Status Epilepticus Associated With Poor Outcome After Subdural Hematoma

The Epidemiology, Risk Factors, and Impact on Hospital Mortality of Status Epilepticus After Subdural Hematoma in the United States.

Seifi A, Asadi-Pooya AA, et al:

Springerplus 2014; 3 (July 1): 332

In-hospital mortality is increased in patients with subdural hematoma who suffer status epilepticus.

**Background:** Seizures frequently complicate the care of patients with subdural hematomas. Status epilepticus (SE) in this setting is not well understood, but may be associated with poor prognosis.

**Objective:** To determine the epidemiology and risk factors of SE in patients with subdural hematoma and the impact of SE on hospital mortality for patients with subdural hematoma.

**Design:** Retrospective review of national database.

**Methods:** Data were gleaned from patients aged >18 years old included in the Nationwide Inpatient Sample (20% of non-federal, short-term admissions) from 1988 to 2011 using ICD-9 codes for subdural hematoma and SE (continuous clinical seizure lasting >5 minutes, >2 seizures without interictal return to baseline, or EEG consistent with SE). In-hospital complications were also defined by ICD-9 codes. Hospitals were grouped by location, size, and type.

**Results:** Of 1,583,255 patient admissions with subdural hematoma, 7,421 included SE (0.5%). Incidence of subdural hematoma increased from 13 per 100,000 in 1988 to 38 per 100,000 in 2011. SE was similar regardless of gender, but was more common in black patients and older patients. Patients with SE were more likely to have pulmonary (36.4% vs 8.5%), hematological (10.8% vs 5.9%), or renal (20.1% vs 6.8%) perturbations. SE was an independent predictor of in-hospital mortality (overall 13.4% without compared to 26.1% with). Mortality without SE reduced from 19.9% in 1988 to 10.3% in 2011; mortality reduction was less for those with SE (27.8% in 1988 to 23.7% in 2011).

**Conclusions:** SE increases risk of in-hospital death in patients with subdural hematoma.

**Reviewer's Comments:** While not common, SE can be a significant complicating factor in patients with subdural hematoma, as this study shows. As a retrospective national database study, analysis of the included data is limited. For instance, use of anti-epileptic drugs and timing of onset of SE are not reported. Neither is the duration of the SE. Head-trauma guidelines currently indicate use of anti-epileptic agents for the first 7 days after injury. Depending on the onset of SE in this group of patients and prevention with medications (which requires additional study), re-assessment of this guideline may be in order. Similarly, increased use of EEG in patients with clinical change is probably warranted to evaluate for the possibility of subclinical SE. (Reviewer-N. Scott Litofsky, MD, FACS).

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Keywords: Subdural Hematoma, Status Epilepticus, Risk Factors, Mortality

Print Tag: Refer to original journal article
Communicating the Glasgow Coma Scale as a single total score was never the original intention of its creators.

**Background:** Teasdale co-authored the original 1974 paper. **Summary:** The Glasgow Coma Scale (GCS) was conceived in the neurosurgery unit of a regional receiving hospital to address the need for meaningful clinical communication between centers regarding a patient's initial condition. A final shortlist of criteria was refined through pioneering studies of interobserver agreement, then in their infancy in neurology. Opening of the eyes was included to avoid imprecise subjective judgments about arousal and awareness. The GCS coincided with accelerating head injury research, new availability of CT, and the realization that research needed standardized reporting of initial severity. The scale became an expected component of publications. It is now used in >80 countries, is the only method in use for assessment of head injuries in 80%, with most translating it into the national language. As introduced, the GCS was intended to be communicated as 3 numbers (eg, eye opening [E] 1, verbal response [VR] 2, and best motor response [MR] 3), but the summing of the separate scores into a single score was soon commonplace. The total provided a useful overview, but had consequences that were not foreseen at the time and were undesirable. These included a less informative replacement for a description of the 3 responses, and thus, the potential for confusion and uncertainty about how best to deal with missing or untestable components. In ad hoc fashion, and also not as intended, the GCS was soon used to subdivide the continuum of head injury into severe, mild, and moderate, starting when a score of 8 was used for "severe" head injury, corresponding to E1, V≤2, and M≤5. The validity of the cutoffs can be challenged. A score of 13 to 15, considered "mild," might be useful epidemiologically, but it groups patients with differing levels of risk of an early complication or an adverse late outcome. Even so, components of the GCS and the overall score are strongly related to outcome after traumatic brain injury. This linkage is strongest if the assessment is done after stabilization rather than before. Low scores are driven by the MR; one is reminded to record the BEST motor score after assessment at several sites, with fingernail pressure being the first maneuver. The practice of reporting an average GCS is not appropriate; it is not an interval score. The problem of untestable components has worsened because severely injured patients may be sedated and intubated at the scene.

