Abstracts From the Twenty-Fourth Annual Meeting of the American Society of Neuroimaging

1. Cranial CT in Patients with Infectious Crimean Hemorrhagic Fever
Yunus T. Efendiev, Baku-sity, Azerbaijan

Hemorrhagic fever (acute infectious capillary toxicity) is the viral infection of CNS. This zoonosis is common for Southern Russia and Central Asia. We performed this study to evaluate changes discovered by cranial CT in this rare disease. 12 patients in acute stages of hemorrhagic fever were observed. CT detected no brain pathologies, or found slight intracranial hypertensive changes in 5 patients. In 4 patients, CT revealed small (5-7 mm) multiple fresh cerebral hemorrhages, predominantly in the subcortical junction of gray and white matter. 3 patients had multiple foci of demyelination (5-7 mm), also proven by MRT. Same patients were observed in the late stages of disease. During the recovery period (3-9 months later), CT detected no cerebral abnormalities in 50% of patients. They had no severe hemorrhagic or neurologic syndromes in the early stages. Other 50% of patients in the recovery period had postischemic and posthemorrhagic multifocal hypodense infarctions and small cysts, prevalently in subcortical white matter and insular area. These local lesions were not round, but spindle-shaped, prolated in the direction of small arterioles. This correlates to pathoanathomical data, confirming the existence of stretched subcortical perivascular infarctions typical for hemorrhagic fever.

2. Detection of Loss of Gray White Matter Differentiation (GWMD) on CT Scan: Interrater Reliability of CT Interpretation by Neurologists
Michel Torbey, Worcester, MA, and Lawrence Recht, Baltimore, MD

Objective/Background: Loss of GWMD on CT scan might carry some prognostic value in cardiac arrest patients. We wanted to assess the interrater reliability of academic neurologist when reporting the visual loss of GWMD on CT scan.

Design/Methods: In a retrospective review, CT scans of 41 cardiac arrest patients were identified. We asked two academic neurologists to classify scans regarding the presence or absence of GWMD. Interrater reliability was expressed as percent agreement and k value. Agreement expected due to chance was also reported.

Results: The observed agreement between neurologists was 68%. The agreement expected on the basis of chance only was 44%. Hence the actual agreement beyond chance was 24%. The interrater reliability constant (K) was 0.424 (p = 0.001).

Conclusion: Perhaps other methods such as Hounsfield Unit (HU) measurement may have a better predictive value for determination of GWMD.

3. Middle Cerebral Artery Infarction and Basal Ganglia Calcification in Prader-Willi Syndrome
M. J. Baker, S. R. Benbadis, and L. D. Prockop, Tampa, FL

Prader-Willi Syndrome (PWS) is a genetic disorder characterized by obesity, mental retardation, short stature, acromacia, and hypogonadotropic hypogonadism. Typically, PWS arises from a paternal deletion of chromosome 15q11.2-12. Type II diabetes mellitus, obstructive sleep apnea, and congestive heart failure are frequent complications of PWS, increasing the risk for cerebrovascular disease. We describe a case of PWS with MRI and CT findings and with the accelerated development of cerebrovascular disease, resulting in a left middle cerebral artery infarction, and the incidental finding of bilateral basal ganglia calcification (BGC). Stroke in PWS has been documented only once in the literature with a case of bilateral middle cerebral artery occlusion and associated MoyaMoya phenomenon. Calcification of the basal ganglia has not been previously described in PWS. Future studies in this patient population may yield insight into the relationship among pathophysiology of stroke, diabetes, and obstructive sleep apnea.

4. Proton-MR-Spectroscopy of Neurometabolites in Hepatic Encephalopathy
B. Turowski, A. Delcker, and F. E. Zanella, Frankfurt, Germany

Introduction: Hepatic encephalopathy (HE) is associated with typical changes of neurometabolites (e.g. increase of Glutamine) probably caused by an elevated ammonia level, which is an accepted surrogate parameter in clinical trials. Those neurometabolites can be assessed in vivo by proton magnetic spectroscopy. The aim of this study was to show the effect of L-ornithine-L-aspartate (LoLa) on the Glutamine+Glutamate/Creatine (Glu+Gln/Cr) ratio as a surrogate endpoint of HE.

Methods: In an open trial 15 patients (mean age 57 years) with a HE (14 HE-grade I, 1 HE grade II) were treated with one i.v. infusion of 40g LoLa. Immediately before and 6 hours after the start of infusion a spectroscopy of the parietal white matter was performed and at the same time arterial blood ammonia level was quantified.

Results: Based on an ITT analysis, neurometabolites were significantly correlated with ammonia data (correlation 0.72, p < 0.001), before and after LoLa infusion. In addition, a significant correlation for the change of values during the infusion existed between the parameters blood ammonia level and Glut+Gln/Cr-ratio (correlation 0.54, p < .04).

Conclusion: Magnetic resonance spectroscopy detects changes of neurometabolites in HE. LoLa induces an effect on Glu+Gln/Cr-ratio, which is significantly correlated with the effect on arterial blood ammonia. These data support that spectroscopy can be used as a cerebral surrogate endpoint in future clinical trials in HE.

5. A Semiquantitative MRI Method of Rating Regional Brain Atrophy in Multiple Sclerosis
Rohit Bakshi, Ralph H.B. Benedict, Robert A. Bemmel, and Lawrence Jacobs, Buffalo, NY

Brain atrophy may occur early in the course of MS and may relate to disability. Brain MRIs of 114 MS patients (Group A) were analyzed for regional atrophy (vs. age-/gender-matched controls) and T1 and T2 lesions using 4-point rating systems. A second group of 35 patients (Group B) was analyzed for cortical atrophy (ordinal scale), 3rd
ventricular width, and total T2 hyperintense lesion volume (computer-assisted). In Group A, regression modeling indicated that inferior frontal atrophy (p = 0.0003) and T2 lesions in the pons (p = 0.02) predicted physical disability (EDS score). Secondary progressive (SP) vs. relapsing patients were predicted by inferior parietal (p = 0.002), superior parietal (p = 0.006), temporal (p = 0.008), inferior frontal (p = 0.01), superior frontal (p = 0.01), cerebellum (p = 0.01), occipital (p = 0.01), and midbrain (p = 0.02) atrophy. SP patients were also predicted by total atrophy (p = 0.01) and third ventricular enlargement (p = 0.03), but not T1 or T2 lesions. In group B, regression model predicting EDSS included only superior frontal atrophy (rho = 0.515; p = .002). Mean kappa coefficients of ordinal ratings were 0.9 (intra-observer) and 0.8 (inter-observer). Ordinal ratings correlated well with quantitative assessments. We conclude that brain atrophy is closely associated with physical disability and clinical course in MS and can be appreciated using a semiquantitative MRI regional rating system.

6. Bicaudate Ratio as a Marker of Brain Atrophy in Multiple Sclerosis: A Quantitative MRI Study Robert A. Bermel, Rohit Bakshi, Jacek Dmochowski, Buffalo, NY; Shelton D. Caruthers, St. Louis, MO; and Lawrence Jacobs, Buffalo, NY

Brain atrophy has emerged as a useful surrogate marker of disease involvement in MS. We used the bicaudate ratio (BCR) to measure subcortical atrophy in 60 MS patients and 50 age-/sex-matched normal controls. BCR—the minimum intercaudate distance divided by brain width along the same line—and manually-traced hyperintense parenchymal lesion volume (PLV) were measured on a workstation using 5-mm interleaved axial T2-weighted FLAIR ± images. The intraobserver coefficients of variation were 2.3% for BCR and 1.2% for total PLV. Increasing BCR was associated with increasing age in both groups (p < 0.05). BCR was higher in MS patients (0.11 ± 0.03) than controls (0.09 ± 0.02) after adjusting for age (p < 0.001), indicating subcortical atrophy in MS. BCR was associated with total PLV (Spearman rho = 0.517, p < 0.001). BCR, but not total PLV, was inversely correlated with Symbol-Digit Modalities Test (SDMT) performance in MS patients (rho = 0.481, p < 0.02). Associations between BCR and PLV (p < 0.001) and between BCR and SDMT score (p < 0.01) remained significant after adjusting for age. BCR and total PLV did not differ between relapsing-remitting and secondary progressive patients and were not associated with EDSS disability scores. BCR may be a useful measure of subcortical atrophy to complement T2 lesion load assessment in MS.

