cord with diffusion tensor imaging (DTI) using a SENSE technique that is less affected by susceptibility artifacts. In three volunteers and 12 patients, we performed DTI of the cervical cord at 1.5T with a single-shot echo-planar sequence in combination with SENSE. We employed a synergy head/neck coil and selected an axial imaging plane. Other imaging parameters were as follows: FOV, 172.5x230 mm; imaging matrix, 112x112; section thickness, 2.5 mm; section gap, 0; number of sections, 60; NEX, 4; and imaging time, 4 min 50 sec. Tractograms were created with a program in image analyzing software (PRIDE, Philips Medical Systems). In each subject, the cord was delineated as a bundle of tracts color-coded in the z-axis. Nerve roots were depicted in variable degrees. DTI using SENSE can be a reliable method for tractography of the cervical cord.

0-34

Neurotractography for the peripheral nerves

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Purpose: We applied fiber tractography using diffusion tensor magnetic resonance imaging on the lumbar spinal nerves and

peripheral nerves of the lower limbs to assess its feasibility and clinical utility. **Subjects and Method:** Five normal volunteers and three cases with peripheral nerve pathology were studied by a 1.5 tesla imager using phased-array local coil. Peripheral nerves were tracked down from the proximal segment distally to reconstruct fiber tractography*. **Results:** In eight out of twelve lumbar spinal nerves, the spinal roots and distal nerve segments were successfully tracked up to a few centimeters in length. The distal plexuses and nerves in the pelvic cavity were not visualized. The sciatic nerves and femoral nerves in the thigh were tracked in all cases. There were cases of lumbar spinal schwannoma and herniated lumbar disk in each of which tractography visualized the relationship of the lesion and the adjacent nerves. **Conclusion:** MR fiber tractography is feasible for the spinal and peripheral nerves and could add clinically useful information.

*Fiber tractography was reconstructed using Diffusion Tensor Visualizer (dTV) developed by Y. Masutani, Ph.D. Refer to the web resource below for further details.

http://www.ut-radiology.umin.jp/people/masutani/dTV_about-j.htm

0-35

Gamma knife radiosurgery for meningiomas: Post-irradiation density changes on CT scan

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Introduction: In recent years, with MR imaging being widely used for post-radiosurgical evaluation of meningiomas, little information has been available about density changes on CT scan after radiosurgery. **Patients:** Among 195 patients who underwent gamma knife radiosurgery (GKRS) for meningiomas at our facilities since 1993, 46 were selected for this study. These 46 patients were followed 3 years or more (max.: 11 years, median; 4 years) and were periodically assessed using CT scans as well as MR imaging. There were 37 female and 9 male patients. Ages at the time of GKRS ranged from 25 to 89 years (mean; 62 years). The tumor was located at the skull base in 25 patients and at other sites in the remaining 21. **Results:** Significant CT density increases of tumors were demonstrated in 20 (43%) of the 46 patients 3–11 years after GKRS; density increases were not apparent 2 years after GKRS. In most patients, density increases occurred in relation to tumor growth control. The only factor significantly related to increased density was the number of post-radiosurgical years ($p = .0012$). We experienced an autopsy case with a meningioma, in which a postmortem examination was performed 42 months after GKRS. In this patient, sequential follow-up CT scans showed gradual tumor shrinkage as well as remarkably increased tumor density. On postmortem studies, the tumor microscopically showed a diffuse area with numerous psammoma bodies.

Conclusion: A density increase due to psammomatous change can be regarded as being promoted by GKRS and to result in tumor growth control.

0-36

Evaluation of MR spectroscopy in differential diagnosis between tumor recurrence and radiation encephalitis after gamma knife radiosurgery for brain metastasis

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Follow up examination of the cases of brain metastasis after Gamma Knife Radiosurgery was performed by MRI and MRS, comparing with the study before GKR and studies after 1 day and once a month till 6 months after GKR if possible, in the meaning of differential diagnosis between tumor recurrence and radiation encephalitis. Reduced Cho during 1 day after GKR is considered to be reflection of initial inhibition of membranous function and cell proliferation. Slight elevation of NAA/Cho, and NAA/Cr in 1-2 month after GKR is probably due to inhibition of tumor cell proliferation and reduction of tumor size. Normalization of MR spectrum pattern is recognized prior to disappearance of the irradiated tumor. MRS is considered to be effective for early evaluation of radiation effect of GKR and differential diagnosis between tumor recurrence and radiation encephalitis to decide suitable treatment and to detect prognosis.

O-37

Thallium-201 SPECT in the evaluation of early effects on brain tumors treated with stereotactic irradiation

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Objective: To determine whether 201Tl-SPECT can predict response to stereotactic irradiation (STI) earlier than MRI. Methods: In 16 patients, 201Tl-SPECT was performed immediately before and after STI. All patients underwent MRI immediately before STI, and 14 patients underwent MRI immediately after STI. Follow-up MRI was performed 1–2 months after STI in 14 patients. As the activity of tumor, Tl-index was calculated in the SPECT. The change in tumor size was compared with the change in Tl-index immediately after STI. Results: No significant relationship between change of tumor size immediately after STI and change of Tl-index immediately after STI was found. Significant correlation ($r=0.69$, $p<0.05$) between change of tumor size 1–2 months after STI and change of Tl-index immediately after STI was found. Conclusions: This study suggests that 201Tl-SPECT can be an early indicator of treatment response.

O-38

FDG-PET for planning of gamma knife radiotherapy of the patient with metastatic brain tumor

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FDG-PET reflects the viability of metastatic brain tumor, and useful to differentiate viable tumor from radiation necrosis, and also useful to whole body screening for the primary cancer. We performed FDG-PET scan for 15 patients who were the candidate for gamma knife radiotherapy, 7 for diagnosis of recurrence, 3 for evaluation of the effect of therapy, and 5 for detection of primary cancer. FDG-PET indicated the tumor viability well and that help to planning of gamma knife therapy for especially in recurrent lesions. Three of five patients were suspected the primary cancer. FDG-PET is useful for planning gamma knife therapy of the patients with metastatic brain tumor.

O-39

Three dimensional cerebral angiography equipment with the Flat Panel Detector

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The usefulness of cerebral angiography equipment with flat panel detector (FPD) is discussed. About the resolving power, distortion and dose of the contrast material, cerebral angiography equipment with flat panel detector (FPD) is compared with one with image intensifier (I.I.). The cerebral angiography equipment with flat panel detector (FPD) made the more homogenous brilliancy, less distortion and less radiation than the one with the I.I.. The cerebral angiography with FPD can be used clinically.

O-40

Visualization of brain perfusion by contrast-enhanced ultrasonography: a preliminary study in the ischemic model of rabbit

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Purpose: We evaluated the usefulness of contrast-enhance media of ultrasonography (galactose parmitine acid: Levovist) to visualize the brain perfusion in rabbit. Materials and methods: 6 rabbits were involved in this study. A hole in the skull bone made under anesthesia was used as an acoustic window for the ultrasonography. Ischemic model (3 of 6 rabbits) were made by occluding the MCA with surgical intervention. Harmonic images before and after intravenous injection of contrast media (150mg/body) were obtained using linear type 5–12Mhz probe. Results: Enhancement of brain perfusion was observed on Harmonic images. Washout was fast and pooling of contrast media was not certain. In ischemic models, hypoperfusion in the occluded side were clearly visualized on Harmonic images. Conclusion: Hypoperfusion of brain in ischemic rat model can be visualized on Harmonic imaging of ultrasonography by using contrast media.

O-41

An in vitro simulator for measuring and visualizing hemodynamics in human vessels

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Hemodynamics plays very important roles on development and growth of intracranial aneurysms, abdominal aortic aneurysms and carotid stenoses. However, there is no well-established in vivo or in vitro hemodynamics measuring system in human vessels at present. Therefore, we established an in vitro simulator for measuring and visualizing hemodynamics in human vessels, utilizing the following; obtaining multiple 2-dimensional slices including human vessels with the use of a clinical imaging scanner; calculation of 3-dimensional vessel data sets by a computer; production of a realistic hollow silicon vessel model using previous computer data sets and a three-dimensional printing using powders and adhesive; completion of refraction index matching

between the silicon model and a mixture of glycerol and distilled water; whole field measurement of hemodynamics in the model by using particle image velocimetry. This simulator enabled us to obtain tailor-made hemodynamics which were as realistic as possible, in patients' pathological vessels.

