Keeping TBI Patients Out of the ICU

Derivation of a Clinical Decision Instrument to Identify Adult Patients With Mild Traumatic Intracranial Hemorrhage at Low Risk for Requiring ICU Admission.

Nishijima DK, Sena M, et al:

Ann Emerg Med 2013; December 4 (): epub ahead of print

Clinical factors of Glasgow Coma Scale, isolation of head injury, age, and brain swelling or shift can be used to anticipate critical care interventions for patients with mild traumatic brain injury.

Background: Patients with mild traumatic brain injury (TBI) may be admitted to an intensive care unit (ICU) for close monitoring to prevent secondary brain injury, even though many do not require critical care intervention. Appropriate use of ICU resources is necessary for safe and efficient care.

Objective: To develop a clinical decision instrument to identify patients with mild TBI who are unlikely to require critical care intervention.


Methods: Patients aged >18 years with mild TBI (Glasgow Coma Scale score [GCS] 13 to 15) and head CT showing intracranial hemorrhage (subarachnoid hemorrhage, epidural hematoma, subdural hematoma, intraventricular hemorrhage, intraparenchymal hemorrhage/contusion) or diffuse axonal injury were enrolled. Patients with pre-morbid "do not resuscitate" orders or pre-morbid anticoagulation orders were excluded. Emergency medicine faculty were surveyed for impression of ICU need and likelihood of critical care intervention. Critical care interventions were defined as mechanical ventilation, neurosurgical interventions (craniotomy, intracranial pressure monitor, ventriculostomy, or hypertonic saline administration), vasopressor or inotrope use, transfusion of red blood cells or fresh frozen plasma, invasive monitoring (central venous pressure arterial line), cardiopulmonary resuscitation, and interventional angiography within 48 hours of admission. Clinical factors were assessed for inclusion in the decision tool by relative risk ratios and binary recursive portioning. The decision instrument was compared to physician clinical impression by sensitivity analysis.

Results: 600 patients (mean age 52 years, 70.8% male) were enrolled; 93% were admitted to the ICU. GCS was 15 in 67.7%, 14 in 27.0%, and 13 in 5.3%. Most common CT findings were subdural hematoma (47.0%), subarachnoid hemorrhage (45.8%), and intraparenchymal hemorrhage/contusion (36.8%). In total, 19.3% required acute critical care interventions. Four predictive factors for critical care intervention included GCS <15, non-isolated head injury, age >65 years, and presence of swelling or shift on initial CT. Physician clinical impression had slightly lower sensitivity (90.1%) than the decision instrument (98.3%), but better specificity (49.2% vs 39.7%). Low-risk patients (those who did not possess any of the predictive factors) accounted for 32% of ICU admissions.

Conclusions: A clinical decision instrument can accurately identify patients (not having GCS <15, non-isolated head injury, age > 65 years, and presence of swelling or shift on head CT) who do not require critical care intervention and ICU admission.

Reviewer's Comments: Optimizing health care resource use is important for society, and anticipating critical care intervention need is necessary for individual patients. This study helps to codify these issues beyond just physician impressions, which were actually fairly comparable to the instrument developed. While the decision instrument misses few patients who require critical care interventions, modeling with improved specificity would go further to reducing ICU admission for the other 50% of patients who do require critical care interventions. (Reviewer-N. Scott Litofsky, MD, FACS).

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Keywords: Mild Traumatic Brain Injury, ICU, Decision Instrument, Age, Glasgow Coma Scale Score, Head CT

Print Tag: Refer to original journal article
Prognosis Relatively Good in Primary Leptomeningeal Lymphoma

Primary Leptomeningeal Lymphoma: International Primary CNS Lymphoma Collaborative Group Report.
Neurology 2013; 81 (November 5): 1690-1696

Primary leptomeningeal lymphoma usually presents with multifocal neurologic signs, and the prognosis is relatively good.

**Background:** Primary central nervous system (CNS) lymphoma refers to non-Hodgkin lymphoma (NHL) that is located only in the CNS. It arises most often in the brain and, very rarely, in the spinal cord, spinal epidural space, intracranial dura, or leptomeninges. The largest published series of primary leptomeningeal lymphoma (PLL) contains only 9 patients.

**Objective:** To study PLL in a large series of patients.

**Design:** Retrospective study.

**Methods:** The authors reviewed the medical records of all immunocompetent patients with PLL treated at 12 sites in 6 countries from 1981 to 2011.

**Results:** The authors identified 48 patients with PLL. Their median age at diagnosis was 51 years (range, 6 to 84 years), and most were men (62%). Diffuse large B-cell lymphoma, an aggressive form of lymphoma, was the most common subtype (62% of cases). Neurologic symptoms typically began subacutely at a median of 2 months before diagnosis. However, the course was sometimes indolent, and 2 to 3 years passed before the diagnosis was made. PLL often presented with multifocal neurological signs (68% of cases), including cranial neuropathies, spinal radiculopathies, bowel/bladder malfunction, headache, ataxia, confusion, and seizures. The authors did not mention pain. Most patients (81%) had abnormalities on MRI, including hydrocephalus (9%) and leptomeningeal enhancement (74%), which occurred almost twice as often around the spinal cord as the brain. All patients had abnormal cerebrospinal fluid (CSF): hypoglycorrhachia (<50 mg/dL, 54% of cases), elevated protein (≥55 mg/dL, 92% of cases), and lymphocytic pleocytosis (92% of cases). A pathological diagnosis was made by CSF cytology (67%), flow cytometry (80%), and immunoglobulin heavy-chain or T-cell receptor gene rearrangement (71%) after a median of 2 lumbar punctures. The remaining patients required leptomeningeal biopsy. Treatment included radiation and systemic and intrathecal chemotherapy. Most patients (66%) received 2 or 3 of these as their initial treatment, and 68% received high-dose systemic methotrexate as its "backbone." Response to treatment was good, with 71% of patients having a complete or partial response. Almost half the patients relapsed (44%), but 35% had at least a partial response to salvage therapy. Median progression-free survival was 8 months, and median overall survival was 24 months. One-fourth of the patients survived >4 years, which suggests that cure is possible. Nothing predicted survival, including age, initial performance status, B-cell or T-cell subtype, or type of treatment.