7. Brain CT and MRI Findings in 97 Patients with Intracranial Tuberculoma Mohammad Wasay, Asumul Bhojo, Mahesh Moolani, Jazia Zaheer, Margaret Pui, and Arif Sanwari, Karachi, Pakistan

Background and Objective: Intracranial tuberculoma is a rare space-occupying lesion. Characteristics of tuberculoma on CT and MRI are not well-known. Methods: The charts of all patients with intracranial tuberculoma were reviewed at AKU Hospital during the period of 1988-1999. The diagnosis of tuberculoma was based on pathology (n = 18), space occupying lesions responding to tuberculosis chemotherapy (n = 57) and space occupying lesions in patients with evidence of systemic tuberculosis (n = 22). MRI was performed in 35 patients while CT scans were done in 62 patients.

Results: A total of 97 patients were reviewed. Age range was 1-75 years (mean 30 years). 41 patients were male. Number of lesions ranged from 1-100+. 30 patients had solitary lesions while 67 patients had multiple lesions. 55 patients had lesions in supratentorial region (cerebral hemispheres, basal ganglia, thalamus), 13 patients had infratentorial lesions (brain stem and cerebellum) and 29 patients had lesions in both supratentorial and infratentorial region. 37 patients had hydrocephalus, of which 21 patients underwent ventricular shunt placement. Cortical or subcortical infarctions were present in 11 patients. More than 350 lesions were counted on post contrast MRI images. Size (diameter) of these lesions ranged from 1mm-5cm. 86% lesions were less than 1 cm, 11% lesions were 1-3 cm and 3% lesions were more than 3 cm.

Conclusion: Multiple tuberculoma and infratentorial tuberculoma were more common in our patient population as compared to previous reports. Most of these lesions are less than 1 cm. Hydrocephalus is common in these patients.

8. The Role of Limited MRI in Acute Ischemic Stroke Stephen D. Samples, Verk Krieger, and Irene Katz

Objective: To examine the role of limited MRI in acute ischemic stroke.

Introduction: Computed tomography (CT) is often the first radiologic test utilized in acute stroke because it is quick and accessible. As a diagnostic tool, it is not very sensitive detecting only 12% of ischemic strokes in the first 48 hours (unpublished data). A complete Magnetic Resonance Imaging (MRI) protocol is sensitive for ischemic stroke but may require too much time. Therefore, we set out to determine if a limited MRI could provide information that could help determine the initial treatment in acute ischemic stroke.

Methods: The diffusion-weighted MRI (MRD) and fluid-attenuated inversion recovery (FLAIR) sequences of 50 consecutive Cleveland Clinic Foundation (CCF) stroke patients were reviewed by 2 blinded CCF Stroke Neurologists. Each reviewer determined the stroke source (cardioembolic, large vessel, or small vessel) and the appropriate treatment (anti-platelet therapy for small vessel and anti-coagulation for large vessel and cardioembolic). Their evaluations were compared to each other and to the source determined by the diagnostic workup.

Results: Individual reviewers were correct at determining the stroke source 66% of the time. Both reviewers were correct in 50% of cases (k = 0.47). Individually, the correct treatment was chosen in 84% of cases and both were correct for 78% (k = 0.7).

Conclusion: A limited MRI requires less than 10 minutes and may provide significant information. Although we were unable to determine the stroke source in a significant number of cases, we were able to select the appropriate therapy (as defined for this study). These results may suggest a role for limited MRI in acute cerebral ischemia.
9. MRI Appearance of Spinal Infections

Saadat Kamran, Lexington, KY

Purpose: To report various appearances of spine infections and abscess formation.

Patients and Methods: Imaging database for the years 1997-98 was reviewed for spinal infections. Contrast enhanced MRI was reviewed with special attention to the appearance of disc, adjacent vertebral end plate and associated spinal abscess formation. Surgical specimen/biopsy culture was available in all patients. A detailed chart review was performed for clinical information.

Results: Eight patients with spinal infection were identified. Age range was 24 to 57 years, seven men and one woman. Offending organisms were Staphylococcus Aureus (n = 6), Mycobacterium Tuberculosis (n = 1), and Staphylococcus Epidermidis (n = 1). Location was cervical (n = 2) and lumbar (n = 6). Number of levels of disc space involvement was one (n = 6), two (n = 1), and three (n = 1). Six patients had associated epidural abscess; in addition, TB patient had prevertebral and epidural abscess. Spinal abscess extended over one vertebral level in four (n = 4), two vertebral levels (n = 1), and pan-epidural abscess involving entire spine in one patient. Vertebral end plates were T2 hyperintense, T1 hypointense with enhancement in (n = 6) patients. The clinical presentation was severe back pain and myelopathy (n = 4), severe back pain and radiculopathy (n = 1), obtundation and myelopathy (n = 1), back pain and fever (n = 1), and severe back pain alone (n = 1). Risk factors were HIV (n = 1), intravenous drug abuse (n = 1), and discography (n = 2). Multilevel infection was seen with intravenous drug abuse and HIV.

Conclusion: Spinal infection may present without epidural abscess. Early disc space infection causes obliteration of the intercortical cleft without significant endplate changes in post-discography patients. In these patients, disc space shows clear enhancement. There was no clear distinction between TB and bacterial spine infections.

10. Isolated Intramedullary Hemangioblastomas of the Spinal Cord

Tibor Becske, Chanland

Roonprapunt, Fred Epstein, and George Jallo, New York, NY

Background: Isolated hemangioblastomas of the spinal cord are much less common than posterior fossa hemangioblastomas in patients without von Hippel Lindau (vHL) disease. They account for 1.6-7.5% of all primary spinal tumors.

Methods: We reviewed the imaging characteristics of nineteen consecutive patients. All patients underwent preoperative MRI scans; nine had preoperative spinal angiogram. In addition, all patients had neuroimaging of the entire neuraxis and neuro-ophthalmological evaluation to rule out vHL disease.

Results: Thirteen of the 19 cases occurred in the cervical cord, 5 in the thoracic cord, and 1 in the conus. On MRI, the tumors were dorsally located, exhibited homogenous enhancement and a cystic component on T1WI. All cases had an associated syrinx and some degree of edema as seen on T2WI. Arterial feeding vessels were mostly derived from the posterior or lateral spinal arteries. There was no specific draining pattern. Tumors with anterior venous drainage were associated with more edema on MRI.

Conclusions: Isolated spinal hemangioblastomas are rare spinal cord tumors. A constellation of a homogenously enhancing mass associated with cyst, syrinx and relatively pronounced cord edema can help in differentiating this neoplasm from other intramedullary tumors.

11. Normal Diffusion MRI: Are We Missing Ischemic Penumbra?

Saadat Kamran, Lexington, KY; Vernice Bates, Buffalo, NY

Background: Acute stroke treatment with thrombolytics is time limited. Recently functional MRI (diffusion-Perfusion MRI and PET studies have been used to identify ischemic tissue at risk of infarction.

Purpose: To identify and treat acute stroke patients with ischemic penumbra beyond the treatment time window.