**Reviewer's Comments:** The original 1974 article is frequently cited and remains the most cited clinical neurosurgical paper. Looking ahead, the GCS will remain a component of evolving multidimensional assessments incorporating advanced functional imaging, biomarkers, neurophysiology, and genetics. (Reviewer-Steven B. Abrams, MD).

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Keywords: Traumatic Brain Injury, Glasgow Coma Scale, Predictive Value, Research

Print Tag: Refer to original journal article
Determining Futility Requires Experience

Differences Between Attendings’ and Fellows’ Perceptions of Futile Treatment in the Intensive Care Unit at One Academic Health Center: Implications for Training.

Neville TH, Wiley JF, et al:

Acad Med 2015; (December 16): epub ahead of print

Determinations regarding futility of care of patients in the intensive care unit are better when made by physicians with more experience after longer deliberation.

**Background:** Quality critical care requires abilities to determine if critical care interventions are likely to influence probability of patient survival. Critical care physicians are generally able to make such determinations.

**Objective:** To determine the ability of fellows in critical care training programs to predict futile critical care relative to attending physicians.

**Design:** Single-institution prospective study.

**Methods:** A questionnaire was developed by a focus group of 13 critical attendings at UCLA to assess futile treatment in patients in the intensive care units (ICU). No instructions were provided on how to determine futile care. Attending physicians and fellows in critical care training programs were queried daily for 3 months about patients in 5 ICUs (medicine, neuro, cardiac, cardiothoracic, and mixed-use). Reasons for determination of futile care were sought. Clinical information on each patient was acquired, including in-hospital and 6-month mortality. Perception of futility of treatment (non-futile, probably futile, and futile) was compared between attending physicians and fellows. Predictors of futility assessment were determined by multivariate analysis. Mortality was compared to designation of futility for each group of patients.

**Results:** 36 attendings made 6897 assessments on 1125 patients and 14 fellows made 4407 on 773 patients. Futility was more often determined by fellows (20.8%) compared to attendings (10.9%). Most common reason for determination of futility for both attendings and fellows was that burdens outweighed benefits. Fellows more often cited a single reason for futility (41% vs 18% for attendings). Attendings listed more reasons per patient (3.0) than fellows (2.1). Factors associated with attending and fellow determination of futility included patient age, patient hospital day, and admission from skilled nursing facility or long-term care facility (relative to emergency department admission). Attendings determined futility less often on outpatient admission patients. Fellows determined futility on their mean second day of clinical service while attendings determined futility on mean fourth day of clinical service. In hospital and 6-month mortality was higher for patients determined to be receiving futile care, with mortality higher for attending determination (68% and 84% vs 51% and 62% for fellows, respectively).

**Conclusions:** Determination of futility by attending physicians is a more complex process than that used by fellows, with a smaller group of patients more likely to die and better accuracy of prediction.

**Reviewer’s Comments:** This interesting study indicates that physician experience and time spent caring for patients are important for making accurate determinations of futility of care. While the study did not specifically report neurosurgical patients, a few lessons are worth gleaning. Senior members of neurosurgical groups should mentor junior colleagues regarding futility of care decisions. All neurosurgeons should be patient and give patients and families some time before deriving a "futility of care" decision, obviously taking the clinical circumstances into consideration. (Reviewer-N. Scott Litofsky, MD, FACS).

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**Keywords:** Futility, Mortality, Critical Care, Attending Physician, Fellow

**Print Tag:** Refer to original journal article
Coiling of Ruptured Aneurysm Durable to 10 Years

The Durability of Endovascular Coiling Versus Neurosurgical Clipping of Ruptured Cerebral Aneurysms: 18 Year Follow-Up of the UK Cohort of the International Subarachnoid Aneurysm Trial (ISAT).

Molyneux AJ, Birks J, et al:

Lancet 2014; (October 28): epub ahead of print

For those who survive a ruptured cerebral aneurysm, the main risk of death over the next 10 years is cancer and cardiac disease.

**Background:** The International Subarachnoid Aneurysm Trial found a reduced rate of death or dependency at 1 year after endovascular coiling compared with clipping of ruptured cerebral aneurysms in 2143 patients. Although a greater percentage of patients who underwent coiling required retreatment, retreatment was not associated with an increased risk of death or dependency.

**Objective:** To compare long-term outcomes of patients in the United Kingdom with a ruptured cerebral aneurysm treated with either endovascular coiling or clipping.