**Conclusions:** PLL is rare, and it usually presents with multifocal neurological signs. MRI shows leptomeningeal enhancement, and CSF cytology or flow cytometry usually gives a tissue diagnosis. The prognosis is relatively good, and some patients can be cured.

**Reviewer's Comments:** This study shows that the neurologic, MRI, and CSF findings in PLL are similar to those in systemic lymphoma with leptomeningeal metastases, but survival is 5 to 6 times longer with PLL. (Reviewer-Marc David Winkelman, MD).

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Keywords: Primary Leptomeningeal Lymphoma, Primary Central Nervous System Lymphoma, Diagnosis, Survival

Print Tag: Refer to original journal article
What Are the Clinical, Imaging Differences Between Schwannomatosis and NF2?

Schwannomatosis: The Overlooked Neurofibromatosis?

Koontz NA, Wiens AL, et al:

AJR Am J Roentgenol 2013; 200 (June): W646-W653

Since imaging plays a critical role in diagnosis of schwannomatosis, it is imperative that radiologists understand the key imaging features that differentiate this entity from neurofibromatosis type 2.

**Objective:** To evaluate clinical and imaging features of schwannomatosis and highlight key differences from neurofibromatosis type 2 (NF2).

**Design:** Retrospective review of the published literature.

**Discussion:** The peak incidence of schwannomatosis is reported to be between the ages of 30 and 60 years. Diagnosis requires exclusion of NF2 on clinical grounds and high-quality imaging of the vestibular nerves. To increase the specificity of the diagnosis of schwannomatosis, the revised criteria exclude all patients who fulfill the existing diagnostic criteria for NF2, have a first-degree relative with NF2, or who carry a known constitutional NF2 gene mutation. Patient age can serve as a useful discriminator; the diagnosis of schwannomatosis becomes more likely with increasing age. Other discriminators, such as concomitant meningiomas, gliomas, or neurofibromas, should sway the radiologist away from suggesting the diagnosis of schwannomatosis. Patients with schwannomatosis frequently present with pain, whereas NF2 patients more frequently present with neurologic deficits. The goal of management is symptom control, and schwannomatosis-related pain is treated much like neuropathic pain. Current clinical outcomes research suggests that patients with schwannomatosis do not have a decreased life expectancy as opposed to patients with NF2. Imaging findings of schwannomatosis include multiple discrete, well-defined, round-to-oval lesions situated along the course of peripheral nerves, including peripheral segments of the cranial nerves or paraspinous nerve roots. Up to one third of patients show segmental schwannomatosis, with the schwannomas confined to 1 limb or within ≤5 contiguous spinal segments. As compared with neurofibromas, which tend to arise centrally from a nerve, schwannomas are more frequently eccentric to the nerve of origin. On MRI, the lesions are typically of low-to-intermediate signal intensity on unenhanced T1-weighted sequences and show high signal intensity on proton density, T2-weighted, and STIR sequences. The results of a small case series (9 patients) suggest that lesions in schwannomatosis tend to show more homogeneous T2 hyperintensity as opposed to the classic “targetoid” signal intensity of isolated schwannomas and benign peripheral nerve sheath tumors. The lesions show intense heterogeneous enhancement after the administration of IV gadolinium-based contrast agents. As compared with neurofibromas, schwannomas more frequently show a heterogeneous appearance, which results from cystic degeneration, hyalinization, and calcification.

**Conclusions:** Since imaging plays a critical role in the diagnosis of schwannomatosis, it is imperative that radiologists understand the key imaging features that differentiate this entity from NF2.

**Reviewer's Comments:** I agree with the authors in that knowledge of the imaging and clinical features of schwannomatosis is very important as it can aid in the diagnostic process and possibly avert misdiagnosis, which in turn can lead to adverse patient outcomes, as management differs substantially between this disease entity and NF2. (Reviewer-Sebastian Sadowski, MD).

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Keywords: Schwannomatosis, Neurofibromatosis Type 2

Print Tag: Refer to original journal article
Unruptured Brain AVMs May Benefit From Medical Management Alone

Medical Management With or Without Interventional Therapy for Unruptured Brain Arteriovenous Malformations (ARUBA): A Multicentre, Non-Blinded, Randomised Trial.

Mohr JP, Parides MK, et al:

Lancet 2013; November 19 (): epub ahead of print

In a study of patients with unruptured brain arteriovenous malformations (AVMs), the ARUBA trial did not enroll any patients with a brain AVM >60 mm or with a Spetzler-Martin AVM grade >4.

Background: The approach to managing patients with unruptured brain arteriovenous malformations (AVMs) is uncertain. Almost 50% of diagnosed AVMs have not bled prior to diagnosis. The results of recent prospective series suggest that the subsequent bleeding risk of AVMs that have not already bled may be as low as 1%/year.

Objective: To compare the risk of death and symptomatic stroke after medical management alone versus medical management with interventional therapy for an unruptured brain AVM.

Design: Prospective, multicenter, parallel design, open-label randomized trial.

Participants: Included patients were ≥18 years of age; had an AVM diagnosed by catheter angiography, MRI, MR angiography, CT, or CT angiography; had no evidence of bleeding of the lesion; and had an AVM that could be eradicated if assigned to that arm of the trial.