0-42
MR blocking effects of Plant Carbon Fibers-The 1st experience report

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Plant carbon fibers with Low Electrical Energy are clinically benefit for decubitus and SARS (severe acute respiratory syndrome) by antimicrobial effect. On the other hand, these carbon fibers have several characters, (A) the carbon heater was found to consume less electrical energy than the previous heater, (B) carbon felt jacket protects MR signal and cannot take the MR scan. Our experience strongly suggested that these carbon fibers can be used as a implant (pacemaker etc) protector, a protector-wearing in the Linear Express and cancer relief by using of protection the electromagnetic waves.

0-43
MR Features of the term children suffering athetotic cerebral palsy

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Purpose: The purpose of the study is to evaluate the brain MR features and assess the frequency of basal ganglia injury in term patients suffering athetotic cerebral palsy. Method and Material: The subjects consisted of 14 children. Their mean gestational age was 39 weeks and the average birth weight was 3142g. Result: MRI revealed periventricular Hyperintensity in four children, basal ganglia in nine children, and normal in one. The incidences of MRI signal abnormality are 78% in thalamus, 64% in putamen and 28% in globus pallidus. Conclusion: In term children, the basal ganglia injury is demonstrated in 92% patients. MRI is very useful to assess the basal ganglia damage and to predict the prognosis of the term children.

0-44
Mollar-tooth anomaly with multicystic polymicrogyria in the cerebellum and multiple T2-prolonged plaque in cerebral whitematter: new variant of Joubert syndrome

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We herein report two cases of Mollar-tooth anomaly accompanying with multicystic polymicrogyria in the cerebellum and multiple T2-prolonged hyperintensity plaque in cerebral whitematter. To our knowledge, variant of Joubert syndrome with cerebellar polymicrogyria is never reported in the literature. Case 1: 51 y.o. female. MRI visualized cerebellar vermian dysgenesis with Mollar-tooth anomaly. Foliation of the cerebellar hemisphere were dysplastic and multiple small subcortical cysts resembling cerebellar polymicrogyria of Fukuyama congenital muscular dystrophy were observed in cerebellar cortices. Cerebellar hemisphere was atrophic for her age and

there were multiple hyperintensity plaque in cerebral white-matter on T2-weighted image. cortex was looked normal. Case 2: 44 y.o. female. MRI findings were same as Case 1 except for the septum pellicidum was also absent in this case.

0-45
The Changing MR Imaging Appearance of Polymicrogyria: A Consequence of Myelination

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Purpose: It was noted that the patterns of cortical abnormality differed significantly among the affected patients with polymicrogyria (PMG). The purpose was to attempt to clarify the cause of the different imaging appearances. Methods: T2-weighted images of 17 patients with PMG (3 days to 43 years) were retrospectively reviewed. Results: T2-weighted images revealed two different patterns: pattern 1, small, fine and undulating cortex with normal thickness (3-4 mm) in 7 patients, all under 12 month-old; and pattern 2, a thick (6-8 mm) bumpy cortex with an irregular cortical-white matter junction in 7 patients over 18 month-old. Serial MR imaging in one patient demonstrated longitudinal changes of the PMG from pattern 1 to pattern 2. Conclusion: These findings suggest that the two appearances (thin and thick) of the cortex likely represent the same process, with the apparent difference being the result of myelination in subcortical and intracortical fibers.

0-46
Proton MRS study of amino acid disease

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We examined cerebral abnormality of patients with abnormality of amino acid metabolism. The subjects were patients of Hypermethioninemia, maple syrup urine diseases, Methylmalonic acidemia and Glutaric aciduria. The T2-WI showed high intensity in the white matter of Hypermethioninemia, maple syrup urine diseases and Glutaric aciduria, but DWI demonstrated high intensity on Hypermethioninemia and maple syrup urine disease but low intensity on Glutaric aciduria. The abnormality of basal ganglia was found on Methylmalonic acidemia and Glutaric aciduria. The quantitative evaluation of proton MRS revealed increased concentration of Cho and mIns on Maple syrup urine disease and Glutaric aciduria. The patient of Glutaric aciduria showed increase of Taurine in the abnormal lesion, but the concentration of Taurine in the blood was kept in the normal level. DWI and proton MRS might be useful to demonstrate abnormality of brain and to conduct differential diagnosis of patients with the abnormality of amino acid metabolism.

0-47
The "cross" sign in patients with multiple systemic atrophy (MSA)

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Objectives: Patients with multiple systemic atrophy (MSA) may show the "cross" sign in MRI. However, correlations between brainstem atrophy and existence of the "cross" sign have not

been fully investigated. **Subjects and Methods:** We studied 68 patients with MSA. T1-weighted (T1W) sagittal and T2-weighted (T2W) axial images were obtained. Patients with grade 1 without the "cross" signs on T2W images. Patients with grade 2 with the incomplete "cross" signs that have relatively clear vertical line and vague horizontal line on T2W images. Patients with grade 3 with the complete "cross" signs on T2W images. **Results and Discussions:** There is a significant correlation between atrophies of pontine base and existence of the "cross" sign. Patients with smaller area of pontine bases below mean minus two standard deviation of normal values had the "cross" sign, which support existence of the "cross" sign depend only on extend of brainstem atrophies.

0-48 **Diffusion-weighted MR images in acute optic neuritis**

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MR features of acute optic neuritis (AON) include enlargement of the affected nerves, hyperintensities on T2-weighted images and short TI inversion recovery (STIR) technique, and Gd-enhancement of the affected nerves. Decrease in ADC has been reported in the affected nerves, although diagnostic value of the diffusion-weighted images (DWI) in AON has not been evaluated. We assessed DWI in 9 patients with AON as well as other MR images. DWI ($b = 1000 \text{ sec/mm}^2$) were obtained within 2 weeks after the onset of the symptoms. In all patients, hyperintensities were observed in the affected nerves on DWI. The sites of the hyperintensity were identical to those of Gd-enhancement in 7 patients in whom postcontrast studies were available. In all 6 patients with follow-up MR studies, hyperintensities decreased on DWI obtained 1 to 11 months later. DWI has diagnostic value in AON, especially in cases without Gd-enhancement.

0-49 **MR imaging of sequelae of central pontine myelinolysis in chronic alcohol abusers**

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Central pontine myelinolysis (CPM) is one of the serious neurological complications of alcoholism. The purpose of this study was to evaluate magnetic resonance (MR) images of sequelae of CPM. Approximately 600 alcoholic patients were examined with a 1.0-T MR scanner, and 11 patients were retrospectively found to have a central pontine lesion, a presumed sequela of CPM. The lesions had various shapes and most were cavitory. In 3 of the 11 patients, bilateral symmetrical oval lesions were faintly visible in the middle cerebellar peduncles. These middle cerebellar peduncular lesions were diagnosed as having wallerian degeneration of the pontocerebellar tract secondary to CPM.

0-50 **Two cases of transient cortical blindness after cerebral angiography**

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Case 1: a 52-year-old male with metastatic cerebellar tumor underwent preoperative cerebral angiography. After the procedure he became disoriented and blind. Emergent angiography showed no arterial occlusion. On the next day CT revealed no infarction in spite of his persistent blindness, and tumor resection

was performed. He developed intracranial hemorrhage after the surgery, but his vision gradually improved and entirely recovered within 8 days.

Case 2: a 32-year-old male with recurrent primary CNS lymphoma underwent cerebral angiography for regional chemotherapy, and after the procedure the patient complained of blurred vision. CT and cerebral angiography showed no infarction or thrombus. His vision completely recovered after 48 hours.

Transient cortical blindness is a recognized complication of cerebral angiography, and the osmotic disruption of the blood-brain-barrier by the contrast agents has been proposed as a mechanism. Prognosis is usually favorable with return of vision within several days.