Patients and Methods: All acute stroke patients with normal CT scan that presented beyond the treatment time window were included in the study. Patients underwent MRI, MRA, and diffusion-perfusion studies. Additional studies (SPECT and cerebral angiography) were obtained when clinically indicated and logistically possible. Treatment consisted of I/V r-tPA for MCA occlusion/stenosis, carotid stenting/angioplasty when carotid lesions were accessible and EC-IC bypass for patients who could not be treated with R-tPA or stenting. I/V r-tPA protocol had hospital IRB approval. The clinical condition was graded using pre-treatment and discharge NIHSS.

Results: In three months period 20 acute stroke patients were admitted with normal CT scans and stroke onset of more than three hours. Eleven patients could not get perfusion-diffusion studies and were excluded. Average time from ictus onset to MRI was 6.25 hours (range 3.45 to 17 hours). All MRI and diffusion (ADC maps) were normal. MRA showed MCA severe stenosis/occlusion (n = 5), ICA severe stenosis (n = 4). Perfusion images showed delayed arrival of contrast on the symptomatic side in all patients (elevated MTT, TTP and time to arrival), without any rCBF changes. SPECT was obtained in 3 patients. SPECT area of hypoperfusion matched the increased MTT and TTP on perfusion studies. Cerebral angiography confirmed ICA severe stenosis in two patients undergoing carotid stenting and angioplasty with slow leptomeningeal flow over the symptomatic area. Post stenting there was resolution of slow flow and improvement in perfusion on SPECT (n = 3). Average time to treatment was 11.82 hours, I/V r-tPA was 5.23 hours, carotid stenting/angioplasty 10 hours and EC-IC bypass 72 hours. Pre-treatment average NIHSS was 13 (range 8 to 22) and post-treatment (discharge) NIHSS was 4 (range 0 to 12). One I/V r-tPA patient failed to recanalize and developed hemorrhagic transformation of the infarct without further clinical deterioration.

Conclusion: Perfusion MRI without decrease in rCBF, with normal diffusion study most likely reflects ischemic penumbra. MTT reflects the extent of tissue at risk of infarction. This tissue can be salvaged with appropriate treatment. Acute stroke treatment should not be time limited. A larger study is required to validate the concept of tissue window for acute stroke treatment.
Medial medullary stroke (MMS) accounts for 0.5% of all cerebral infarcts, and bilateral MMS is even more rare. We present a case with right medullary infarct progressing to bilateral MMS documented by neuroimaging and autopsy. A 64-year-old African-American woman, smoker, with history of hypertension, hepatitis C, chronic renal insufficiency presented with left hemiparesis sparing the face, upbeat nystagmus, labile blood pressure, tachycardia, dysphonia and right tongue deviation. Head CT was normal but diagnosis of medullary stroke was entertained and confirmed by brain magnetic resonance imaging (MRI). Magnetic resonance angiography (MRA) revealed right vertebral artery stenosis and tortuous basilar artery. She was treated with intravenous heparin. One day later she developed right hemiparesis and experienced respiratory distress requiring intubation. Repeated diffuse weighted imaging revealed bilateral MMS. Patient later was unable to move her tongue or facial muscles. She died 2 months later due to worsening renal insufficiency and sepsis secondary to peritonitis. Autopsy showed cystic bilateral medullary strokes with vertebral artery stenosis and 50% basilar artery stenosis. This is the first report of progressive unilateral to bilateral MMS documented by serial imaging and autopsy. The cause of the infarct was likely related to vertebral artery atherosclerosis.

13. Sneddon’s Syndrome, Intracerebral Hemorrhage and Cerebral Angiomatosis: A Case Report Francisco de Assisi Aquino Gondim, Rodney L. Leacock, T. A. Subramanian, and Salvador Cruz-Flores, St. Louis, MO

Sneddon’s syndrome is characterized by livedo reticularis, multiple strokes and positive antiphospholipid antibodies. Intracerebral hemorrhage (ICH) has not been reported as presenting complaint. A 38-year-old woman was found unresponsive. A left parietal lobar hemorrhage with subarachnoid and intraventricular extension was observed by computed tomography (CT). She had history of two miscarriages, Raynaud’s phenomenon, livedo reticularis and behavioral changes prior to this event. Her livedo reticularis worsened after her first pregnancy. The patient was disoriented, had global aphasia, nuchal rigidity, pallilalia, and perseveration. An angiogram revealed leptomeningeal and deep angiomatosis that was called “vasculitis.” Drug screen, ANA, VDRL, HIV test, rheumatoid factor, p/c-ANCA, serum electrolytes, C3/C4/CH50, AT-III, protein C/S, anti-smooth muscle, anti-centromer, SS-A/B, RNP, SCL-70 and anti-histones were negative. Her ESR was normal and her antiphospholipid panel was positive. A right frontal brain biopsy did not reveal vasculitis. Brain MRI/MRA showed residual ICH, diffuse atrophy, multiple small white matter infarcts and leptomeningeal enhancement especially over parieto-occipital regions. This case illustrates two points: a) first report of Sneddon’s syndrome and ICH with leptomeningeal and deep angiomatosis. A disorder called Divry-van Bogaert shares some of the features raising the question of b) overlapping disorders vs. different end of a disease spectrum.


Objective: To report the MRI features of two atypical cases of isolated pontine progressive multifocal leukoencephalopathy (PML). Background: PML is a demyelinating syndrome in immunocompromised patients which most commonly involves the hemispheric white matter. MRI demonstrates focal or multifocal, non-enhancing T2 signal abnormalities within the white matter, without surrounding edema. Involvement of posterior fossa structures occurs in up to 48% of patients, but clinical and radiographic brainstem involvement in isolation is rare.

Case Reports: One patient, a 35-year-old man with AIDS, presented with an isolated right sixth nerve palsy. Initial MRI demonstrated a single, discrete, non-enhancing lesion in the right dorsomedial tegumentum of the pons, which enlarged over four weeks. The second patient, a 37-year-old man with AIDS, presented with progressive dysarthria, dysphagia, and diplopia. MRI demonstrated pronounced T2-signal abnormality throughout the pons, but sparing the decussating axonal fibers, without hemispheric abnormalities or enhancement with gadolinium. Diffuse edema of the pons was noted. Conclusions: PML may involve the pons or brainstem as an isolated mass lesion or as a diffuse, infiltrating lesion, without supratentorial or cerebellar involvement. PML should be considered in the differential diagnosis of focal pontine lesions in immunocompromised patients.

15. Lateral Medullary Infarct Missed by Diffusion Weighted MRI: A Case Report Francisco de Assisi Aquino Gondim, Yi Pan, Rodney L. Leacock, and Salvador Cruz-Flores, St. Louis, MO

Diffusion weighted imaging (DWI) is thought to be very sensitive to identify early cerebral ischemia, and practitioners may assume that the absence of abnormalities indicates no ischemia. We present a case of lateral medullary stroke that was missed by DWI. A 45-year-old African-American male presented with lightheadedness, dysarthria, ataxia, left side hemihyposthesia, dysphagia, and later hiccup. His neurological exam was normal except for fluctuating decreased temperature sensation on the left hemibody, positive Romberg, and an atactic gait. Brain magnetic resonance imaging and angiography (MRI and MRA) performed approximately 6 hours after the onset of symptoms were negative for ischemia and only revealed dolichoectatic vessels in the posterior circulation. His gait did not improve and non-organic disorder was suspected. Repeated MRI revealed a small right medullary stroke in the fluid attenuated inversion recovery (FLAIR) sequence. A few days later, he devel-
opoped a right Horner’s syndrome, right ocular tilting and hyperreflexia in the right upper extremity.