Methods: Patients were randomly assigned to receive either medical management alone (therapy for seizures, headaches, and any coexisting vascular risk factor) or medical management combined with interventional therapy (neurosurgical, endovascular, radiotherapy, or combinations of these procedures). Patients were seen every 6 months for the first 2 years, then annually thereafter. The primary outcome measure was symptomatic stroke or death. The secondary outcome measure was clinical impairment at 5 years (modified Rankin scale score of ≥2).

Results: The study was stopped prematurely after 226 patients were enrolled. Because 323 patients refused participation and 177 patients were treated outside of randomization, a potential source of bias was introduced. Of the 226 patients enrolled, 116 received interventional therapy and 110 received medical management alone. Baseline characteristics were similar for both groups: the mean patient age was 44.5 years, approximately 41% of subjects were female, and 43% of patients had no symptoms, such as headaches or seizures, at presentation. All AVMs were <60 mm. No patients had a Spetzler-Martin AVM grade >4. The mean follow-up was 33 months. Symptomatic stroke or death occurred in 10.1% of patients receiving medical management alone and 30.7% of interventional therapy patients. At 30 months, a modified Rankin scale score of ≥2 (clinical impairment) occurred in 46.2% of interventional therapy patients and 15.1% of patients receiving medical management alone. When stratified by Spetzler-Martin grade, the highest event rates were in those with AVM grades 2 and 3.

Conclusions: In patients with unruptured brain AVMs, medical management alone is superior to interventional therapy for the prevention of death or stroke up to 33 months.

Reviewer's Comments: This trial is surrounded by substantial controversy. An editorial by Cockroft and colleagues (Stroke 2012; 43:1979-1981) argues that ARUBA's follow-up is not long enough and that the study population does not include a broad representation of patients with brain AVMs. When counseling patients, it may be best to identify the patient to whom ARUBA most closely applies. (Reviewer-Brian Silver, MD).

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Keywords: Unruptured Brain Arteriovenous Malformation, Stroke

Print Tag: Refer to original journal article
Family members can benefit from being present during brain death examination of their loved ones.

**Background:** Family members increasingly are permitted to be present during resuscitations, invasive procedures, and at the time of patients' deaths without impacting psychological stress. Concerns about family member presence during brain death examination have included disruption to care, fear of litigation, and psychological distress.

**Objective:** To determine if family presence during brain death examination impacts family member distress.

**Design:** Single-institution, prospective, randomized controlled trial.

**Methods:** Subjects consisting of family members aged >17 years of patients suspected of suffering brain death in the medical intensive care unit (ICU), neurosciences ICU, trauma/surgical ICU, and pediatric ICU were asked to provide informed consent to participate in the study. Consenting subjects were randomized as family groups to be present or absent during brain death examination. Subjects completed a questionnaire measuring understanding about brain death prior to brain death examination and then again after the examination. Organ donation requests followed brain death declaration. Impact of Event Scale (IES) and General Health Questionnaire-12 (GHQ-12) surveys measured emotional and psychological impact of the brain death experience on subjects. Subjects were surveyed by telephone 1 month after brain death examination.

**Results:** 17 of 30 families agreed to participate, and accounted for 58 subjects. In total, 38 family members of 11 patients were present during brain death examination, and 20 family members of 6 patients were not present. Understanding of brain death was similar between groups prior to examination, but better in subjects present after examination. Thirty-six of 38 subjects (94.7%) present during the examination felt that their presence helped their understanding, and 32 (84.2%) would recommend being present to others. Follow-up IES and GHQ-12 obtained in 41 subjects (71%) – 24 present and 17 absent – were similar between groups. Brain death examination was not disrupted by any family member. Organ procurement was obtained in 10 of 16 potential organ donors. Of the non-donors, positive consent was obtained in 4; consent was not obtained in 1 patient with family members present and 1 with family members absent.

**Conclusions:** Family member presence during brain death examination increases their understanding of the process without increasing emotional or psychological distress.

**Reviewer's Comments:** This study supports the practice of allowing family members to be present during brain death examination of critically ill patients. Using the metrics assessed, these family members did not suffer adversely and had a better understanding of their loved ones' extent of illness and the processes associated with end-of-life care. There may have been some bias by the informed consenting process, and the sample size was small. Regardless, these issues are important for neurosurgeons, who encounter these events frequently. Impact on organ donation could not be determined. I will consider a family member presence approach to brain death examination. (Reviewer-N. Scott Litofsky, MD, FACS).

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Keywords: Brain Death Evaluation, End-of-Life Care, Family Presence, Medical Education, Organ Donation, Understanding Brain Death

Print Tag: Refer to original journal article
Looking for the Cause of Long-Term Cognitive Impairment After Critical Illness

Long-Term Cognitive Impairment After Critical Illness.

Pandharipande PP, Girard TD, et al:


Critically ill patients with longer duration of delirium are more likely than those with a shorter duration of delirium to have cognitive deficits.

Objective: To study the epidemiology of long-term cognitive impairment after critical illness and to test whether length of hospital delirium and higher doses of sedatives and analgesics are independently associated with cognitive impairment after hospital discharge.

Design/Participants: Multicenter, prospective cohort study of 821 critically ill adult patients, with a mean age of 61 years.

Methods: The study included adult patients admitted to medical or surgical intensive care units with respiratory failure, cardiogenic shock, or septic shock. The 2 primary risk factors studied included duration of delirium and use of sedative and analgesic medications. Patients were evaluated for delirium daily. Daily use of benzodiazepines, opiates, propofol, and dexmedetomidine was recorded. Global cognition and executive function were evaluated at 3 and 12 months after hospital discharge. Covariates included age, years of education, chronic disease burden, pre-existing cognitive impairment, cerebrovascular disease, and apolipoprotein E genotype.