P-01 **Three-dimensional cerebellar development analyzed using MRI of postmortem fetuses**

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The developing fetal cerebellar anatomy has yet to be visualized in detail. The aim of this study is to establish human MR atlas of the developing fetal posterior fossa structures at different gestational ages. Three-dimensional data of twelve formalin-fixed fetal brains ranging from 7 to 28 weeks of gestational age (GA) were obtained using a 4.7 Tesla MRI system, and five were used for the histopathological study. The morphological features of cerebellar development in fetuses greater than 7 weeks GA were possible. Development of the rhombic lips, vermis, cerebellar fissures, deep nuclear and external germinal layer were demonstrated and documented. Especially human germinal trigone of the cerebellum was first shown. This MR atlas of the developing fetal posterior fossa structures might assist accurate interpretation of clinical echograms and magnetic resonance images of the fetal anomaly in utero.

P-02 **A case with Aicardi syndrome**

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Aicardi syndrome is defined by the clinical triad of infantile spasms, agenesis of the corpus callosum, and pathognomonic chorioretinal lacunae. Almost all patients are girls with severe cognitive and physical handicaps, and epilepsy. We report a 1-month-old infant of Aicardi syndrome, who has seizure, microphthalmia, microcephaly, abnormal EEG pattern, vertebral abnormality and cleft lip and palate. MR imaging shows agenesis of the corpus callosum, interhemispheric cyst, and severe cortical dysplasia and polymicrogyria. Eye balls and optic nerve are hypoplastic. Cleft lip and palate which is infrequent finding are also demonstrated on coronal-reformatted CT image (approximately 3 percent of reported cases).

P-03**Perirolandic hypointensity in adult cases on echo planar T2-weighted images**

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Purpose: To correlate the perirolandic hypointensity seen on echo planar T2-weighted MR images in adults with anatomically located sensorimotor cortex and analyze the prevalence of this findings in craniocaudal height level. **MATERIALS AND Methods:** Axial echo planar T2-weighted MR images of 100 consecutive adult patients were reviewed. MR unit was GE Signa Echo Speed LX CV/i version9.1 (1.5T). Two independent readers attempted to identify the central sulcus using two anatomic methods independently and in combination. The perirolandic hypointensity on echo planar T2-weighted images was compared with anatomically identified central sulcus. **Results:** Perirolandic hypointensity were seen in 85 cases on the top parietal level, 78 cases on the centrum semiovale, 70 cases on the top of lateral ventricle and 60 cases on the corpus callosum and caudate nucleus level. **Conclusion:** Perirolandic hypointensity on echo planar T2-weighted images is useful to identify central sulcus especially on the lower craniocaudal level.

P-04**Assessment of the relationship between the size of occipital sinus and transverse sinus with contrast-enhanced MRV**K. Kobayashi¹, O. Matsui², M. Suzuki³, F. Ueda²¹Department of Radiology, Toyama Red Cross Hospital, Toyama²Department of Radiology, Kanazawa University School of Medicine, Ishikawa³Department of Radiological Technology, Kanazawa University School of Medicine, Ishikawa

Purpose: We investigated the relationship between the size of the occipital and the transverse sinus. **Method:** We examined 552 patients who had undergone contrast-enhanced brain MRV using efgre3d with spectral IR. The presence and size of the occipital sinus and the size of the transverse sinus 2cm laterally to the midline were assessed. **Result:** The occipital sinus was craniocaudally continuous to the sinus or venous plexus in 109 patients. The result showed that, if the size of the occipital sinus is large, the transverse sinus is not so small. Thus, statistically significant relationship could be detected between the size of the occipital and the transverse sinuses. **Conclusion:** There was no definite relationship between the size of the occipital and the transverse sinuses, so that a large occipital sinus is not always relevant for intracranial venous drainage.

P-05**Germinoma originated from hypothalamus to basal ganglia preceded panhypopituitarism**M. Takasu¹, T. Kaneko¹, T. Matsushita¹, K. Oguchi³, K. Kurata², M. Kadoya¹¹Department of Radiology, University of Shinshu School of Medicine, Nagano²Department of Pediatrics, University of Shinshu School of Medicine, Nagano³Aizawa Hospital PET Center, Nagano

We experienced a case of germinoma originated in hypothalamus to basal ganglia preceded panhypopituitarism. Patient was

11 years old boy presenting diabetes insipidus. After 18 months from onset, he showed short stature, and diagnosed panhypopituitarism. MRI obtained at onset showed no abnormal lesion; hyperintensity on T1-weighted image at the posterior part of pituitary was unclear. Hyperintensity lesions in hypothalamus to basal ganglia was recognized on T2-weighted image after 32 months from onset, but no space occupying lesion found in sella turcica. Therefore lesion was exist at hypothalamus, diagnose had delayed due to evaluation performed only pituitary area. Biopsy was performed at basal ganglial lesion. Diagnosis was germinoma with syncytio trophoblastic giant cells. We speculated that hypopituitarism was induced by hypothalamic invasion of germinoma.

P-06**MR imaging detectability of metastatic lesions: Comparison between 1.0 T unit and 1.5 T unit**H. Sato, S. Okamoto, M. Makino, M. Yamamoto, Y. Urakawa
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Introduction: We analyzed whether the detectability of brain metastases (METs) has improved since installation of a new 1.5 T MR unit as compared with the previously used 1.0 T MR unit. **Patients and Methods:** Among 1156 cases with brain METs treated with gamma knife (GK) radiosurgery at our facility since July of 1998, 376 cases in which MR study covering the whole brain with a slice thickness of 5 mm was performed on the day before GK treatment and MR study with a slice thickness of 2 mm on the day of GK treatment were selected for this study. These cases were divided into two groups. Group A; 253 cases (3126 lesions) examined using a 1.0 T MR unit between July of 1998 and August of 2002. Group B; 123 cases (1171 lesions) examined using a 1.5 T MR unit since September of 2002. **Results:** One or more lesions invisible on a 5 mm slice study were additionally detected on a 2 mm slice study in 120 cases (47%) in group A and 32 (26%) in group B ($p < .0001$). Although the minimum lesion volumes detected were 13 cu. mm in the 5 mm slice study and 5.5 cu. mm in the 2 mm slice study in group A, these volumes were 4.3 cu. mm and 3.8 cu. mm, respectively, in group B. **Conclusion:** For preradiosurgical examination, a 5 mm slice study using a recently developed 1.5 T MR unit appears to be sufficient.

P-07**The reconsideration of 'CSF cleft' sign in intracranial meningioma**H. Miki¹, T. Takeguchi¹, K. Kikuchi¹, S. Ohue²¹Department of Radiology, Ehime University School of Medicine, Ehime²Department of Neurosurgery, Ehime University School of Medicine, Ehime

The purpose of this study is to reconsider the "CSF cleft" sign in meningioma. Fifty meningiomas were examined. We retrospectively evaluated the rim as the brain-meningioma interface showing the low signal intensity (SI) by T1WIR and the high SI by T2WTSE. In cases with rim, the SI of the rim was evaluated by FLAIR, and the enhancement effect by CE-T1WIR. The characteristics of the rim on the dura-attachment side were also evaluated. In 35 lesions, the rim was observed. The rim was shown as iso-high SI compared to the tumor parenchyma by FLAIR, and was enhanced by CE-T1WIR. In 16 lesions, 2-layer structures with the SI of the rim connecting to the tumor surface and the null SI of CSF were observed by FLAIR on the dura-attachment. We considered that the "CSF cleft" sign should be a small area consisting of the dura-attachment site alone.

P-08**Two cases of Prolactinoma with atypical findings**

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We report two cases of prolactinoma which revealed unusual MRI and CT findings with review of the literature. Case 1: An asymptomatic 59-year-old female. Brain MRI demonstrated a parasellar mass, which was hypointense on T1WIs, markedly hypointense on T2WIs, and partially enhanced after Gd-administration. CT showed a hyperdense mass containing with multiple granular calcifications. After biopsy, histologically amyloid deposition was found in the solid part of the mass. Amyloid probably contributed to its atypical signal intensity. Prolactinoma with amyloid deposition is very rare entity, and three cases have been reported. Case 2: A 26-year-old hyperprolactinaemic male, who has been noted bitemporal hemianopia and galactorrhea. MRI revealed a solid and cystic mass in the pituitary fossa and suprasellar region. On CT hyperdense areas were scattered in the solid portion of the mass. After surgery, histologically calcifications were noted in the tumor. Two cases of cystic prolactinoma with calcification have been reported.