DWI is an excellent tool to identify early cerebral ischemia although its sensitivity and positive predictive value are not known. This report along with few others indicate that in patients with suspected cerebral ischemia, a normal DWI does not rule out infarction.

16. MRI Leads to Correct Diagnosis in a Healthy Patient with PML Maxim D. Hammer, Stephen D. Samples, Hans O. Lüders, and Jeff Ross, Cleveland, OH

Goal: To review the differential diagnosis of cerebellar white matter lesions.
Case Presentation: A healthy 51-year-old female presented to her local hospital with sudden onset of unsteadiness of gait. A stroke workup was negative. Over the next two months, she accumulated several other symptoms in a step-wise fashion: a clumsy right hand, speech problems, and ocular symptoms. She was transferred to the Cleveland Clinic. Examination revealed scanning speech, ocular flutter, marked bilateral dysmetria, and gait ataxia. Her MRI showed abnormal increased signal on the FLAIR and T2 sequences, involving both middle cerebral peduncles, as well as more posterior cerebellar white matter, without mass effect or enhancement. There were no other abnormalities, and the MRA was normal. The differential diagnosis based on these findings was primarily viral or postviral rhombencephalitis, HIV, and PML (progressive multifocal leukoencephalopathy). Demyelinating disease, lymphoma, and ischemic injury were felt less likely.

A paraneoplastic workup was negative, and the patient was HIV negative with a normal CD4. Despite the fact that the patient was immunocompetent, a brain biopsy was pursued, based on the radiologic appearance of the lesions. Biopsy revealed the presence of JC virus by electron microscopy. She was started on antiviral therapy, and improved subjectively. A follow-up MRI showed that the cerebellar lesions were stable and that there was a new lesion near the right thalamus.

Discussion: This type of lesion would normally have been worked up for stroke, demyelinating disease, or lymphoma. The atypical MRI findings added to the case by expanding the differential to include viral diseases, specifically PML. These entities would not otherwise have been looked for in this healthy patient. Without the knowledge of the differential of cerebellar white matter lesions, this diagnosis would have been missed.

17. Successful Treatment of Magnetic Resonance Spectroscopy-proven Myelinolysis Vladimir Skijarevski and Rup Tandan, Burlington, VT

Myelinolysis is a rare but potentially life-threatening condition that has a predilection for the central pons, but may affect any part of the brain. Almost invariably, it results from a rapid correction of hyponatremia, although it may occur in other clinical settings as well. So far, no treatment has been proven effective.

We report the case of a 59-year-old woman who acutely developed encephalopathy and quadriaparesis following moderately rapid correction of hyponatremia. Magnetic resonance of the brain revealed increased signal on T2-weighted and FLAIR sequences in the white matter of hemispheres and the brain stem. Magnetic resonance spectroscopy showed increased choline and preserved NAA signal. The patient exhibited a dramatic clinical response to treatment with plasmapheresis and thyrotropin-releasing hormone.

To the best of our knowledge a case of widespread myelinolysis with such a dramatic response to intervention has not been previously reported in the Western literature. Also, we found no reports on spectroscopy in extrapontine myelinolysis. A variety of therapeutic mechanisms of action of TRH have been postulated in myelinolysis. Published anecdotal case reports, including ours, justify further research in this field.

18. Internal Capsule and Corpus Callosum Myelinolysis in an Adult Due to Correction of Severe Hyponatremia Adriana Palade, Tatyana Barsouk, and George Small, Pittsburgh, PA

Central pontine myelinolysis is linked to aggressive correction of hyponatremia, and rarely hypernatremia. In addition to demyelination in the basis pontis, similar lesions have been described in extrapontine locations. We present a case of osmotic extrapontine myelinolysis caused by correction of acute hypernatremia with abrupt onset of altered mental status, hemiparesis and expressive aphasia. A 53-year-old woman with endometrial carcinoma and diabetes mellitus was admitted for oophorectomy and lymph node resection. Postoperatively she was neurologically intact. Seven days later she developed central diabetes insipidus. When the initial serum sodium of 188 mEq/l was gradually corrected to 139 mEq/l over four days, transient expressive aphasia, dysarthria, right upper extremity hemiparesis and right facial droop developed. Bilateral extensor plantar responses were noted. These deficits completely resolved two weeks later. Magnetic Resonance Imaging (MRI) of the brain revealed high signal intensities on T2 weighted imaging of the internal capsules bilaterally, the corticospinal tracts, and the splenium of the corpus callosum. Low B value diffusion-weighted imaging and Fluid Attenuation Inversion Recovery (FLAIR) sequences revealed similar findings. Repeat MRI one year later showed resolution of these abnormalities. Our case describes osmotic extrapontine demyelination in locations not previously reported due to correction of severe hyponatremia.

19. Phineas Cage and the Recurrent Artery of Heubner: A Case of an Acute Frontal Lobe Syndrome S. Schuele, H. Ringendahl, J. Joerg, Wuppertal, Germany

Objective: To investigate the clinicopathological correlation in an acute frontal lobe syndrome by MRI.

Introduction: Infarction in the territory of the anterior cerebral artery (ACA) is uncommon, comprising 0.6% to 3% of cerebral infarctions. The clinical findings of ACA infarctions are not clearly delineated and further confounded by the variable anatomy of the anterior cerebral artery territory.

Methods: We describe the first case of an acute frontal lobe syndrome after infarction of the right anterior cerebral
artery including the recurrent artery of Heubner. Results: Mr. B was a 55-year-old right-handed man who presented with acute onset of akinesis mutism, utilization behaviour, perseveration, memory disturbance and anosognosia. Initial CT showed hypodensity in the right frontal area to the midline and increased attenuation of the right basal ganglia, initially described as simultaneous infarction of the right anterior and middle cerebral artery. MRI revealed infarction of the right caput nuclei caudati, anterior putamen and internal capsule, consistent with involvement of the territory of the recurrent artery of Heubner. The patient underwent clinical and neuropsychological testing for frontal lobe dysfunction at presentation and after 6 months follow-up. Conclusion: This is the first description of a classical frontal lobe syndrome after unilateral infarction of the right anterior cerebral artery. The MRI reveals the involved vascular territory and demonstrates infarction of the right-sided frontal and prefrontal area and anterior basal ganglia. Involvement of the recurrent artery of Heubner appears to be required to explain the extensive deficits in frontal lobe function as demonstrated by neuropsychological testing.

20. Role of MRI in the Diagnosis of Orbital Lesions Ramesh Gopalaswamy, Ronald M. Burde, and Thomas L. Slamovits, Bronx, New York

Case Report: A 42-year-old multigravida presented to the neuro-ophthalmology service with painless, progressive proptosis followed by horizontal diplopia and visual loss in the right eye of 1-week duration. She was in her 36th week of pregnancy, and her prior pregnancies were uncomplicated. There was no previous significant ocular history. After undergoing an uneventful labor and delivery, she developed worsening of her visual symptoms and noted a transient right facial hypesthesia. Ocular findings were consistent with multiple, right sided cranial neuropathies (II, III, V). CT Brain (with and without contrast) was normal. CT orbits revealed extensive abnormal density in the right frontal bone with some expansion, suggestive of fibrous dysplasia of the skull. There was displacement of the right orbital contents medially and anteriorly, especially the lateral rectus muscle resulting in the proptosis. MRI Brain/Orbits with and without fat suppression and Gadolinium enhancement was highly suggestive of a large right intra-diploic meningioma with epidural extension into the right middle cranial fossa with mass effect, and edema within the right temporal lobe. This case illustrates the superior ability of MRI to differentiate meningioma from fibrous dysplasia as the radiological and clinical characteristics of the two can be quite similar and difficult to distinguish.