Results: Among the 821 patients, 51 (6%) had evidence of pre-existing cognitive impairment. Delirium was identified in 606 patients (74%) and lasted for a median of 4 days. In total, 31% of the patients did not survive to 3-month follow-up, and another 7% died before 12-month follow-up. At 3 months, 40% of the tested patients had global cognition scores that were worse than those seen in patients with moderate traumatic brain injury, and 26% had scores similar to scores of patients with mild Alzheimer disease. At 12-month follow-up, 34% and 24% of the patients had scores similar to scores for moderate traumatic brain injury and mild Alzheimer disease, respectively. Cognitive impairment was not limited to older patients or burden of coexisting conditions. Executive function scores were also low at 3 and 12 months, regardless of age. Longer duration of delirium was an independent risk factor for worse global cognition scores and worse executive function at 3 and 12 months. However, duration of coma was not associated with impaired global cognition scores at 3 or 12 months. High doses of benzodiazepines were associated with worse executive function scores at 3 months. None of the other studied medications was a risk factor for worsening cognitive or executive function scores.

Conclusions: Cognitive impairment after critical illness is common and can easily last for at least 1 year. Longer delirium is associated with higher probability of development of cognitive dysfunction.

Reviewer's Comments: Cognitive decline is a problem after major surgery, and there are multiple investigators trying to find a causative link between anesthesia and decline in cognition. The presented study makes me think that the disease process itself or the surgical trauma unlocking a process, such as systemic inflammatory response, may be the real cause of the cognitive decline, with the delirium being the observable manifestation of the severity of this process. (*Audio review recorded by David S. Beebe, MD.*) (Reviewer-Krasimir George Bojanov, MD).

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Keywords: Cognitive Impairment, Critical Illness

Print Tag: Refer to original journal article
The Sella in Pseudotumor Cerebri -- Larger But Not Empty

Enlargement of the Sella Turcica in Pseudotumor Cerebri.

Kyung SE, Botelho J, Horton JC:

J Neurosurg 2013; December 6 (): epub ahead of print

Pseudotumor cerebri are often associated with a marked increase in the sellar size, but there is little change in the pituitary size.

Background: Pseudotumor cerebri has been cited as a cause of empty sella syndrome ever since Kaufman reported the association in 1968 (Radiology 90:931-941). He based it on measurements of the pituitary gland alone, not of the sella. The authors of the present article challenge the association of pseudotumor cerebri and empty sella syndrome based on the hypothesis that what occurs is bony enlargement of the sella and not a real reduction in the size of the pituitary.

Objective: To determine if the pituitary is decreased in size in pseudotumor cerebri with an enlarged sella.

Design: Retrospective study.

Methods: The MRIs of 48 consecutive pseudotumor cerebri patients, all female, were compared with 48 aged-matched controls. Measurements of the pituitary and the sella were done twice in a blinded and random fashion.

Results: Symptoms of pseudotumor cerebri were present for 7 months on average at the time of the MRI. Papilledema was noted in 45 of the 48 patients. The CSF opening pressure was between 230 and 600 mm H2O, which is high. The average body mass index was 37, meaning that the patients were obese. The mean sellar area was significantly larger in pseudotumor cerebri patients at 90 mm2 versus 66 mm2 in controls, which shows that there was a 63% increase in the sellar size. The median pituitary gland area was 34 mm2 in pseudotumor cerebri patients versus 42 mm2 in controls, which is significantly smaller. The authors conclude that this decrease in pituitary size is slight and is due to difficulties in measuring the gland.

Conclusions: Pseudotumor cerebri are often associated with a marked increase in the sellar size, but there is little change in the pituitary size.

Reviewer’s Comments: The authors are right, the sella is usually larger in pseudotumor cerebri, but contrary to what they conclude the pituitary is usually smaller in pseudotumor cerebri. In fact, their data confirm this. Ranganathan and colleagues (Neuroradiology 2013, 55:955-961) also conclude that the pituitary is smaller in pseudotumor cerebri and additionally show that the gland increases in size after treatment. In fact, I would argue that the partial re-expansion of the pituitary might one day be a criterion to assess whether shunts are working in these patients. (Reviewer: Luc Jasmin, MD, PhD, FRCS (C), FACS, FAANS).

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Keywords: Pseudotumor Cerebri, Empty Sella Syndrome, Enlarged Sella, MRI

Print Tag: Refer to original journal article
Background: The common cause of spontaneous intracranial hypotension (SIH) is cerebrospinal fluid (CSF) leaking through a tear in the dura. CT myelography (CTM) is considered the gold standard for showing an extradural collection of CSF, which proves that CSF is leaking.

Objective: To determine the sensitivity of spinal MRI for identifying CSF leaks.

Design: Retrospective study.

Participants/Methods: 12 patients with orthostatic headache and an extradural collection of CSF shown by CTM also underwent MRI of the spine with and without contrast enhancement. Eleven of the 12 first underwent MRI before undergoing CTM.

Results: MRI without contrast enhancement showed the extradural CSF collection in 11 of 12 patients (sensitivity, 92%). Of the 12 patients with extradural CSF leakage documented on CTM, 4 did not have signs of SIH on MRI of the head, such as sagging brain or dural enhancement.

Conclusions: Compared to CTM (the gold standard), MRI of the spine without contrast has a sensitivity of 92% in showing a CSF leak. In patients with orthostatic headache, MRI of the spine without contrast should be the first test to search for a CSF leak because it is noninvasive and spares the patient exposure to radiation.