P-09**Cavernous sinus sampling in ACTH producing pituitary microadenoma: Report of two cases**

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Case 1 is 16 years old female with Cushing's disease. MR imaging showed two nodules in the bilateral wings of the pituitary gland. Case 2 is 39 years old female with Cushing's disease. MR imaging showed no apparent pituitary tumor. Cavernous sinus sampling was performed in these patients and showed marked step up of the adrenocorticotrophic hormone (ACTH) in the left side respectively. Hardy's operation clarified ACTH producing microadenomas predominantly located in the left side of pituitary glands in these patients. Cavernous sinus sampling was useful to identify the functioning pituitary microadenoma in these patients.

P-10**A case of Endolymphatic sac tumor with extensive skull base invasion**

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A 30-year-old man presented with left hearing loss for 6 years and tinnitus for 7 years. On physical examination, associated with left 5th and 7th cranial nerves symptoms were found. CT demonstrated a tumor approximately 6 cm in diameter. The tumor located in the left temporal bone with extending to the jugular foramen. The tumor eroded the temporal bone on the left side. On T1WI, the tumor appeared heterogeneous and had a peripheral

rim of increased signal intensity. On contrast-enhanced T1WI, the tumor intensely enhanced. On T2WI, the tumor had multifocal hyperintensities. Angiography revealed a hyper-vascular tumor. On 123I-MIBG scintigraphy, an increased activity was seen in the tumor. Histological study demonstrates Endolymphatic sac tumors (ELST). ELST which is a rare tumor originating from the temporal bone. ELSTs radiologically mimics paraganglioma, chondrosarcoma and metastatic tumor.

P-11**Ewing's sarcoma of temporal bone**

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A case of primary Ewing's sarcoma of the right temporal bone was reported. Primary Ewing's sarcoma of the skull is rare. A 2-year-6month-old girl was admitted to the hospital due to right facial palsy in progress. MRI demonstrates that whole right pyramidal temporal bone was edematous and enhanced by Gadolinium. The dura around it became thick and spreads to the cavernous sinus. CT scan demonstrated soft tissue in temporal bone without bone destruction. The diagnosis of Ewing tumor of temporal bone was difficult. But it might be characteristic that this lesion has shown low intensity on DWI.

P-12**Rare vascular lesions presented with subarachnoid hemorrhage: evaluation with contrast-enhanced MPRAGE and MRA**

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The purpose of this study was to evaluate usefulness of contrast-enhanced MPRAGE and MRA to diagnose rare vascular lesions presented with subarachnoid hemorrhage. Six patients (2 males and 4 females, 19–68 years) who presented with subarachnoid hemorrhage were evaluated by contrast-enhanced MPRAGE and MRA. The vascular lesions included perimedullary AVF in four, cerebral aneurysms associated with Behçet's disease in one, and unknown cause in one. The findings of MRI/MRA were compared with those of catheter angiography. In 5 of 6 patients, abnormal vessels adjacent to the brain or spinal cord were found by contrast-enhanced MPRAGE and MRA. These 5 lesions were confirmed by catheter angiography and surgery. In one patient who had no abnormal vessels on MRI/MRA, catheter angiography did not show any abnormal findings. Contrast-enhanced MPRAGE and MRA were useful for diagnosing rare vascular lesions presented with subarachnoid hemorrhage.

P-13**Usefulness of 3D-CT for diagnosis of dissecting anterior cerebral artery aneurysm: Two cases report**

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We report two patients with dissecting anterior cerebral artery aneurysm. Case 1: A 54-year-old man was presented with sudden onset of severe headache follow by left hemiparesis. CT scan on admission showed a subarachnoid hemorrhage in the inter-

hemispheric fissure and MRI on the following day demonstrated a cerebral infarction on the right medial frontal lobe. On 3D-CTA, dissecting aneurysm of ACA was identified by multi planar reconstruction (MPR). Case 2: A 73-year-old woman was presented with sudden onset of severe headache and disturbance of consciousness. CT scan on admission showed subarachnoid hemorrhage. 3D-CT on the same day identified Basilar artery small aneurysm by volume rendering, and suspected dissection of ACA by MPR. After 6 day, she was presented with disturbance of consciousness again, CT scan showed subarachnoid hemorrhage increased. On 3D-CTA, dissecting aneurysm of ACA appeared newly. MPR of 3D-CT was useful for diagnosis of dissecting anterior cerebral artery aneurysm.

P-14

Use of Surface Shaded Display for Screening for Cerebral Aneurysm

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Purpose: For cases requiring differential diagnosis, we perform surface shaded display (SSD) in addition to usual MIP display. In our present study, we evaluated the usefulness and examined its problems in screening of unruptured cerebral aneurysm. Method: Covering about 80 patients for whom differential diagnosis of cerebral aneurysm was made with SSD, images were examined retrospectively, so as to evaluate the usefulness of SSD and its problems in the screening for cerebral aneurysm. The apparatus used was GE Sigma contour. Results: The shape of aneurysm and positional relation of aneurysm to the surrounding blood vessels could be observed in more detail than with MIP. Besides, SSD made it possible to differentiate aneurysm from the branch of blood vessel, the bending of blood vessels, and fenestrated site in some cases. Thus, it was useful. Since the following tendencies were observed from the results, care should be taken in reading the images.

P-15

A Case Report of Left Atrial Myxoma Complicationg Multiple Cerebral Aneurysm

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A case of cardiac myxoma with multiple cerebral aneurysm is reported. A 71-year-old male had complained of dysarthria. The brain CT showed high density area in left sylvian fissure. MRI demonstrated thrombosed giant aneurysm of right middle cerebral aretery with right parietal cerebral infarctions. Digital subtraction cerebral angiography reveiled multiple cerebral aneurysms. The echocardiogram also showed myxoma in the left atrium. Total resection of the tumor and giant aneurysm was carried out for the improvement of the patient's general condition. T2WI was useful to demonstrate thrombosed giant aneurysm, and enhanced T1WI could show multiple aneurysm as small enhancing lesions.

P-16

AVM of the hypothalamus; A case report

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A 12-year-old man suddenly became restless with severe headache and vomiting. CT revealed intraventricular hemorrhage. MR imaging after two weeks from onset revealed a nodular lesion in the right side hypothalamus existing to the third ventricle. The lesion appeared isointense on T1- weighed image and hypointense on T2-weighted image, and enhanced after administration of Gd-DTPA. Tumor was suspected. Angiographic finding revealed anomalous vascular lesion, fed by A1. The preoperative diagnosis was AVM. Removal operation was performed. Nidus located in the right hypothalamus to optic tract, and fed by A1 and drained to the deep sylvian vein. In this case angiograms and progress were useful for diagnosis.

P-17

Artery to artery embolization of BA occlusion due to VA stenosis cause by spur-Case report

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Acute basilar occlusion still has a high mortality even after treatment by local intra-arterial thrombolysis. We experienced basilar occlusion cause by a severe stenosis on the extra-cranial C5-6 vertebral artery. We treated by PTA on vertebral artery and basilar artery occlusion by balloon catheter. And around basilar top artery and PCA treated by Urokinase. Recanalization was all arteries without a Left PCA was partial recanalised. MRI showed infarction on brainstem and a small area at thalamus. 3 month later neurological condition was free without extra ocular paresis. 3D CT was performed VA stenosis which C 5-6 spure and alignment. Conclusion, This case was very rare case but we need follow up study for VA stenosis caused by spur.

P-18

A case of Neurosyphilis mimicking herpes simplex encephalitis

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We report a case of neurosyphilis mimicking herpes encephalitis. A 42-year-old woman was presented with progressive dementia of six-month long. Brain MRI revealed prominent T2-prolonged lesions in bilateral temporal lobe with frontal atrophy. These lesions were not enhanced by Gd-DTPA and showed hypo signal intensity on DWI. Those imaging findings were resembled with herpes encephalitis or paraneoplastic limbic encephalitis. Neurosyphilis was diagnosed clinically. Neurosyphilis should be included in the differential diagnosis of herpes simplex encephalitis.