21. Reversible Thalamic Edema Secondary to Straight Sinus Thrombosis Qing Ni, Becky J. Parks, Amarylis Pascual, and Salvador Cruz-Flores, St. Louis, MO

Cerebral infarction caused by vein thrombosis is associated with hemorrhagic transformation. The imaging and pathological abnormalities rarely disappear. Early vein thrombosis may cause vascular congestion and edema without infarction. A 22-year-old woman presented with two-month history of headache, confusion, nausea and vomiting. Her exam showed decreased attention, increased tone and ankle clonus. There was no papilledema. CSF exhibited an opening pressure 31 cm H2O, 80 WBC mononuclear, RBC 130, protein 1667mg; glucose 50mg and xanthochromia. Magnetic resonance imaging (MRI) revealed bilateral hyperintense thalamic lesions on fluid attenuated inversion recovery (FLAIR) with contrast enhancement on T1. There was an absent flow void in the vein of Galen and straight sinus. Diffusion weighted imaging was not consistent with ischemia. A four-vessel angiogram showed absence of the deep cerebral venous system. She was treated with intravenous heparin and warfarin. One week later her headache disappeared. Follow-up MRI showed recanalised deep venous system and normal brain tissue. The only risk factor was injectable estrogen. Our case illustrates vascular congestion and edema secondary to cerebral vein thrombosis. These changes were rapidly reversible with anticoagulation. This supports the idea that vascular congestion and hemorrhage are the cause of injury in this entity rather than infarction.

22. MRI of Spinal Cord Infarction: The “H” Sign Bing Liu and Frank A. Raila, Jackson, MS

We report two cases of spinal cord infarction (SCI) in a 46-year-old man and an 11-month-old infant. Both developed paraplegia and loss of rectal tone immediately after successful aortic surgery, during which they experienced prolonged hypotension. The man underwent an emergent aorta repair for his incomplete aorta dissection after his automobile accident, and the infant had elective surgery for her Tetralogy of Fallot. MRI reveals abnormal high signal in the gray matter of the thoracic spinal cord and resembles the letter “H” on T2-weighted images. Spinal cord gray matter is very sensitive to hypoxia, and it shows a unique infarction pattern in our two cases. It is unlike that seen in anterior spinal cord infarction, which involves the anterior areas of spinal cord white and gray matter. In our cases, MRI detected early SCI: day 1 for the man and day 4 for the infant, rather than 1-2 weeks after the event as previously reported.

23. Diffusion-Weighted MRI as a Powerful Tool for the Diagnosis of Creutzfeldt-Jacob Disease (CJD) E. Pereria, M. Landrio, and P. Capone, Winchester, VA

Background: CJD is a progressive and fatal dementing disease caused by a virus-like agent called piron. Currently, the definitive diagnosis can only be made through brain biopsy. However, given its potential transmissibility, it is paramount to have a noninvasive and reliable means to detect this disease. Objective: To evaluate the dependability of diffusion-weighted MRI in the diagnosis of CJD. Case Presentation: A 63-year-old man was referred to us because of rapid progressive decline in cognitive functions. Sequential diffusion-weighted MRI was obtained as part of the evaluation. Brain biopsy confirmed the diagnosis of CJD.
Results: The diffusion-weighted images demonstrated extensive areas of hyperintense signal involving the cortex of frontal, temporoparietal and occipital lobes bilaterally. Some of these areas were also noted as slightly increased signal on FLAIR images. The centrum semiovale and basal ganglia nuclei were spared, and there was no global cortical atrophy. Follow-up contrast MRI performed two weeks later remained unchanged.

Conclusions: We confirmed that diffusion-weighted image is the most sensitive sequence and the study of choice for the diagnosis of CJD.

24. Comparison of Transcranial Color-Coded Sonography and Magnetic Resonance Angiography in Acute Ischemic Stroke Li-Ming Lien, Wei-Hung Chen, Jiunn-Rong Chen, Hou-Chang Chiu, Yuh-Feng Tsai, Wai-Min Choi, Patrick Renolds, and Charles Tegeler, Taipei, Taiwan, Winston-Salem, NC

This study was designed to assess the accuracy of transcranial color-coded sonography (TCCS) for intracranial arterial stenosis or occlusion in patients with acute cerebral ischemic as compared to magnetic resonance angiography [MRA]. We prospectively identified 120 consecutive patients admitted with acute ischemic stroke and performed both TCCS and MRA with a mean interval of one day. TCCS data (sampling depth, peak systolic and end diastolic velocity, mean velocity, and pulsatility index) for middle cerebral arteries (MCA) were compared to MRA data which was classified into 4 grades: Grade 1, normal caliber and signal; Grade 2, irregular lumen with reduced signal; Grade 3, absent signal in the stenotic segment (flow gap) and reconstituted distal signal; Grade 4, absent signal. MCA Doppler signals were obtained in 135 vessels and the velocities (peak systolic, end diastolic, mean) were significantly different (p = 0.001, 0.006, < 0.001) among the MRA grades: Grade 1 {100, 47, 73 cm/sec}; Grade 2 (171, 72, 110 cm/sec); Grade 3 (226, 79, 134 cm/sec); Grade 4 (61, 26, 39 cm/sec). Additionally, an MCA peak systolic velocity 120 cm/sec correlates with intracranial stenosis on MRA (Grade 2 or worse) with high specificity (90.5%) and positive predictive value (93.9%), but relatively low sensitivity (66.7%) and negative predictive value (55.1%). In conclusion, elevated MCA velocities on TCCS correlate with intracranial stenosis detected on MRA. A peak systolic velocity 120 cm/sec is highly specific for detecting intracranial stenosis as defined by significant MRA abnormality.


Duplex scanning has become the standard for non-invasive evaluation of carotid stenosis. However, the criteria for threshold stenoses are quite divergent. This study was undertaken to determine velocity criteria by ways of receiver operator characteristic analysis. Data of 134 carotid endarterectomy patients were collected. Doppler systolic, diastolic velocity and Carotid Ratio was compared with the finding of angiogram.

For the detection of 70% stenosis, the best systolic criterion was 240 cm/sec [sensitivity 86%, specificity 87%, area under the curve (AUC) 88.4%], while the best diastolic criterion was 55 cm/sec [sensitivity 86%, specificity 81%, AUC 88.9%]. For 60% stenosis, the best systolic criterion was 225 cm/sec [sensitivity 78%, specificity 88%, AUC 86.8%], while the best diastolic criterion was 50 cm/sec [sensitivity 78%, specificity 79%, AUC 87.1%]. For 50% stenosis, the best systolic criterion was 150 cm/sec [sensitivity 76%, specificity 77%, AUC 86.4%], while the best diastolic criterion was 50 cm/sec [sensitivity 76%, specificity 84%, AUC 87.7%]. Using the combination of systolic and/or diastolic criteria for detecting threshold stenosis did not show significant improvement of benefit.

The validity of carotid ratio was not good enough for detecting threshold stenoses [For 70% stenosis, AUC = 63.4%. For 60% stenosis, AUC = 64.3%. For 50% stenosis, AUC = 70%].

26. Age is an Important Determinant in Cerebral Blood Flow Velocities (CBFV) Following Aneurysmal Subarachnoid Hemorrhage (ASAH)

Michel T. Torbey, T.K. Hauser, A. Bhardwaj, M. Williams, J. Ulatowski, M. Mirski, and A. Razumovsky, Baltimore, MD

Objectives: We tested the hypothesis that (1) TCD determined CBFV is lower in elderly patients following ASAH. (2) clinical VSP (CVSP) occurs at a lower CBFV in elderly patients.

Methods: We retrospectively evaluated all admissions to the Neurosciences Critical Care Unit with ASAH between 1991 and 1999. Only patients with complete medical records and TCD studies were included. Angiogram results were also reviewed.