Reviewer’s Comments: The authors appended an algorithm for diagnosing and treating SIH. A patient with orthostatic headache should get an MRI of the brain with and without contrast and MRI of the spine without contrast. If the brain MRI shows signs of intracranial hypotension or if the spine MRI shows an extradural CSF collection, then make a diagnosis of SIH. If the MRIs are negative, do a gadolinium MRI myelogram, which is more sensitive for an extradural CSF collection than is spine MRI. Use MRI to perform the myelogram rather than CT because it avoids radiation exposure to the patient. Most patients with evidence of a CSF leak will respond to 1 to 3 undirected lumbar epidural blood patches. If the headache does not respond, then the leak must be localized for a targeted treatment (directed epidural blood patch, fibrin-glue injection, or surgery). If the extradural CSF collection shown on spine MRI is extensive (>2 segments), it is probably due to a "fast leak." Conventional CT and MRI myelography cannot localize a fast leak because, by the time the patient has had the lumbar puncture on the fluoroscopy table and is moved to the CT or MRI suite, the contrast will have flowed into the CSF collection and you will miss seeing the leak's location. Instead, do a dynamic study (ultrafast CTM or digital subtraction myelography), which will show the dural tear as CSF leaks through. If the CSF collection is small (≤2 segments on spine MRI), gadolinium MRI myelography or CTM should show the site of the leak. (Reviewer-Marc David Winkelman, MD).
Association Between MS and Trauma Uncertain

Physical Trauma and Risk of Multiple Sclerosis: A Systematic Review and Meta-Analysis of Observational Studies.

Lunny CA, Fraser SN, Knopp-Sihota JA:

J Neurol Sci 2013; August 15 (): epub ahead of print

Meta-analysis of case-control studies suggests a significant association between head trauma and the risk of developing multiple sclerosis, but meta-analysis of cohort studies suggests that there is no association.

Background: Some believe that physical trauma can bring about the onset of multiple sclerosis (MS).

Objective: To conduct a systematic review and meta-analysis of observational studies addressing this question.

Methods: The authors used modern statistical methods to assess the methodological quality (risk of bias) and heterogeneity of studies. They found that most case-control studies did not describe trauma precisely, so they subdivided trauma broadly into head trauma, spine trauma, fractures, burns, and other trauma (unspecified location and type of trauma). They also separated trauma in childhood (age ≤20 years) from that in adulthood (age >20 years).

Results: 40 studies were identified for this meta-analysis, including 36 case-control studies and 4 cohort studies. The case-control studies contained 6664 MS cases and 7521 controls. The average risk of bias of the case-control studies was medium. The meta-analysis of high-quality case-control studies showed statistically significant associations between the diagnosis of MS and preceding head trauma in childhood (OR, 1.27; 95% CI, 1.12 to 1.44; P <0.001), head trauma in adulthood (OR, 1.4; 95% CI, 1.08 to 1.81; P =0.01), and "other trauma" during childhood (OR, 2.31; 95% CI, 1.06 to 5.04; P =0.04). The meta-analysis of low-quality case-control studies showed statistically significant associations between MS diagnosis and preceding "other trauma" and spinal injury in adulthood. The meta-analysis of case-control studies showed no association between diagnosis of MS and spine injury during childhood or fractures or burns at any age. The 4 cohort studies concerned head trauma only, and they evaluated a total of 335,405 MS patients. The average risk of bias of these 4 studies was low. The meta-analysis of the cohort studies showed no significant association between head trauma and a diagnosis of MS.

Conclusions: Meta-analysis of case-control studies suggests a statistically significant association between head trauma and the risk of developing MS, but meta-analysis of cohort studies suggests there is no association.

Reviewer's Comments: The case-control studies rely on MS patients' memories regarding trauma, which may have happened many years before. Recall bias degrades even the best studies, which means that these case-control studies may overstate the association between MS and trauma. Another defect of case-control studies is that it is biologically implausible that trauma in the distant past should trigger the appearance or relapse of MS years later. However, the cohort studies do not have these shortcomings, so the conclusion of the cohort studies (no association between trauma and MS) is more convincing. The issue of the relationship of MS and trauma has more medicolegal than medical importance. An important note is that this study was concerned only with the initial diagnosis of MS, not with MS relapse. (Reviewer-Marc David Winkelman, MD).

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Keywords: Multiple Sclerosis, Etiology, Trauma vs Risk

Print Tag: Refer to original journal article
What Might Altered Brain Metabolism in Vestibular Migraine Mean?

Altered Brain Metabolism in Vestibular Migraine: Comparison of Interictal and Ictal Findings.

Shin JH, Kim YK, et al:

Cephalalgia 2013; August 5 (): epub ahead of print

Vestibular migraines may have unique metabolic changes as compared to other migraine syndromes.

**Background:** Vestibular symptoms often occur with migraines. The mechanism for these symptoms in migraine is unknown. They could originate in the locus ceruleus, dorsal raphe nucleus, and the trigeminal nucleus caudalis, which all have connections to the vestibular nuclei. Activation of this system may cause vestibular symptoms. Cortical spreading depression may act on vestibular nuclei through projections from the posterior parietal cortex to the vestibular nuclei. PET during migraine attacks shows hypermetabolism of the locus ceruleus, dorsal raphe nucleus, the cingulate, bilateral insulae, and cerebellum, suggesting that the dorsal brainstem is involved in the activation of migraines.

**Objective:** To investigate brain metabolism in vestibular migraines comparing the ictal and interictal states.

**Participants/Methods:** 2 patients were studied. The first patient was a 30-year-old woman with a 15-year history of intermittent migraine headaches with vertigo. Between the attacks, she had subtle left-beating nystagmus without fixation that changed to right-beating after horizontal head shaking (HHS). During attacks, she had similar findings except prominent downbeat nystagmus after HHS. The second patient was a 57-year-old woman with a 40-year history of migraines, but these were accompanied by vertigo for only the past 5 years. Between the attacks, she had subtle downbeat nystagmus during straight head hanging. During an attack, she had subtle left-beating spontaneous nystagmus without fixation. She also had subtle left-beating horizontal-torsional nystagmus with a downbeat component during head turning to either side while supine and Dix-Hallpike maneuver in either direction. Eye movements were recorded with a video-oculography system. Recordings were done with routine eye movements as well as passive horizontal head shaking. Eye movements were also recorded during positional maneuvers including the Dix-Hallpike and straight head hanging test. Horizontal saccades were also recorded. Both patients also underwent F-18 FDG PET scan during an attack and during the headache-free phase.

