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# Neuroradiology

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# NEURORADIOLOGY

## COMMENTARY

Although gadolinium-based contrast media used in MR scanning are generally very safe, the emergence of nephrogenic systemic fibrosis (NSF) has led to a serious rethink regarding their use. NSF is a progressive disorder that leads to multisystem failure. It was first described after the repeated use of large doses of gadolinium in patients with renal failure. It has since been observed even after the use of single standard doses. The common factor has been pre-existing renal impairment. The current paper Golding and Provenzale suggests that the presence of a concomitant infection increases this risk - something to be borne in mind in our local setting where a significant percentage of neurological patients are suffering from infections.

Inferior petrosal sinus sampling (IPSS) is just about as invasive a diagnostic procedure as you can get. The article by Gandhi et al re-emphasises the general safety and accuracy of this procedure.

Having suffered a minor head injury myself, it was reassuring to learn from Smits et al that most patients will recover completely. The study also bears out that early CT abnormalities are a good predictor of eventual functional outcomes.

Even with CT angiography using 64 row multi-detector CT (MDCT), the detection of small aneurysms is not as good as old-fashioned digital subtraction angiography (DSA). For the time being, it would seem that DSA will remain the gold standard in the setting of acute subarachnoid haemorrhage.

Finally a question neuroradiologists grapple with on a daily basis: tumour versus infection in the context of a focal brain lesion. Magnetic resonance spectroscopy held out the promise of being able to differentiate between the two. However, in our experience this has not been as reliable as we had initially expected. Hourani et al suggest that perseverance and combining this with other parameters such as perfusion maps may be useful.

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## NEPHROGENIC SYSTEMIC FIBROSIS: POSSIBLE ASSOCIATION WITH A PREDISPOSING INFECTION

**OBJECTIVE:** Infection at time of MR contrast administration has been reported to predispose patients with renal failure to development of nephrogenic systemic fibrosis (NSF). We assessed the frequency of infection at the time of MR contrast administration in a group of NSF patients. **MATERIALS AND METHODS:** Eight patients developed NSF during 2002–2006, of whom seven received the MR contrast agent gadodiamide (Omniscan), with doses of 0.10–0.31 mmol/kg. Data for the following were available for only 2005 and 2006: numbers of infected and uninfected renal failure patients who received MR contrast material and number of contrast-enhanced MR scans in all patients. We extrapolated data to 2002–2006 to approximate rates of NSF in infected and uninfected renal failure patients using Fisher's exact test for association

between variables and calculated odds ratios with 95% CIs. **RESULTS:** Five of seven NSF patients receiving MR contrast material had infections at the time of contrast administration. Three hundred thirty-four patients with renal failure received MR contrast material in 2005 and 2006 (29 infected). The rate of NSF was 6.7% in infected renal failure patients and 0.26% in uninfected patients. Data extrapolated to 2002–2006 yielded estimates of 75 infected and 750 uninfected renal failure patients. The association of NSF with infection was highly significant ( $p < 0.001$ ) with an odds ratio of 25 and CI of 3.9–264.4. **CONCLUSION:** The association of NSF with infection was highly significant, supporting the hypothesis that infection at the time of MR contrast administration in renal failure patients predisposes to NSF.

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## NEUROLOGIC COMPLICATIONS OF INFERIOR PETROSAL SINUS SAMPLING

**BACKGROUND AND PURPOSE:** Inferior petrosal sinus sampling (IPSS) is a useful diagnostic technique in adrenocorticotrophic hormone (ACTH)-dependent hypercortisolism with normal or equivocal MR imaging. The procedure is believed to be safe, with mostly minor complications. However, there are rare, but severe, neurologic complications that need to be considered. **MATERIALS AND METHODS:** We performed an institutional review board–approved retrospective review of our institutional IPSS experience from July 2001 to January 2007. IPSS was performed for the evaluation of Cushing disease. The end points of particular interest were the indications for IPSS and the incidence of associated complications. **RESULTS:** During the study period of 5 years, 44 patients underwent IPSS for evaluation of Cushing disease. There were 33 women and 11 men with a mean age of 43.1 years. Because of equivocal imaging and endocrine testing, 36 of 44 patients underwent IPSS, and 8 of 44 underwent IPSS after failed transsphenoidal exploration. The only complication was injury to the brain stem that occurred after an unremarkable procedure in a 42-year-old woman. She developed clinical evidence of pontomedullary

dysfunction with MR imaging consistent with brain stem infarction. The cause of this injury is unclear, but a venous variant leading to transient venous hypertension or thrombosis is suspected. **CONCLUSION:** Neurologic injury is a rare but serious complication associated with IPSS. Despite this, if performed under a strict paradigm, IPSS is both accurate and safe and can be very useful in the management of Cushing disease