Results: Patients were subdivided into two groups: < 68 years old (n = 47) and ≥ 68 years old (n = 34). We report:
1) The maximum MCA and ICA CBFV achieved during their hospital stay was lower in the elderly group (76 vs. 114, 76 vs. 126 cm/s, respectively) (p < 0.003).
2) The MCA CBFV was lower in the elderly group at the time of CVSP (± 1 day) [55 vs. 92 cm/s, p = 0.009]. A similar trend was noted in the ICA (p = 0.079).
3) Elderly patients developed CVSP and TCD VSP less frequently than younger patients (44% vs. 66%, p = 0.03) and (23% vs. 42%, p < 0.0001), respectively. A similar trend was noted in angiographic VSP (p = 0.1).

Conclusion: The data suggests that elderly patients: 1) have lower CBFV, 2) develop CVSP at lower CBFV and are less prone to develop clinical, TCD and angiographic VSP.


Objective: To correlate the severity of ipsilateral extracranial internal carotid artery (ICA) lesions with the severity of first-ever hemispheric ischemic stroke.

Methods: Carotid duplex was used to evaluate carotid arteries. National Institutes of Health Stroke Scale was used to describe the severity of the stroke and was stratified as follows: 1-6 = mild,
7-15 = moderate, > 15=severe. Duplex findings were categorized according to velocity criteria into < 50% stenosis if ICA peak systolic velocity (PSV) [cm/sec] < 140; > 50% stenosis if ICA PSV > 140 or ratio of ICA and common carotid artery in PSV > 2; no detectable flow at ICA was considered occlusion.

Results: 219 consecutive patients were enrolled, including 127 mild, 65 moderate and 27 severe stroke. There were 3.6%, 1.4%, 0.9% ICA stenosis > 50%, respectively. 2 patients in severe group had total ICA occlusion. The overall prevalence of significant ICA lesions was 6.8%.

Conclusion: There is no positive correlation of stroke severity with the severity of duplex findings, but this may be due to low prevalence of significant ICA lesions. Most of the patients had mild strokes and the majority had ICA stenosis < 50%. Intracranial artery lesions or other factors causing cerebrovascular disease and related to stroke severity in Taiwanese patients should be investigated.

28. Cerebral Blood Flow Velocities In Very Premature Neonates Treated with Dopamine Paul Maertens, Nader Bishara, Abdel Kasmia, and Fabien Eyal, Mobile, AL

In a prospective study, 10 neonates less than 25 weeks (group 1) and 3 neonates at least 25 weeks but less than 30 weeks (group 2) were examined by transcranial power-based duplex sonography before, during and after dopamine therapy. Blood pressures were recorded simultaneously with blood flow velocities, pulsatility (PI) and Pourcelot’s resistance indices (RI). Neurosonogram was performed at the time of each study to assess the possible effects of intracranial hemorrhages. In both groups of patients, a significant increase in mean flow velocities (MVF) and decrease in PI and RI were seen when mean blood pressure increased with dopamine therapy. Once hypotension was corrected, MVF, RI, and PI didn’t vary significantly with blood pressure but increased as expected with gestation age. There was no correlation between dosage of dopamine and MVF. Neonates who failed to increase MVF and decrease PI and RI with high doses of dopamine died and/or sustained severe (grade 3 or 4) intracranial hemorrhages. These findings suggest that dopamine improves cerebral perfusion in normal very premature neonates. When cerebral perfusion fails to improve, a poor prognosis can be expected.


Introduction: Microembolic signals (MES) have been recently detected by transcranial Doppler (TCD) in patients with and without the fat embolism syndrome (FES) following long bone fractures and during their surgical repair (A Forteza, Stroke 2000).

Paradoxical fat embolism through a patent foramen ovale (PFO) during skeletal surgery is well recognized and may lead to an increase in the systemic embolic load and thereby affect neurological outcome adversely.

Case Report: A 17-year-old girl suffered a femoral fracture and developed FES. TCD showed MES in multiple vascular territories. A large PFO was diagnosed by transesophageal echocardiogram. Deep venous thrombosis was ruled out. A brain MR with diffusion-weighted sequences showed ischemic lesions in watershed territories bilaterally. Percutaneous PFO closure with a CardioSeal device was successfully performed. A dramatic reduction in MES was noted (poclosure mean MES > 12dB 8 per study, range 4-12; post-closure mean 0.7, range 0-4) and clinical improvement followed. Subsequent surgical repair of the fracture under TCD monitoring was uneventful.

Discussion: Large fat globules have been shown crossing a PFO during orthopedic procedures and neurological worsening frequently follows bone surgery. Our patient was at risk for further neurological deterioration intra-operatively. Closure of the PFO resulted in reduction in the number and intensity of MES and was accompanied by clinical improvement. This is also the first report of diffusion abnormalities in the FES.

30. Transcranial Doppler Ultrasound: A New Method of Monitoring Hemispheric Anesthetization

During the Intracarotid Amobarbital Procedures (IAP) Vinita J. Acharya, Winston Salem, NC

Rationale: To determine if middle cerebral artery (MCA) blood flow changes using continuous transcranial doppler (TCD) monitoring are a measure of hemispheric anesthetization during IAP.

Methods: We performed continuous TCD monitoring during the IAP in 10 patients with medically intractable partial epilepsy. Mean velocities were monitored continuously in both MCAUs. The changes in MCA velocities on continuous TCD monitoring were time-locked with the EEG changes.

Results: The baseline average mean MCA velocities were within normal limits bilaterally (68-85 cm/sec) in all patients. Mean MCA velocities increased in both patients to 95-105 cm/sec at the beginning of the test. This initial rise was followed by a considerable reduction in mean MCA velocities on the ipsilateral side after injection of sodium amobarbital to values of 5-33 cm/sec in all patients, returning to the baseline with the recovery of hemiparesis. In eight patients, the duration of delta activity on EEG coincided with the time interval during which the mean MCA velocities were low on TCD monitoring, whereas in two, the EEG remained normal on the ipsilateral side.

Conclusions: Continuous TCD monitoring may be a useful method of determining the effects of hemispheric anesthetization during IAP and may be more accurate than conventional EEG.

31. The Role of Induced Hypervolemia in the Interpretation of Transcranial Doppler (TCD)-Measured Cerebral Blood Flow Velocities (CBFV) P. Varelas, W. Ziai, M. Mirski, and A. Razumovsky, Baltimore, MD

The effect of the increased rate of fluids given for vasospasm treatment after subarachnoid hemorrhage (SAH) on the CBFV measured by TCD is not clear. We examined the effect in normal subjects and patients with SAH. One liter N/S 0.9% bolus was given by IV infusion, followed by 200, 300, 400 cc/hour, for 3 hours each and a bolus of 0.5 L CBFV of the anterior circulation...
vessels were measured by TCD at baseline, after every fluid bolus or rate change, and at 24 hours. Two M and 3 F volunteers (mean age 41.4 years) consented. The mean net volume at the end of infusion was 3.2 L and at 24 hours 1.5 L. No significant change in the mean arterial pressure or the CBFV compared to baseline was found, except for the CBFV in the right Internal Carotid Artery (ICA) after the bolus of 1 L and the right Middle Cerebral Artery at the end of the infusion (61.6 ± 8.5 vs. 70.8 ± 11.1 cm/sec and 68.4 ± 12.2 vs. 84.4 ± 6.5 cm/sec, respectively, P < 0.05 Wilcoxon). An increase of the right intracranial/extracranial ICA CBFV ratio was found after the 1 L bolus (1.8 ± 0.4 vs. 2.5 ± 0.8, P < 0.05).

Preliminary results of this ongoing study showed presence of autoregulation in normal subjects. The increased CBFV found in two vessels may be due to the small number of subjects. We are presently enrolling patients with SAH.