P-19

EB virus encephalitis with non-characteristic MRI and SPECT images

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Only a limited number of EB virus encephalitis has been reported in Japan and its specific changes in images of MRI and SPECT has not been identified. In this paper we report a case of encephalitis with elevated titer of EB virus antibody and with non-characteristic findings of MRI and SPECT images. The 73 male patients was found vomiting and yelling strange things by his wife and transferred to our hospital. On admission, the patient's conscious level was JCSI I-10 and was noticed mild left hemiparesis. CSF was 13/3(9/3mono, 4/3poly), EEG showed diffuse PLEDs. Elevation of EB virus antibody was confirmed by the paired serum. T2 weighted and diffusion images of brain MRI demonstrated that high intensity area in the right temporal and occipital lobes of cortical and sub-cortical zones which did not correlated with the vessel drainage areas. SPECT revealed that moderate and diffused high perfusion in the right cerebrum.

P-20

Secondary Hemophagocytic Lymphohistiocytosis : Serial MR Imaging and Pathologic Findings Correlation

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We herein report a case of a 13-year-old boy complicated by CNS infiltration of Epstein-Barr virus-associated hemophagocytic lymphohistiocytosis (EBV-HLH). Virus-associated HLH is distinguished from familiar HLH. However, for pathologic categorization, both conditions are classed together because of common microscopic findings. We correlated MR findings of CNS involvement in HLH with pathological findings. Serial MR imaging of the brain showed diffuse white matter change, especially in the posterior and parietal lobe, presumably due to cyclosporine encephalopathy. In addition, T2-prolonged lesions with Gd-DTPA enhancement were seen in the splenium of corpus callosum and the left globus pallidus, presumed to be caused by extensive infiltration by lymphocytes and hemophagocytic histiocytes. Pathologic findings revealed CNS infiltration of hemophagocytic histiocytes in the splenium of corpus callosum but not in the left globus pallidus. Cyclosporine encephalopathy was depicted in the latter.

P-21

Posterior reversible encephalopathy syndrome following hemophagocytic syndrome due to EB virus infection: a case report

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Background: Hemophagocytic syndrome (HPS) is complicated with infections and lymphoma, and its pathogenesis is considered as hyper-cytokinaemia followed by pancytopenia due to hemophagocytosis by macrophages. We experienced a patient with posterior reversible encephalopathy syndrome (PRES) following HPS. A Case report: A nineteen-year-old woman who was diagnosed as HPS due to EB virus infection had corticosteroid therapy with benefit. However, during recovery phase of HPS, she complained occipital headache followed by sudden onset visual and consciousness disturbance and convulsions. MRI scans revealed multiple T2 elongated lesions in parieto-occipital cortex and subcortex. Her clinical symptoms recovered several days later. MRI scans about a month after showed no abnormalities, and then we made a diagnosis of PRES. Discussion: PRES is known to be caused by hypertension, eclampsia and immunosuppressive drugs, but PRES due to HPS has not been reported yet. Hypercytokinaemia due to HPS may induce hyperpermeability of blood brain barrier causing PRES.

P-22

Six cases of transient focal splenium lesion

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Purpose: To describe six cases of transient focal splenium lesion. Materials and Methods: Six patients that included three viral encephalitis, two receiving antiepileptic drugs and one with hemolytic uremic syndrome were evaluated. All patients underwent MRI. Five patients underwent diffusion-weighted images. Results: All patients demonstrated focal high signal lesion in the splenium of the corpus callosum on T2-weighted images and FLAIR sequence. Diffusion-weighted MR imaging showed markedly restricted diffusion of the lesion in the all five patients which underwent Diffusion-weighted MRI. All five patients received follow up MRI showed complete reversibility of the lesion. Discussion: Although this lesion has been assumed to be vasogenic edema or cytotoxic edema in the previous reports, diffusion-weighted MR imaging showed markedly restricted diffusion and complete reversibility of the lesion in the present cases, suggesting that intramyelinic edema was the main patho-physiological abnormality.

P-23

Focal lesion in the splenium of the corpus callosum in a case of depression

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We report a focal magnetic resonance (MR) imaging abnormality of the corpus callosum in a patient with depression. A 19-year-old woman presented with depression and antidepressant therapy was started. T2-weighted MR imaging after 17 days of antidepressant therapy revealed a nonenhancing ovoid hyperintense lesion in the splenium of corpus callosum. The lesion was hyperintense on diffusion weighted MR imaging. Apparent diffusion coefficient was decreased in the lesion. The patient was asymptomatic except for depression, and her neurological examinations were unremarkable. Antidepressant was highly suspected as cause of the lesion.

P-24

Magnetic resonance imaging of cerebrotendinous xanthomatosis

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Cerebrotendinous xanthomatosis is a rare autosomal recessive disorder due to an impairment of the metabolic pathway of cholesterol. Patients present with tendon xanthomas, early cataracts and neurological dysfunction. We reviewed MR images and clinical findings of two patients with cerebrotendinous xanthomatosis.

The typical findings of MR images are seen: the cerebellar and cerebral atrophy and bilateral and symmetrical increase of the signal intensity on T2-weighted images in the cerebellar and periventricular cerebral white matter, the dentate nuclei and brain stem. The high cholestanol serum level confirmed the diagnosis.

P-25**MR findings of Marchiafava Bignami disease responded to high-dose intravenous thiamine administration -case report**Y. Kinoshita¹, H. Yasukouchi¹, E. Tsuru¹, T. Okudera²¹Department of Neurosurgery, Munakata Suikokai General Hospital, Fukuoka²Department of Neuropsychiatry, Iwate Medical University, Iwate

Marchiafava-Bignami disease (MBD) associated with chronic alcoholism is a fatal disorder characterized by demyelination of the corpus callosum. A 62-year-old male Japanese, a heavy drinker for his last over 10 years, was admitted to our hospital because of dysarthria of acute onset. The first MR imaging study showed abnormal signal intensity of the corpus callosum; a diagnosis of MBD was made. After large doses of thiamine injection, his symptom gradually improved. Follow-up MR studies showed reduction of signal intensity abnormalities and residual callosal atrophy. Pathogenesis and therapy of MBD were discussed, and MRI scanning proves to be a highly useful tool for early diagnosis of MBD.

P-26**Cerebral cortical and white matter lesions in hepatic encephalopathy:postmortem MR-pathologic correlations**E. Matsusue¹, T. Kinoshita¹, S. Sugihara¹, S. Fujii¹, H. Miyata², M. Otsuka², E. Ohama², T. Ogawa¹¹Department of Radiology, Tottori University Faculty of Medicine, Tottori²Department of Neuropathology, Institute of Neurological Sciences, Tottori University Faculty of Medicine, Tottori

We investigated correlations between the hyperintensities on the postmortem T2 weighted images and histologic findings in two autopsy-proven cases of hepatic encephalopathy. In both cases, MR images obtained at several days after the onset showed T2 hyperintensities in the bilateral cerebral white matters and T1 hyperintensities in the bilateral globi pallidi, but no signal changes in the cerebral cortices. Postmortem T2 weighted images showed hyperintensities in the bilateral deep and convolutional white matters as well as laminar hyperintensities in the deep cerebral cortices in both cases. Histologically, T2 hyperintensities in the cerebral white matters showed spongiform changes and/or tissue rarefaction, and hyperintensities in the deep cerebral cortices showed laminar spongiform changes (pseudolaminar spongy degeneration) associated with numerous Alzheimer type II glias. These findings were characteristic histologic changes of hepatic encephalopathy. Laminar T2 hyperintensities in the deep cerebral cortices in hepatic encephalopathy, may reflect pseudolaminar spongy degeneration.

P-27**Utility of Perfusion CT in Acute Ischemic Stroke: comparison with early ischemic CT signs**T. Kuroiwa¹, K. Takano¹, H. Utsunomiya¹, S. Arai²¹Department of Radiology, Fukuoka University, Fukuoka²Department of Radiology, Hakujuji Hospital, Fukuoka

Purpose: To describe the utility of perfusion computed tomography in patients with acute ischemic stroke and compare the results with early computed tomographic signs (ECS) of non-contrast CT. Material and Methods: We reviewed 14 consecutive patients who underwent perfusion CT within 9 hours of stroke onset. While undergoing non-contrast CT, each patient received a perfusion CT imaging. Maps of cerebral blood flow (CBF), cerebral blood volume (CBV), and mean transit time (MTT)

were obtained from perfusion CT data. The region of interest rate (ROI rate) of CBF and CBV, MTT were calculated from MCA territory of lesion side and ipsilateral. Correlation of each ROI rate and extent of infarct lesion volume on follow up CT was estimated. And then, early CT signs of non-contrast CT in admission were evaluated. Result: The ROI rate of CBF on perfusion maps correlated most strongly with final infarct volumes. The ROI rate of CBF, there was it in the determination which caused broad infarction was equal to or less than 30%. The ROI rate of CBV, there was it in the determination which caused massive haemorrhagic infarction and herniation was equal to or less than 100%. Correlation was not seen in ECS of non-contrast CT in admission and an infarct lesion volume of follow up CT. Conclusion: The ROI rate of a quantitative value in perfusion CT was useful for a prediction of infarct lesion seriousness. It was thought that perfusion CT was useful to exclude adaptation of thrombolytic therapy.