**Results:** Interictal PET in patient 1 showed hypometabolism in the right cerebellum and hypermetabolism in the bilateral centrum semiovale, bilateral fronto-parietal cortices, and temporo-occipital lobes. Patient 2 had hypometabolism in the bilateral fronto-parieto-occipital areas and increased metabolism in the bilateral cerebellum and left temporal lobe. The ictal PET showed activation of the bilateral cerebellum, thalamus, and frontal cortices in both patients. Patient 2 had activation of the left temporal cortex and splenium of the corpus callosum as well. Both had hypometabolism of the posterior parietal and occipitotemporal regions. Compared with interictal images, ictal PET showed increased metabolism of the bilateral cerebellum, frontal cortices, and thalami in both patients. Metabolism decreased in the bilateral occipitotemporal and posterior parietal cortices during the headache.

**Conclusions:** The changes on ictal and interictal PET scans in patients with vestibular migraine may represent reciprocal inhibition between the visual and vestibular systems.

**Reviewer’s Comments:** These results suggest unique metabolic changes in vestibular migraine that may differentiate it from other migraine syndromes. Further studies are needed to support these results. (Reviewer- John Schwankhaus, MD).

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Keywords: Migraine, Vertigo, Vestibular Migraine, PET, Metabolism

Print Tag: Refer to original journal article
Adjacent Segment Disease -- Disc Fusion or Disc Replacement?

The Rate of Adjacent Segment Disease in Cervical Disc Arthroplasty Versus Single Level Fusion: A Meta-Analysis of Prospective Studies.

Verma K, Gandhi SD, et al:

Spine 2013; 38 (December 15): 2253-2257

Total disc arthroplasty and anterior cervical decompression and fusion have similar rates of adjacent segment disease over time.

**Background:** To this day, there has been no study comparing the incidence of adjacent segment disease (ASD) as the primary end point when comparing total disc arthroplasty (TDA) versus anterior cervical decompression and fusion (ACDF).

**Objective:** To determine if, over time, TDA has a lesser rate of ASD than ACDF.

**Design:** Retrospective study.

**Methods:** The authors performed a systematic review using PubMed and Cochrane libraries. The databases searched for prospective randomized studies comparing TDA to ACDF. Six randomized and controlled studies with at least 2 years follow-up were pooled.

**Results:** The total number of patients for these 6 studies was 1586 (TDA, 809; ACDF, 777). The follow-up was 3 years on average. At follow-up, 66 patients required surgery because of ASD (30 from the TDA group and 36 from the ACDF group); there was no statistical difference between the 2 groups. Thus, after TDA the yearly incidence of ASD was about 3.1% and the projected 10-year incidence is 31.0%. The factors that increased the risk of ASD after TDA were osteopenia and lumbar degenerative disease. Age, gender, and smoking did not seem to increase the risk of ASD.

**Conclusions:** TDA and ACDF have similar rates of ASD over time.

**Reviewer's Comments:** Until the 10-year follow-up data from FDA sanctioned trials become available, we will not know for sure if preserving motion retards the evolution of cervical spine degeneration. The idea of keeping the joint mobile makes a lot of sense and patients do express a greater degree of satisfaction. But in the long-term many patients are likely to require another surgery, which is an indication that the problem is not the surgeon, but the natural disease that follows its unrelenting course. (Reviewer-Luc Jasmin, MD, PhD, FRCS (C), FACS, FAANS).

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Keywords: Adjacent Segment Disease, Total Disc Arthroplasty

Print Tag: Refer to original journal article
Short-Term Outcomes for Radiculopathy Better With ACDF


Engquist M, Löfgren H, et al:

Spine 2013; 38 (September 15): 1715-1722

Cervical fusion for cervical radiculopathy is more effective than nonoperative treatment for up to 2 years, but the difference in treatment outcomes diminishes with time.

**Background:** Cervical radiculopathy is a common condition that is amenable to nonoperative treatment in most cases. Persistent and severe cases are treated with anterior cervical discectomy and fusion (ACDF). The surgical outcomes are usually favorable.

**Objective:** To compare the efficacy of a comprehensive physical therapy program alone versus ACDF with postoperative physiotherapy for the treatment of cervical radiculopathy.

**Design:** Prospective, randomized controlled trial.

**Participants/Methods:** Consecutive patients were recruited into the study in 3 Swedish spine centers during a 6-year study interval. To be included in the study, patients must have been between 18 and 65 years of age, must have had radicular symptoms lasting between 8 weeks and 5 years, and must have MRI evidence of cervical stenosis in 1 or 2 levels. Patients were randomly assigned to treatment with ACDF followed by physiotherapy or physiotherapy alone. They were then followed up for 24 months. In the ACDF group, patients started physiotherapy at 3 months postoperatively after they were confirmed to be fused radiographically and clinically. The nonsurgical patients were treated with comprehensive physical therapy, including neck-specific exercises, general exercises, and pain-coping and stress management training for a minimum of 3 months. The outcomes data were collected prospectively at regular intervals for 24 months.

**Results:** There were 31 patients in the surgical group and 32 in the nonsurgical group. The baseline sociodemographic data were similar in both groups, except that the surgical group was slightly older (4.7 years). The study outcomes showed that both groups improved significantly over time. The neck pain intensity scores (visual analog scores) and patient's global assessment were significantly better in the surgery group at 12 months but not at 24 months. There was a trend at better scores in all outcome measures in the ACDF group at the end of the study (24 months), but the differences were not statistically significant.

**Conclusions:** ACDF combined with postoperative physiotherapy, when compared to physiotherapy alone, leads to better neck pain reduction and global assessment scores in the short term, but the difference between the groups diminishes with time. The authors acknowledge that low sample size and the crossover may have affected their results. They emphasize that physical therapy was still found to be quite successful and should be attempted prior to surgery in patients with cervical radiculopathy.