32. Opportunity Costs in Technology Utilization: Added Value of the Vascular Laboratory Robert A. Boyajian, and Shirley M. Otis, La Jolla, CA

Introduction: Today’s neurosonology laboratory technology offers broad applications throughout vascular medicine. We explore the added value of noninvasive Doppler and duplex ultrasonography with respect to medical value, quality, and cost-containment in vascular diseases management.

Methods: Specialized diagnostic studies for prevention of stroke and pulmonary embolism, and diagnosis and management of femoral pseudoaneurysm were reviewed for our 355-physician clinic and hospital practice. Invasive and noninvasive procedures and costs were accounted for diagnosing carotid stenosis (n = 4211 duplex and angiogram studies); deep venous thrombosis (n = 7932 duplex and venogram studies); and intrafemoral femoral pseudoaneurysm (n = 299 duplex studies).

Results: Estimated and projected cost burdens were plotted onto an axis from 0% to 100% utilization of noninvasive technology. Assuming no discounting of medical value, i.e., if all patients undergo indicated testing irrespective of cost or risk, the projected opportunity cost associated with 100% noninvasive diagnoses (compared to 100% invasive) would be $6 million over two years. Actual opportunity costs of incremental changes to prevailing practice patterns are readily estimated from the graphic model. Conclusion: A graphical model based on technology utilization mix was developed illustrating the relationship between resource allocations for noninvasive laboratory services and levels of medical value, quality, and cost-containment in vascular diseases management.

33. A Pitfall of Electron Beam CT Angiography in Diagnosis of Subclavian Steal Syndrome D. Ratnakorn, J. Laathomatas, S. Pongpech, S. Yamwong, and W. Tirapanich, Bangkok, Thailand

CT angiography (CTA) is a promising method to reliably and non-invasively evaluate intra- and extracranial vessels, aorta, and peripheral vessels. However, the reports on CTA in diagnosis of subclavian steal syndrome are limited. We report a patient who presented with vertebrobasilar insufficiency during exertion. Carotid and vertebral duplex, and transcranial Doppler ultrasonography showed reversal of flow in both extra- and intracranial vertebral and basilar arteries suggesting bilateral subclavian and vertebro-basilar steal, as well as moderate stenosis of right internal carotid artery and complete occlusion of left internal carotid artery. Electron beam CTA showed no evidence of subclavian artery stenosis including normal vertebral artery origin on both sides. However, digital subtraction angiography revealed complete occlusion at the origin of right innominate and left subclavian arteries with retrograde flow from both vertebral and basilar arteries to reconstitute both subclavian arteries. This false-negative finding on CTA in detection of subclavian steal syndrome is due to limitation of this method in differentiating flow direction and hemodynamic times sequences. This report demonstrates a pitfall of CTA in diagnosis of subclavian steal syndrome compared to more reliable hemodynamic information obtained by duplex ultrasonography, transcranial Doppler ultrasonography, and digital subtraction angiography.

34. Carotid Duplex In a Rural Setting: A Pilot Study J. Ivan Lopez, Lake City, FL

A total of 219 consecutive carotid duplex studies performed in two different rural hospitals in North Florida were reviewed. The aim of this study was to assess the yield of abnormal results depending on the diagnosis that prompted the study. The results were classified as follows: normal if there was not significant amount of plaque, no significantly abnormal if the stenosis was equivalent to 30% or less, and abnormal if the area of stenosis was larger than 30% and the internal carotid artery/common carotid artery (ICA/CCA) ratio was more than 1.0. The diagnoses were divided as follows: presumably vascular (stroke, transient ischemic attack (TIA), and carotid stenosis) and presumably non-vascular syncope, dizziness, vertigo, headaches, seizures, chest pain, and others.

Although the sample was small, the tendency was for the carotid duplex to be more likely abnormal if the diagnosis that prompted the study was stroke, TIA, or carotid stenosis. On the other hand, if the diagnosis was other than those classified above as vascular, the study was more likely to be normal or to show no significant abnormalities.

35. Selective Arterial Distribution of Cerebral Hyper-Perfusion in Fabry Disease David F. Moore, Peter Herscovitch, and Raphael Schiffmann, Bethesda, MD

Fabry disease is an X linked recessive deficiency of lysosomal α-galactosidase A associated with an increased risk of early onset cerebrovascular disease. The disorder is reported to affect the posterior circulation predominantly. We previously reported increased resting global cerebral blood flow (CBF) in Fabry disease. We now present data on resting regional CBF (rCBF) in 26 hemizygous patients with Fabry disease and 10 control subjects using H215O and PET. Statistical parametric map (SPM99) PET images of patients and controls were produced. These were then color coded and blended with a coregistered T1 MRI
36. Contrast-enhanced Transcranial Color Duplex Sonography in Acute Ischemic Stroke K. Niederkorn, S. Horner, D. Svetina, and E. Reinbacher, Graz, Austria

Objective: The quick and non-invasive diagnosis of brain artery occlusion in acute ischemic stroke remains a critical question in respect to treatment strategies. The bedside method of transcranial Doppler sonography (TCD) is available for quick and easy diagnosis of acute vessel occlusion of the basal brain arteries. Insonation problems and prolonged examination time are, however, limitations of this method. To overcome these limitations, Transcranial Color Duplex Sonography (TCCD) with the additional use of contrast material has been shown to be of potential value. The present study aims at assessing the diagnostic range of contrast-TCCD as compared with native TCCD and conventional TCD in acute stroke.

Materials and Methods: 29 consecutive patients (12 males, 17 females, mean age 69.8 years, range 29-97 years) with acute supratentorial stroke were examined within 6 hours from stroke onset. After the routine extracranial color Duplex examination, a handheld TCD exam at the basal brain arteries was performed. In addition to these routine procedures, TCCD before and after the application of Levovist™ (2.5 g iv, 300 mg/ml, 0.5 ml/sec; Schering AG, Berlin, Germany) was performed on the symptomatic side and in the vertebrobasilar territory.

Results: The contrast effect lasted 3.0 (0-5.5) minutes with an initial “blooming” time of 0.4 (0-2) minutes. TCCD without contrast allowed the imaging of 2.9 (0-10) vessel segments, after the application of Levovist™ 7.4 (0-10) vessel segments could be visualized. The total TCCD-examination time of the symptomatic side was 4.7 (3-9) minutes, the time for the contrast study was 3.0 (0-5.5) minutes. Contrast-TCCD was diagnostic in 31 vessels (10 MCA(M1) occlusions, 6 MCA branch(M2) occlusions, 1ACA branch occlusion, 2PCA stenoses, 1 BA stenosis and 11 normal exams) whereas native TCCD and conventional TCD were diagnostic in 14 and 20 vessels, respectively. In one case, all 3 modalities were non-diagnostic.

Conclusion: The total additional time for the TCCD examination was 4.7 minutes. C-TCCD allowed the additional diagnosis of 3 M1 occlusions and 5 M2 occlusions when compared with conventional TCD. Non-enhanced TCCD was less sensitive and allowed a diagnosis only in 14 vessels as compared with 31 vessels for C-TCCD. These results indicate that a quick and reliable diagnosis of symptomatic intracranial vessel occlusion is possible by contrast-enhanced TCCD. The clinical significance of this finding is currently investigated in the ongoing Neurosonology in Acute Ischemic Stroke (NAIS) Study, a project of the Neurosonology Research Group of the World Federation of Neurology (e-mail: G.M.Reutern@asklepios.com).