P-28**Attempts to reduce radiation exposure by a brain CT perfusion, and evaluation of a quantitative brain blood-flow**

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Because CT perfusion is a dynamic study, the contrast media in a blood vessel influences greatly in a measurement result. By decreasing the influence of a blood vessel, it is reported that the measured value by CT perfusion has high correlation with nuclear medicine and Xe-CT using a diffusible tracer, and we analyzed the normal brain blood-flow quantitatively according to age using these methods. Moreover, the increase in the radiation exposure is mentioned as the greatest problem in a CT perfusion. There is almost no report which considered change of the quantitative brain blood-flow by the decrease of S/N or change of radiation quality. We considered change of the quantitative value, advancing reduction of the radiation exposure. It became possible, after keeping quantitative values of a brain blood-flow to the same extent as the conventional conditions, to decrease a dose of radiation exposure about to 1/3.

P-29**Cerebral circulation analysis of dural AVF with perfusion MRI**W. Tsuruta¹, I. Anno², Y. Matsumaru¹, A. Matsumura¹¹Department of Neurological Surgery, University of Tsukuba Institute of Clinical Medicine, Ibaraki²Department of Radiology, University of Tsukuba Institute of Clinical Medicine, Ibaraki

Dural AVF is sometimes associated with intracerebral hemorrhage due to disturbance of venous perfusion. We examined cerebral circulation in patients with retrograde venous drainage using perfusion MRI. Based on our analysis, increase of CBV apparently reflects disturbance of venous perfusion.

P-30**Changes of cerebral blood flow before and after carotid endarterectomy: Evaluation by diamox-challenge ¹²³I-IMP SPECT**I. Sakuma¹, S. Takahashi¹, N. Tomura¹, K. Omachi¹, J. Watarai¹, T. Yanagisawa², H. Kinouchi², K. Mizoi²¹Department of Radiology, Akita University School of Medicine, Akita²Department of Neurosurgery, Akita University School of Medicine, Akita

The purpose is to investigate cerebral blood flow (CBF) changes after carotid endarterectomy (CEA). In 12 patients (13 ICAs), CBF and cerebral vasoreactivity (CVR) were assessed before and 7-9 days after CEA using diamox-challenge 123I-IMP SPECT. 99mTc-HMPAO SPECT was also performed immediately after surgeries. Ipsilateral CBF did not significantly change. However, ipsilateral CVR improved in most cases, and diamox-challenge Asymmetry Index (AI) significantly increased ($p < 0.05$) after CEA. In 5 patients (38%), ipsilateral hyperperfusion was seen on 99mTc-HMPAO SPECT. In patient with hyperperfusion, CVR decreased compared with in patients without hyperperfusion. Ipsilateral CVR and diamox-challenge AI improved after CEA. After surgery, hyperperfusion was associated with reduction of CVR.

P-31
Examination of Isolated Spinocerebellar Degeneration using 1H-MRS

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We examined cerebral function and metabolism of comparatively early stage Isolated Spinocerebellar degeneration using 1H-MRS. We compared the result of this examination of Isolated Spinocerebellar degeneration (Cerebellocortical atrophy; CCA 12 members and Olivopontocerebellar atrophy; OPCA 14 members) and normal examination. 1H-MRS examinations were performed on a 1.5 Tesla MR unit (SIEMENS MAGNETOM VISION, sensitivity encoding; TR/TE=1500/270. Acq; 128, single voxel). In the members of CCA, the NAA/Cr ratio were markedly decreased in cerebellum. In the members OPCA, the NAA/Cr ratio were markedly decreased in cerebellum, pons, thalamus, putamen and frontal lobe. Decrease of the NAA/Cr ratio, in the members of OPCA, is likely to reflect obstacle of extensive cerebral function. The results suggested to perform 1H-MRS is useful as back-up diagnosis of Spinocerebellar degeneration.

P-32
Evaluation of the Alzheimer's disease and depression using 1H-MR spectroscopy

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Purpose: In the patients with early stage of Alzheimer's disease (AD) and depression (DP) who complained forgetfulness, we studied difference of cerebral functional changes, using 1H-MRS. Patients & Methods: 26 patients with early stage of AD and 14 patients with DP were carried out. 1H-MRS was performed on a 1.5Tesla MR unit. Volumes of interests (VOI) were acquired in the frontal cortex, parietal cortex, temporoparieto-occipital region (TPO), hippocampus, occipital cortex and cingular gyrus. Result: In AD patients, it was seen significant decrease of NAA/Cr in the frontal cortex, TPO and cingular gyrus in comparison with normal subjects. On the other hand, in DP patients, it was seen significant decrease of NAA/Cr in only frontal cortex. Conclusion: Those result suggested that there were clearly different pathophysiological changes in AD and DP.

P-33
Proton Magnetic Resonance Spectroscopy in Schizophrenia associated with Gilbert's syndrome

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Whether patients with schizophrenia associated with idiopathic unconjugated hyperbilirubinemia (Gilbert syndrome, GS) have specific changes in brain metabolism was examined on proton magnetic resonance spectroscopy (proton MRS). This study applied proton MRS in the hippocampus, basal ganglia, and vermis of the cerebellum of schizophrenic patients with GS (n = 15), without GS (n = 15) and healthy subjects (n = 15). In the hippocampus, schizophrenic patients with GS showed a significant decrease of N-acetyl aspartate/creatine-phosphocreatinine (NAA/Cr) and myo-inositol/creatine-phosphocreatinine (mI/Cr) ratios compared with healthy subjects and the patients without GS. In the basal ganglia, the patients with GS showed a significant decrease of mI/Cr compared with the patients without GS. In the vermis of the cerebellum, the patients with GS showed a significant decrease of mI/Cr compared with healthy subjects. The findings suggest that schizophrenia with GS is a more severe subtype with regard to brain metabolism.

P-34
Comparison of post processing of signals using prior knowledge on proton MR spectroscopy

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The prior knowledge of spectra data can be used for the post processing of MRS signals. The representative programs were MRUI and LCModel, and available by downloading from the web sites. We applied these programs to the same spectra and compared the calculated peak ratios and Cramer-Rao lower bound. MRUI showed some errors on the spectra obtained by short TE, but LCModel could analyse all data with short TE. On the analysis of long TE spectra, the linear correlation ($r = 0.7-0.9$) was found between MRUI and LCModel. The lower bound by MRUI was better than that by LCModel, but the correlation was kept between two methods. The result by two methods was well correlated but MRUI might cause some error for fitting of short TE spectra.

P-35
The tissue classification of brain MR-images, using Self-Mapping characteristic

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Aim: The trial of image transaction as simple brain MR images for non-professional doctor or patient. Method: The model is self-organization and suitable learning of the human brain. The model preserves the input function and makes topological mapping in the network. Calculate the characteristic parameter of pixel of interest, and make the self-organizing map. Instrument: MRI GE Signa Contour (0.5T) T2wi (DICOM data) PC: CPU pentium4 2.4GHz, 1024 MB, OS Windows 2000 SP4,

Visual C 6.0 Enterprise Edition. Result: 1. Automatic classification of brain tissue using self Mapping characteristic of self organizing Map 2. Objective data for diagnosis

P-36

Quantitative brain functional MRI: A New Approach

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In the context of quantitative functional MRI, baseline deoxy-hemoglobin (dHb) content or its equivalent quantity has been indirectly evaluated by use of respiratory CO₂ challenge. We present a direct approach based on quantification of the reversible contribution (R₂') of the transverse relaxation rate, which allows for mapping of cerebral dHb content without any physiologic challenge or physiologic assumption. Combined with functional MRI techniques for CBF and BOLD measurements in photic stimulation experiments for human (8 subjects), the change in CMRO₂ was calculated to be 18.3 ± 6.7% increase in the primary visual area in parallel to 43.3 ± 15.6% CBF increase.