**Reviewer's Comments:** This study definitely adds to the body of knowledge about treatment options for cervical radiculopathy. The results emphasize the importance of trying nonoperative treatments prior to surgery, but they also show that surgery may lead to faster resolution of symptoms. The study by its design would have diminished the benefits of surgical intervention due to voluntary enrollment and ability to crossover into the surgical group. (Reviewer-Vladimir Sinkov, MD).

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Keywords: Cervical Radiculopathy, Cervical Fusion & Physiotherapy, Outcomes

Print Tag: Refer to original journal article
Compared with facetectomy, Ponte osteotomies add time and blood loss to scoliosis correction.

**Background:** Ponte osteotomies were first designed for improving the posterior correction of kyphosis. They consist of removing the joints of the posterior elements of the spine, including the entire facets and any overgrown laminae. They have also been increasingly used in the posterior correction of scoliosis.

**Objective:** To explore the costs and benefits of performing Ponte osteotomies of the thoracic spine in adolescent idiopathic scoliosis (AIS).

**Methods:** During a 3-year study interval, the authors retrospectively analyzed patients with thoracic AIS (Lenke 1 and 2) who underwent fusion. Seventeen patients had inferior facetectomies alone, and 18 underwent Ponte osteotomies. Operative time and blood loss as well as amount of correction were compared for the 2 procedures. Originally, the authors performed routine Ponte osteotomies at most levels, but after developing the impression that they were not adding anything, they switched to inferior facetectomies only. Quarter-inch rods were used in all cases, which were primarily stainless steel in the osteotomy group and cobalt chromium in the facetectomy group. Two attending surgeons collaborated in each case.

**Results:** Preoperatively, the mean curves were 59° in the Ponte group and 52° in the facetectomy group. The corrections were equal in both groups at 84%, although the Ponte group tended to be stiffer preoperatively. Improvement in kyphosis was greater in the Ponte group than in the controls (improvement, 6° vs 0°, respectively), but this difference was not statistically significant. Ponte osteotomies added a mean of 8 minutes of surgical time per level. They also added a mean of 30 mL estimated blood loss per level.

**Conclusions:** For routine thoracic AIS, Ponte osteotomies do not improve correction of the curves, and they add to the associated operative time and blood loss.

**Reviewer's Comments:** This article contained many subtle but important points. These curves were largely mild (mean Cobb angle, 50° to 60°), so they may not make demands that could illustrate the benefits of osteotomies. The Ponte group had larger preoperative curves and less bending flexibility of the largest curve, and yet patients had benefits of improved correction in the sagittal plane. It is quite possible that, with a larger series of patients that is more evenly matched, a difference between the groups would emerge. Also, the authors performed the osteotomies at nearly every level. Spinal deformity correction is a very physical surgery. The use of these osteotomies has been quantified in this article. It involved an extra 8 minutes of surgical time per level and an extra 30 mL of blood loss per level. The procedures were all done safely, but the surgeon should always carefully weigh the risks of Ponte osteotomies against the benefits in deciding whether they are best for a given patient. (Reviewer-Paul D. Sponseller, MS, MD, MBA).

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Keywords: Adolescent Idiopathic Scoliosis, Ponte Osteotomies, Thoracic Spine, Efficacy

Print Tag: Refer to original journal article
Wear Thyroid Shields Tightly to Reduce Radiation Dose

Types and Arrangements of Thyroid Shields to Reduce Exposure of Surgeons to Ionizing Radiation During Intraoperative Use of C-Arm Fluoroscopy.

Lee SY, Min E, et al:

Spine 2013; 38 (November): 2108-2112

During intraoperative use of C-arm fluoroscopy, the use of a thyroid shield by the surgeon is most effective at reducing the radiation dose to the thyroid when worn tightly.

**Background:** Orthopedic surgeons are increasingly using radiation during various procedures. The most radiosensitive tissues include the thyroid, cornea, bone marrow, breasts, and gonads. While the wearing of lead shields is essentially routine, thyroid shields are sometimes omitted or worn loosely due to discomfort.

**Objective:** To determine the radiation dose to the surgeon's thyroid during intraoperative use of C-arm fluoroscopy and the effects of different "wearing" styles of lead thyroid shields on the degree of radiation exposure.

**Methods:** Phantoms were used to model a patient and a surgeon performing thoracic spine surgery. Three different ways of wearing a lead thyroid shield were modeled: worn tightly, worn loosely, and worn loosely but with a bismuth-masking agent under the lead shield and around the surgeon's neck. The latter technique is an accepted way of increasing the protection without the shield needing to be worn as tightly. These experiments were repeated using a commercially available lead-equivalent shield that is lighter than lead.

**Results:** Wearing the thyroid shield tightly reduced the exposure to the thyroid to nearly half the value of that experienced by wearing it loosely. Use of a bismuth mask with a lead shield reduced the exposure slightly more than did either of the other 2 shield-wearing conditions without a masking layer. Use of a lead-equivalent shield was actually slightly better than lead, although it was more expensive. A thyroid shield, even when worn loosely, reduced the dose to the thyroid by >85% compared to wearing none at all.

**Conclusions:** Thyroid shields are very helpful in reducing the radiation dose to the thyroid. They are significantly more effective when worn tightly. Use of a bismuth layer underneath the shield is an effective alternative. The lead-equivalent shields are good substitutes for lead shields.

**Reviewer's Comments:** The results of this useful study can help us improve the safety of surgeons in the operating room. During intraoperative use of C-arm fluoroscopy, the use of a thyroid shield by the surgeon should be routine, and it should be worn tightly. Several spine deformity surgeons have been affected by thyroid cancer, and it behooves all of us to take protective measures and wear the thyroid shield tightly when necessary. (Reviewer-Paul D. Sponseller, MS, MD, MBA).