37. The Cerebrovascular Reaction to Pressor Stimuli Is Impaired in Isolated Systolic Hypertension

Sergio Castellani, Nadia Boni, Ilaria Carobbi, Andre Ungar, Gian Franco Gensini, Giulio Masotti, Firenze, Italy

The effects of isolated systolic hypertension (ISH) on cerebral pressure autoregulation have never been described. The aim of this study was to investigate the systemic and cerebrovascular reaction to a pressor stimulus (90 second isometric handgrip) in 10 elderly (60 to 69 yrs, mean 64.5), 10 young (21 to 31 yrs, mean 24.5) normotensives (NT) and 10 elderly with ISH (60 to 78 yrs, mean 69.5). Blood pressure [Finapres] increased in all subjects during handgrip (+11 mm Hg, p < 0.001 vs. baseline in the young; +18 mm Hg, p < 0.01 vs. baseline in the elderly normotensives; +19 mm Hg, p < 0.001 vs. baseline in patients with ISH] and, in hypertensives, also during the 10 minute recovery period. In both elderly groups, the pressure increases led to an uprise of the mean velocities (Vm) in the middle cerebral arteries (MCA) [transcranial Doppler] [F = 2.7, \( p < 0.05 \) for Vm in right MCA; F = 4.5, \( p < 0.05 \) in left MCA in the elderly normotensives; F = 11.9, \( p < 0.001 \) for Vm in right MCA; F = 13.8, \( p < 0.001 \) for Vm in left MCA in patients with ISH; whole curve ANOVA] and had no effect on cerebral hemodynamics in the young. End-tidal CO\(_2\) [Datex Canograph] remained constant in all. In conclusion, the cerebrovascular reaction to handgrip was impaired in patients with ISH and was associated with a longer lasting pressure elevation that can lead to an amplification of the pressure insult on cerebral hemodynamics.

38. A Case of MRI Co-registered to Thallium-201 and TC-99 HMPAO SPECT in an AIDS Patient Keith A. Josephs and Lee A. Forstrom, Rochester, MN

A 48-year-old female with a history of HIV x 4 months presented with left upper extremity clumsiness, difficulty walking, blurred vision and word-finding difficulties for the past 2-3 weeks. AN MRI head with and without contrast showed a non-enhancing lesion with increased T2 signal in the left pons and left cerebellar peduncle and a 2 cm enhancing mass in the left temporal lobe with surrounding edema. PCR for Epstein-Barr virus on CSF was negative and PCR for JC virus was positive. Thallium-201 (T1-201) and Tc-99 HMPAO (Tc) SPECT, imaging co-registered to MRI showed increased uptake and decrease uptake in the corresponding temporal area on T1-201 and Tc SPECT, respectively. MR spectroscopy was consistent with lymphoma and a brain biopsy was positive for lymphoma.

Conclusion: In some series the sensitivity of the PCR for EBV in patients with CNS lymphoma is 100%. Our case of a patient with a negative PCR for EBV
and T1-201/Tc SPECT studies consistent with lymphoma with a positive brain biopsy clearly demonstrates the complementary role of brain SPECT studies in AIDS patients with CNS lesions. We believe that SPECT studies should continue to be used to complement clinical, CSF and serologic studies in AIDS patients with CNS lesions.


Objective: To investigate the accuracy of MRA in the diagnosis of intracranial arterial stenosis when compared to TCD and cerebral angiography.

Methods: 50 patients referred for neurologic consultation with TIAs had both TCD and MRA testing. 11 of these patients had subsequent angiography performed to resolve discrepancies between the two noninvasive modalities. When comparing TCD using MRA as the gold standard (450 arteries), the test sensitivity was 58% reflecting a high number of false negative TCD studies. When the 11 angiograms (99 arteries) were compared with TCD, the sensitivity was 97% with the only discrepancy being a mislocalized distal vertebral artery stenosis.

Conclusion: MRA should not be the sole diagnostic tool for intracranial artery stenosis, however, when complemented with TCD, conventional angiography can be obviated in many instances.

40. SPECT Brain Imaging Identification and Reactivation of Hypoxic Dormant Neurons with High Dose Oxygen Therapy R. A. Neubauer and J. Michael Uszler, Santa Monica, CA

Identification and reactivation of hypoxic dormant neurons may play a significant role in certain patient’s recovery from neurologic insult. Currently, neurorehabilitation depends primarily upon plasticity within the central nervous system. Comparing the serious brain insult to a heart attack, there is an epicenter of irreparable damage. Fanning out toward the periphery however is the possibility of viability. Single photon emission computerized tomography (SPECT) imaging following high dose oxygen administration has revealed areas of dormant idling but recoverable neurons. Reactivation of these and enhancement of plasticity may be associated with varying degrees of clinical improvement. Thus, the outlook for long-term brain injury may be determined not only by the size and location of the epicenter, but also the volumes of surrounding recoverable cells. Organization and reorganization of impaired and non-impaired sensory and motor neurons play a major role. The degree of asymmetry and the decussation at the cord/medullary junction also influences the outcome. Sequential SPECT imaging with high dose oxygen intervention may play a role both in prognosis and outcome. Sequential SPECT scan changes with high dose oxygen treatment in long-term stroke, traumatic brain injury, anoxic ischemic encephalopathy, and cerebral palsy will be presented.

41. Percutaneous Transluminal Angioplasty after Failed Intra-arterial Thrombolysis Pinky Agarwal and Souvik Sen, Edison, NJ

Background: Intra-arterial thrombolysis is increasingly being used in the treatment of acute ischemic stroke. The failure rate of intra-arterial thrombolysis in treatment of acute ischemic stroke has been reported to be as high as 60%. Percutaneous transluminal angioplasty may be an option for treatment of stroke patients who fail intra-arterial thrombolysis.

Case Description: We report a case of an 89-year-old female with an acute right hemispheric stroke who presented 4 hours from onset of symptoms (NIHSS 14). Cerebral angiography performed 5 hours from the symptom onset revealed a right middle cerebral artery M1 occlusion. Local intra-arterial thrombolysis was performed by administering a total of 20 mg rtPA (recombinant tissue plasminogen activator) in proximity of the occlusion without angiographic recanalization or clinical improvement. Percutaneous balloon angioplasty was performed using a 2.5 mm stealth balloon catheter. Subsequent angiography revealed good recanalization (TIMI 3) and patient had marked clinical improvement to NIHSS of 4. Patient was discharged home with a modified Rankin score of 2.

Conclusion: Balloon angioplasty is a therapeutic alternative for patients with middle cerebral artery occlusion who fail intra-arterial thrombolysis. It can result in recanalization, significant clinical improvement and limit the size of infarct on CT.

42. Pituitary Apoplexy in the Setting of Coronary Angiography Vladimir Skljarevski and Timothy James Fries, Burlington, VT

Pituitary apoplexy is a rare but potentially life-threatening event. Almost invariably, it results from infarction or hemorrhage into a pituitary adenoma, although cases affecting the intact gland have been reported. Pituitary apoplexy may occur spontaneously or in a setting of certain therapeutic and diagnostic procedures. Some authors postulate association of pituitary apoplexy and Gadolinium and Hexabrix administration.

We report a case of pituitary apoplexy following coronary angiography. To the best of our knowledge, this scenario has not been previously reported. 66-year-old female with a congenital septum primum defect was admitted for coronary angiography. The procedure was technically uncomplicated. The patient received Omnipaque, Heparin, and Fentanyl. Immediately after the procedure, patient experienced left retroorbital pain and developed ophthalmoplegia. Magnetic resonance imaging (MRI) showed a hemorrhagic sellar mass extending into the cavernous sinus. Three-month follow-up MRI revealed cystic changes. Cardiac surgery was performed 1 month after the event. The patient expired 4 months later due to cardiorespiratory failure. Pituitary apoplexy in the absence of adenoma was confirmed on autopsy. We hypothesize that apoplexy here was related to the administration of Omnipaque in combination with anticoagulation effect of heparin.