P-37

Different findings of the water and T2 changes in the acute stage of maple syrup urine disease: a follow up study

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The acute phase of the neonatal classical form of maple syrup urine disease (MSUD) is associated with diffuse brain edema and characteristic MSUD edema. We report a follow up study of a baby with MSUD. The acute phase was seen in the eighth day after birth and the 18th month after birth. Image findings of Diffusion-weighted imaging (DWI) studies were really different between these two times. This change thought to be deeply concerned with the progress of myelination. Myelinated area showed a marked decrease in the apparent diffusion coefficient (ADC) compatible with intramyelinic edema. While the unmyelinated area showed an increase in ADC, consistent with vasogenic edema. MSUD edema corresponds to myelinated area of the full-term baby. On follow-up studies, when neurological findings were normalized, the image findings were almost normal except slight delay of myelination. ADC was thought to be within normal limit.

P-38

Utility of Diffusion-weighted MR imaging in diagnosis of postoperative abscess

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There are many reports of utility of diffusion-weighted MR imaging in diagnosis of abscess. We report a utility of diffusion-weighted images in diagnosis of postoperative abscess. Postoperative infection is one of the important complications of surgery. On conventional MR images, postoperative abscess may show atypical finding which is different from general abscess, and its diagnosis may be difficult. We report 5 cases of subacute and chronic postoperative infection. In subacute cases,

diffusion-weighted imaging was useful to distinguish abscess formation from reactive fluid collection. In chronic cases of infection to the encapsulated subdural hematoma, diffusion-weighted image was able to distinguish abscess formation from organized hematoma.

P-39

Diffusion images obtained before and after callosotomy for hemimegalencephaly

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Purpose: We investigate what changes are obtained by the diffusion tensor analysis, when long nerve tracts have been transected. Material and Methods: We analysed the 0 years-old girl with hemimegalencephaly who underwent hemispherectomy for the medical treatment of the refractory epilepsy. As a method, we performed diffusion tensor images before and after the operation, and compared them in various analyses. Result: Fractional anisotropy (FA) in along with transected nerve tracts decreased as compared with the normal side. Conclusion: Child's brain changes dynamically with development. In children, therefore, it is difficult to judge changes by development and changes by the treatment of an operation etc. We wait eagerly for standardization of aging changes of the diffusion image.

P-40

Diffusion tensor imaging of ALS: semi-automatic ROI analysis using DT Tractography

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The purpose of this study is to assess the clinical feasibility of semi-automatic ROI analysis using diffusion tensor tractography in the patients with amyotrophic lateral sclerosis (ALS). 16 patients with ALS (9 limb-onset type, 7 bulbar-onset type) and 9 volunteers were studied. Diffusion tensor imaging (TR6000, TE 78 ms, 13 axes, b-value 1000s/mm², 128x128 matrix, 2 NEX, 5mm thickness, acquisition time 5.5 min.) was performed by 1.5T MR imager (Signa Lx ver9.0). Diffusion tensor tractography (DTT) was visualized by vizDT and Volume-one (original software by Masutani). ROIs were semi-automatically placed on the corticobulbar tract (CBT) and corticospinal tract (CST) and FA values within the ROIs were calculated. Mean FA of ALS patients were significantly lower than that of controls. Mean FA on CBT of bulbar-onset type was significantly lower than that of limb-onset type. DTT could be used to segmentate the white matter tracts for FA analysis.

P-41

Diffusion tensor imaging of COACH syndrome: Absence of the crossing of the superior cerebellar peduncles and corticospinal tract visualized on diffusion tensor imaging of MRI

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We visualized brainstem whitematter anomalies in a case of COACH syndrome by using diffusion tensor imagings (DTI). COACH syndrome is an autosomal recessive disease associates with cerebellar vermis hypoplasia, oligophrenia, ataxia, coloboma, hepatic fibrosis, and renal insufficiency. CNS imaging characteristics are similar to Joubert syndrome: the dysplastic vermis with thick horizontal superior cerebellar peduncles (SCP). Absence of crossing of SCP and that of cortico spinal tract (CST) is also reported in the autopsy case of Joubert syndrome but have not been visualized on MRI. 14 y.o. female case of COACH syndrome underwent DTI of MRI. The crossing of SCP was faint on the axial anisotropic diffusion weighed image (DWI) and color map. The left corticospinal tract was not visualized in the ventral pons on the axial anisotropic DWI and color map, and also the crossing of CST was not visualized on the coronal anisotropic DWI (diffusion gradient = perpendicular to the slice).

P-42

A case report of spinal ganglioglioma

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Ganglioglioma are a rare tumor of the central nervous system, representing only 3 percent of primary CNS tumor. Intramedullary location account about 10 percent of cases. We report a case of spinal ganglioglioma. A 51 years old woman admitted our hospital for 7 years history of lumbago. Neurological examination showed no definite abnormality. Radiography showed dilatation of spinal canal at the lower level of Th11. Magnetic resonance imaging revealed an intradural tumor with solid and cystic components. Partial biopsy was performed, and pathologic diagnosis was spinal ganglioglioma. Although a few cases were reported, this case was eventually compatible with MR imaging of ganglioglioma.

P-43

Two cases of primary spinal germinoma.

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We reported two cases of primary spinal germinoma. Case 1, 35-year-old man with progressive myelopathy from five years ago. MRI showed T2 elongation in the spinal cord at Th6 level without cord enlargement. This year, MRI revealed intramedullary cord tumor at Th6-8 level. Signal intensity on T2WI was iso- or low intensity. At Th9 level, spinal cord was atrophic. Pathological diagnosis was germinoma. Increased serum HCG, Klinefelter syndrome and atrophy with T2 elongation in the left putamen were found. Case 2, 27-year-old man had Klinefelter syndrome and gait disturbance since five years ago. MRI showed atrophy of the cerebellum. Three years ago, MRI revealed intramedullary cord tumor. Pathological diagnosis was malignant glioma. Two years ago, T2WI showed atrophy of the cerebellum with T2 elongation in the cerebellar white matter. Biopsy of the cerebellum revealed germinoma. Reexamination of pathology recognized germinoma in the specimens of the spinal cord.

P-44

Spinal Epidermal Tumor Secondary to Open Myelomeningocele Repair

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Epidermoid tumor of the central nervous system account for less than 1% of all intracranial tumors, and their incidence within the spinal canal is much rare. Epidermoid tumors arise from the invagination of epidermal elements into the neural tube at the time of closure of the neural groove during embryonic period. We reported a 14-month-old boy with spinal epidermal inclusion cyst secondary to open myelomeningocele repair. He had been operated just after birth. Preoperative MRI revealed typical open myelomeningocele without intraspinal mass. Twelve months later, follow-up MRI showed a fat-intensity mass with cystic components at the repair site without any neurological symptom. The mass was resected and proved to be an epidermal cyst with lipoma pathologically. Iatrogenic implantation of epithelial cells during myelomeningocele repair is most likely cause. An acquired epidermoid tumor should be considered as a diagnosis when we encounter an intraspinal mass in children after repairing open myelomeningocele.

P-45

Evaluation of the lesions mimicking spinal cord AVM on MR imaging

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Four patients with MR findings mimicking spinal AVM are described. These patients were suspected of spinal AVM by MR imaging. DSA was performed and denied spinal AVM respectively. Case1: T2WI showed a hypointense beaded structure on the surface of the conus and post contrast T1WI showed dense enhancement. The operation clarified a schwannoma. Case2: T2WI showed focal atrophy and hyperintensity of the thoracic cord. Post-contrast T1WI showed serpiginous enhancement on the surface of the cord. Although 4 times DSA revealed no spinal AVM, angio-CT showed spinal AVM and the operation clarified the spinal dural AVF. Case 3: T2WI showed the diffuse hyperintensity of the cervical cord and serpiginous flow void on the surface of the cord. DSA clarified the dural AVF of the jugular foramen with spinal venous drainage. Case 4: Although post contrast 3-D fastSPGR showed the slightly dilated vessel near the conus, it was diagnosed as the normal vein.