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## OUTCOME AFTER COMPLICATED MINOR HEAD INJURY

**BACKGROUND AND PURPOSE:** Functional outcome in patients with minor head injury with neurocranial traumatic findings on CT is largely unknown. We hypothesized that certain CT findings may be predictive of poor functional outcome. **MATERIALS AND METHODS:** All patients from the CT in Head Injury Patients (CHIP) study with neurocranial traumatic CT findings were included. The CHIP study is a prospective, multicenter study of consecutive patients, 16 years of age, presenting within 24 hours of blunt head injury, with a Glasgow Coma Scale (GCS) score of 13–14 or a GCS score of 15 and a risk factor. Primary outcome was functional outcome according to the Glasgow Outcome Scale (GOS). Other outcome measures were the modified Rankin Scale (mRS), the Barthel Index (BI), and number and severity of postconcussive symptoms. The association between CT findings

and outcome was assessed by using univariable and multivariable regression analysis. **RESULTS:** GOS was assessed in 237/312 patients (76%) at an average of 15 months after injury. There was full recovery in 150 patients (63%), moderate disability in 70 (30%), severe disability in 7 (3.0%), and death in 10 (4.2%). Outcome according to the mRS and BI was also favorable in most patients, but 82% of patients had postconcussive symptoms. Evidence of parenchymal damage was the only independent predictor of poor functional outcome (odds ratio = 1.89,  $P = .022$ ). **CONCLUSION:** Patients with neurocranial complications after minor head injury generally make a good functional recovery, but postconcussive symptoms may persist. Evidence of parenchymal damage on CT was predictive of poor functional outcome.

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## DETECTION OF ANEURYSMS BY 64-SECTION MULTIDETECTOR CT ANGIOGRAPHY IN PATIENTS ACUTELY SUSPECTED OF HAVING AN INTRACRANIAL ANEURYSM AND COMPARISON WITH DIGITAL SUBTRACTION AND 3D ROTATIONAL ANGIOGRAPHY

**BACKGROUND AND PURPOSE:** Four-section multisection CT angiography (MSCTA) accurately detects aneurysms at or more than 4 mm but is less accurate for those less than 4 mm. Our purpose was to determine the accuracy of 64-section MSCTA (64MSCTA) in aneurysm detection versus combined digital subtraction angiography (DSA) and 3D rotational angiography (3DRA). **MATERIALS AND METHODS:** In a retrospective review of patients studied because of acute symptoms suspicious for arising from an intracranial aneurysm, 63 subjects were included who had undergone CT angiography (CTA). Of these, 36 underwent catheter DSA; all but 4 were also studied with 3DRA. The most common indication was subarachnoid hemorrhage (SAH;  $n = 43$ ). Two neuroradiologists independently reviewed each CTA, DSA, and 3DRA. **RESULTS:** A total of 41 aneurysms

were found in 28 patients. The mean size was 6.09 mm on DSA/3DRA and 5.98 mm on 64MSCTA. was excellent (0.97) between the aneurysm size on 64MSCTA and DSA/3DRA. Ultimately, 37 aneurysms were detected by DSA/3DRA in 25 of the 36 patients who underwent conventional angiography. The reviewers noted four 1- to 1.5-mm sessile outpouchings only on 3DRA; none were considered a source of SAH. One 64MSCTA was false positive, whereas one 2-mm aneurysm was missed by CTA. The sensitivity of CTA for aneurysms less than 4 mm was 92.3%, whereas it was 100% for those 4–10 mm and more than 10 mm, excluding the indeterminate, sessile lesions. **CONCLUSIONS:** In comparison with the available literature, 64MSCTA may have improved the detection of less than 4-mm aneurysms compared with 4- or 16-section CTA. However, the

combination of DSA with 3DRA is currently the most sensitive technique to detect untreated aneurysms and should be considered in suspicious cases of SAH where the aneurysm is not depicted by 64MSCTA, because 64MSCTA may occasionally miss aneurysms less than 3–4 mm size.

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## CAN PROTON MR SPECTROSCOPIC AND PERFUSION IMAGING DIFFERENTIATE BETWEEN NEOPLASTIC AND NONNEOPLASTIC BRAIN LESIONS IN ADULTS?

**BACKGROUND AND PURPOSE:** Noninvasive diagnosis of brain lesions is important for the correct choice of treatment. Our aims were to investigate whether 1) proton MR spectroscopic imaging (1H-MRSI) can aid in differentiating between tumors and nonneoplastic brain lesions, and 2) perfusion MR imaging can improve the classification. **MATERIALS AND METHODS:** We retrospectively examined 69 adults with untreated primary brain lesions (brain tumors, n = 36; benign lesions, n = 10; stroke, n = 4; demyelination, n = 10; and stable lesions not confirmed on pathologic examination, n = 9). MR imaging and 1H-MRSI were performed at 1.5T before biopsy or treatment. Concentrations of N-acetylaspartate (NAA), creatine (Cr), and choline (Cho) in the lesion were expressed as metabolite ratios and were normalized to the contralateral hemisphere. Dynamic susceptibility contrast-enhanced perfusion MR imaging was performed in a subset of patients (n = 32); relative cerebral blood volume (rCBV) was

evaluated. Discriminant function analysis was used to identify variables that can predict inclusion in the neoplastic or nonneoplastic lesion groups. Receiver operator characteristic (ROC) analysis was used to compare the discriminatory capability of 1H-MRSI and perfusion MR imaging. **RESULTS:** The discriminant function analysis correctly classified 84.2% of original grouped cases (P < .0001), on the basis of NAA/Cho, Chonorm, NAAnorm, and NAA/Cr ratios. MRSI and perfusion MR imaging had similar discriminatory capabilities in differentiating tumors from nonneoplastic lesions. With cutoff points of NAA/Cho 0.61 and rCBV 1.50 (corresponding to diagnosis of the tumors), a sensitivity of 72.2% and specificity of 91.7% in differentiating tumors from nonneoplastic lesions were achieved. **CONCLUSION:** These results suggest a promising role for 1H-MRSI and perfusion MR imaging in the distinction between brain tumors and nonneoplastic lesions in adults