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Keywords: Scoliosis Surgery, Intraoperative Fluoroscopy, Reducing Radiation Exposure

Print Tag: Refer to original journal article
Quincke vs Whitacre Needle Associated With Higher Incidence of Intravascular Injection

**A Comparison of Quincke and Whitacre Needles With Respect to Risk of Intravascular Uptake in S1 Transforaminal Epidural Steroid Injections: A Randomized Trial of 1376 Cases.**

Shin J, Kim YC, et al:

*Anesth Analg* 2013; 117 (November): 1241-1247

During transforaminal epidural steroid injections at S1, the Quincke needle was associated with a higher rate of intravascular injection than was the Whitacre needle.

**Objective:** To test the hypothesis that the intravascular injection rate when using Whitacre needles is lower than that of Quincke needles during transforaminal epidural steroid injection (TFESI) at the S1 level.

**Design/Participants:** Prospective, randomized clinical trial including 616 adult patients for TFESI at the S1 level.

**Methods:** Patients were randomly assigned to receive TFESI with either a 25-G 9-cm Quincke needle or a 25-G 9-cm Whitacre needle. In case of bilateral S1 TFESIs, the 2 different needle types were used, one for each side (randomly allocated). All injections were placed with the patient in the prone position and with fluoroscopy guidance. Each occurrence of intrasacral bone contact was recorded. After negative blood aspiration, 1 to 2 mL of contrast media was injected under fluoroscopy and studied for intravascular injection.

**Results:** The participating 616 patients had a total of 1376 TFESIs. Unilateral injection was performed in 242 cases, and bilateral injections were given in 1134 cases. A Quincke needle was used in 735 and a Whitacre in 641 cases. There were no statistically significant differences between the groups with respect to sex, age, height, weight, hypertension, or diabetes mellitus. The rate of intravascular injection in the Quincke group (24.9%) was higher than that in the Whitacre group (16.7%). The overall incidence of intravascular injection was 21.1% and did not result in serious complications. Intravascular injections were significantly associated with needle tip type, blood aspiration test, intrasacral bone contact, and the physician performing the procedure. Intravascular injections were not associated with injection side, history of lumbosacral spine operation, or use of anticoagulants. The incidence of intrasacral bone contact did not differ based on needle type, but in the Quincke group intrasacral bone contact was associated with a significantly higher incidence of intravascular injection, 59.0% versus 30.2% in the Whitacre group. The intravascular injection rates of 2 physicians were higher than those of the others.

**Conclusions:** During transforaminal epidural steroid injection, Quincke needle, intra-sacral bone contact, positive blood aspiration test, and physician performing the procedure were associated with a higher incidence of intravascular injection.

**Reviewer's Comments:** There were 11 physicians participating in the study, each with experience of >2000 to 3000 fluoroscopy-guided injections. The study was not able to pinpoint the factors that resulted in 2 of the physicians experiencing higher rates than the others of intravascular injections. *(Audio review recorded by David S. Beebe, MD.)* (Reviewer-Krasimir George Bojanov, MD).

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Keywords: Quincke Versus Whitacre Needles, Intravascular Uptake, S1 Transforaminal Injection, Epidural Steroids

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Specialists Tell Us How to Manage Different Aspects of Bell Palsy

Clinical Practice Guideline: Bell's Palsy Executive Summary.

Baugh RF, Basura GJ, et al:

Otolaryngol Head Neck Surg 2013; 149 (November): 656-663

Along with history and physical, imaging, and lab tests for initial management, treatment with oral steroids was strongly recommended for patients with Bell palsy.

Discussion: The classical teaching in Bell palsy is that it should be a diagnosis of exclusion that requires identification of pathologies that can cause facial nerve paralysis and/or paresis in an acute manner (ie, <72 hours). Outside of the obvious paresis or paralysis, patients can present with hyperacusis, dryness of the eyes or mouth, taste loss or disturbance, or pain around the ears. After the presentation of this presumably viral inflammation of the facial nerve, most improve within 2 to 3 weeks with complete resolution in 3 to 4 months. For those with only paresis, 94% are expected to have full recovery without any interventions. For those with complete paralysis, 70% are expected to have full resolution, while 30% may suffer from partial recovery of the facial nerve function. The risk factors for Bell palsy are pregnancy, severe pre-eclampsia, diabetes, obesity, hypertension, and upper respiratory ailments. For this report, the authors examined the literature and presented guidelines on the current management of Bell palsy. They explicitly state that this is not a standard of care monograph. This guideline can be summarized as such. History and physical, imaging, and lab tests for the initial management were recommended. Treatment with oral steroid was strongly recommended, and this was based on grade A level of evidence. The authors did not recommend antivirals alone. Recommendation for treatment with a combination of steroids and antivirals was equivocal. The authors were strong in their recommendations against electrodiagnostic tests for incomplete paralysis, but for the other adjuvant tests and treatments, they were once again equivocal. They did not recommend surgical decompression, but the text of the manuscript suggested that they did not have any clinical evidence for or against surgery.

Reviewer’s Comments: This guideline is a good review for general otolaryngologists, but this report lacks an important aspect of evidence-based guidelines in that it there is a deficit of strong evidence from the literature. In short, it is a review of opinions from specialists throughout the country as to how to manage different aspects of Bell palsy. The real weakness is the lack of a substantial bibliography. While this was a guideline statement by the members of the Academy, this lack of citations is troubling. Even though there may be a paucity of good literature on this topic, readers should clearly understand that this is a guideline and not a standard of care statement. Most of the aggregate evidences for this guideline are rated Grade C or less. Only one recommendation was rated Grade A, and this was the use of oral steroids. The take-home message of this endeavor is that solid clinical research on Bell palsy is inadequate. (Reviewer-Young J. Kim, MD).

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Keywords: Bell Palsy, Facial Paralysis, Guidelines

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