P-46

Stent placement for intracranial lesions

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We discussed effectiveness and problem of stenting for intracranial vascular lesions. Three of intracranial IC-stenosis, which suffered infarction, were attempted to stenting. Two were succeeded of stenting, but one was incompletely due to winding of cervical IC. One was observed re-stenosis in stent on 6 months after treatment. Another was performed successful stenting for contralateral cervical IC-stenosis, simultaneously. Systemic heparinization and trans-femoral approach, no ischemic complications. Two of ruptured VA-aneurysm were performed of stent-supported neck plasty technique. One was ruptured

VA-DA, with contralateral VA hypoplasia. First, stenting at dissection, following GDC embolization through stent mesh, GOS was GR. Other was ruptured broad-neck VA-union-aneurysm. Rupture during stent placement procedure, discontinuation of placement and emergency embolization of GDC only, GOS was D. Stenting for intracranial complex vascular lesions was useful treatment, if could to delivery of stent-device. It was expected to development of stenting for intracranial vascular lesions, and proficiency of our technique.

P-47

Intraaneurysmal embolization of dumbbell-shaped intracranial aneurysms simultaneously using a double microcatheter technique and a balloon-assisted technique

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We describe a double microcatheter technique in combination with a balloon-assisted technique to treat two patients with large, dumbbell-shaped intracranial aneurysms for detachable coil treatment. The aneurysms were completely occluded using this technique. One patient could be accomplished this treatment via unilateral femoral artery approach by use of a 7 French guiding sheath. Follow-up studies at 6 months showed good results in both patients.

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Embolization for cerebellar AVM with aneurysm - 2 cases report

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We reported two cases of cerebellar AVM with aneurysm. Case 1 is 69 y.o. male presenting with intraventricular hemorrhage. Angiography revealed AVM supplied by left PICA with multiple aneurysms on hemispheric branch. Aneurysms are embolized by using liquid material completely but nidus is opacified by left SCA partly. Case 2 is 68 y.o. male presenting with SAH. Angiography showed AVM supplied by right AICA with aneurysm located on the brachial loop. Aneurysms are embolized by using liquid material completely, but nidus is opacified by right SCA. Patient suffered from dysphasia due to brain stem infarction. Although embolization of cerebellar AVM with aneurysm is feasible, interventionalist should be familiar with anatomical knowledge.

P-49

Clinical experience of spinal arteriovenous malformations encountered by an interventional neuroradiologist in a local city

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Purpose: To share the clinical experience of spinal arteriovenous malformations (AVM), relatively rare diseases, encountered by a neuroradiologist in a local city. Subjects: 11 patients of spinal AVM consecutively experienced by the first author as an interventional neuroradiologist from September 1995 to July 2003, nine men and two women, one to 84 years of age. Results: Four patients were with dural arteriovenous fistula (AVF), seven with perimedullary AVF. Embolization using n-butyl cyanoacrylate (NBCA) was performed as a curative treatment in five patients, and complete obliteration was achieved in four. The other patients underwent surgery alone or after embolization. Complete obliteration was achieved in eight patients, and clinical amelioration was observed in all the patients. Conclusions: With proper selection of treatment modalities and patients, complete obliteration and clinical amelioration could be achieved in most of patients with spinal AVM even in a medical environment in a local city.

P-50

Continuous catheter perfusion with heparinized saline using a syringe pump in intraoperative cerebral angiography

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To determine the safety of intraoperative angiography with a continuous perfusion of a small amount of heparinized saline using a syringe pump through a catheter placed in the cerebral artery. Four patients with brain AVMs and one patient with a brain AVF were examined. Three internal carotid arteries and three vertebral arteries were catheterized. Saline containing 2,000 or 8,000 units of heparin per liter was perfused at a rate of 3mL/hr. The duration of the continuous perfusion ranged from 6 to 9.5 hours. The approximate total volume of the perfused saline was 18 to 29 mL per catheter. The approximate total dose of the perfused heparin was 40 to 230 units per catheter. No complications due to the intraoperative angiography were observed in this study. For intraoperative angiography, a continuous perfusion using a syringe pump through a catheter placed in the cerebral artery would be appropriate.

P-51

Tailored reproduction of main arteries from the aortic arch to the intracranial major trunks in a three-dimensional concrete model individualized for each person

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Purpose: To develop a method of tailored reproduction of arteries from the aortic arch to the intracranial major trunks in a three-dimensional concrete model individualized for each person, which would be useful for pretherapeutic planning and simulation as well as for experiments on flow dynamics. Method: Three-dimensional data of arteries from the aortic arch to the intracranial major trunks in a normal adult were collected with 3D TOF MR angiography and contrast-enhanced MR angiography. Data were transferred and processed to make a cast with Rapid Prototyping technology. The cast was buried in a pool of liquid silicone and after the silicone solidified, the cast was removed. Result: A block of silicone that contained hollow luminal spaces reproducing those of the original arteries was obtained. Conclusion: Tailored reproduction of arteries from the aortic arch to the intracranial major trunks in a three-dimensional concrete model for each person would be possible.

P-52**Erectaneous vertebroplasty - the basic indications, techniques and outcomes**

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Purpose: To present the basic indications, techniques and outcomes of percutaneous vertebroplasty (PV) based on our clinical experience. Materials and Methods: We performed PV for 60 treatment levels in 35 patients which comprises of 52 osteoporotic and 8 metastatic fractures. Results: Pain relief was achieved in the majority of patients and no significant complication was noted. Percutaneous vertebroplasty was thought to be a simple, useful and safe method. Conclusion: On the basis of our clinical experience, we believe that PV is an important option for pain relief in vertebral compression fractures.

P-53**A new clinical application of CT-guided percutaneous vertebroplasty with n-BCA injection for metastatic bone tumor**

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A 76-year-old male with metastatic sacral tumor from hepatocellular carcinoma presented with unbearable low back pain. Percutaneous vertebroplasty was requested because of failure of narcotics, radiotherapy, transcatheter arterial embolization and local n-BCA injection. CT-guided vertebroplasty with n-BCA injection successfully relieved the patient's pain. Follow-up MRI after the procedure showed no growth of the tumor. Percutaneous vertebroplasty is thought to have a role to control tumor growth and relieve pain. Moreover, local n-BCA injection controlled bleeding effectively during the procedure and could have an additional effect to control the tumor. A new clinical application of percutaneous vertebroplasty is thus presented.

P-54**Cement distribution patterns on percutaneous vertebroplasty; Correlation with MR findings**

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Purpose: To correlate the distribution patterns and leakage of cements during vertebroplasty with MR findings. Methods: The

vertebral lesions were classified into 4 patterns based on MR findings (1. Acute changes 2. Necrosis. 3. Cleft. 4. Tumors). The distribution of cements were classified into 3 patterns (1. Trabecular. 2. Solid. 3. Mixed). We examined the relationship between the distribution patterns and the leakage of cement, and correlated them with MR findings. Results: All vertebral bodies showed acute changes on MRI but often mixed with necrosis and/ or clefts in the same vertebral bodies. Trabecular pattern was seen only in the areas of acute changes. When necrosis or clefts were present, cements tended to show solid distributions, making a mixed pattern. Cement leakage was observed mainly in the vertebral bodies with solid or mixed patterns. Conclusions: Distribution and leakage of cements during vertebroplasty may be predicted from MR findings.

P-55**3D rotational imaging for assessment of extent of cements after vertebroplasty**

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Purpose: To evaluate 3D rotational imaging findings for the extent of cement after vertebroplasty, comparing those findings with CT. Materials and Methods: We treated 50 vertebral bodies (42 vertebral bodies were benign and 8 were metastasis) in 35 patients. 3D rotational imaging was performed after finishing injection of cement, then producing volume-rendering (VR) and multi-planar reconstruction (MPR) images. We evaluated the extent of cement, especially focusing on posterior edge of vertebral bodies, foramina, pedicles, disks and veins, then compared those findings with those of CT. Results: CT was superior to 3D rotational imaging with regard to overall image quality. On 3D rotational imaging, MPR images could clearly show the extent of cement. The findings were mostly equivalent to those on CT. VR images were difficult to be evaluated. Conclusion: 3D rotational imaging after vertebroplasty can be performed without any effort to transfer patients and give enough information about the extent of cements.

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