**Methods:** Patients were enrolled between September 12, 1994, and May 1, 2002. Patients were randomly assigned to either neurosurgical clipping or endovascular coiling. A questionnaire was mailed annually to participants assessing functional status and inquiring about any additional treatment of the aneurysm. Minimum follow-up was 10 years. All deaths were automatically reported to the Oxford Neurovascular and Neuroradiology Research Unit by the Office of National Statistics in the UK. A good outcome was defined as a modified Rankin scale score of 0 to 2.

**Results:** As of March 2013, 1256 of the original 1644 patients in this cohort (76%) were still living. Because follow-up ranged from 10 to 18 years, the authors calculated 10-year survival, which was 80% overall, 83% for those treated with coiling, and 79% for those treated via clipping (statistically significant difference for coiling versus clipping). The proportion of patients with a good outcome at 10 years was 82% among those who had coiling versus 78% among those who had clipping of their aneurysm (difference not statistically significant). When the authors calculated the probability of an independent survival, there was a statistically significant benefit in favor of coiling. The incidence of rebleeding after 1 year was calculated as 1.56 per 1000 patient-years in the coiling group and 0.49 per 1000 patient-years in the clipping group.

**Conclusions:** Although the rates of good outcomes at 10 years did not differ significantly between those who had clipping versus coiling, the probability of death or dependency was significantly greater in the group treated via clipping. Rebleeding was more likely after coiling than after clipping, but the risk was small and the probability of disability-free survival was significantly greater in the coiled group at 10 years.

**Reviewer's Comments:** These data provide important long-term information regarding outcomes of patients with a ruptured cerebral aneurysm who have their aneurysm coiled or clipped. Based on this trial, there are 4 fewer patients per 100 treated with coiling compared with clipping who have died or are dependent at 10 years. For those who survived the ruptured aneurysm, the risk of death due to cancer and cardiac disease at 10 years was increased, which speaks to the ongoing need for modification of treatable risk factors, such as smoking. (Reviewer-Brian Silver, MD).

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Keywords: Ruptured Cerebral Aneurysms, Clipping vs Coiling, Long-Term Outcomes

Print Tag: Refer to original journal article
The Food and Drug Administration has yet to approve an alternative to temozolomide.

**Background:** Since 2006, temozolomide is prescribed to almost all patients diagnosed with a glioblastoma. It's unclear, however, if everyone benefits from temozolomide. For instance, patients aged ≥65 years with a glioblastoma expressing MGMT (a glioblastoma in which the MGMT promoter is unmethylated) probably don't benefit.

**Objective:** To review the current knowledge on this subject.

**Design:** Review of the literature. **Review:** Clinicians prefer treating all glioblastoma patients with temozolomide. Most labs use a PCR-based assay, but the results can be off because of heterogeneity across the tumor or because of sample contamination by non-neoplastic cells. This should not discourage us from using a MGMT assay because a number of clinical trials have convincingly shown that MGMT promoter methylation (indicating low or no MGMT expression) is associated with better outcomes for all ages. For a while, it was thought that sustained temozolomide administration led to suppression of MGMT activity, with the tumors becoming more susceptible over time to the alkylating effects. This was never confirmed. Currently, the recommended treatment for glioblastoma depends on age and functional status. In patients <65 years and autonomous, maximal resection, followed by radiotherapy and temozolomide, is the norm regardless of the MGMT promoter methylation status. In patients aged ≥65 years, or in younger patients with a poor functional status, radiation can be given alone if the MGMT promoter is unmethylated. Withholding temozolomide is more likely to occur in Europe. One reason why we are less likely to withhold on temozolomide might be that in older and impaired patients, we often give a lesser dose of radiation. After all, there is ample evidence that the standard 60 Gy radiation regimen produces cognitive impairment, especially in older patients. The ongoing trial of hypofractionated radiation, which involves a total dose 34 to 40 Gy, was specifically designed to address this issue. So the question remains as to if there is an alternative to temozolomide in patients with newly diagnosed or recurrent glioblastomas that are expressing MGMT. The short answer is that there are many options but none are yet shown to improved progression-free survival (PFS) or overall survival (OS), except for the combo of lomustine and bevacizumab. This combo was tested in the recently published BELOB trial, reviewed last month. In this phase 2 trial, the combo of lomustine and bevacizumab increased both PFS and OS in recurrent glioblastoma. A phase 3 trial is underway.

**Conclusions:** MGMT promoter methylation is a favorable prognosis factor in glioblastoma and allows predicting the tumor susceptibility to the cytotoxic effects of temozolomide, but in 60% of patients, the promoter is unmethylated.

**Reviewer's Comments:** In the near future, the combo of cytotoxic and anti-angiogenic agents might become the alternative treatment for temozolomide-resistant glioblastoma. (Reviewer-Luc Jasmin, MD, PhD).
Low Complication Rate After ALIF Using rhBMP-2

Anterior Lumbar Interbody Fusion Using Recombinant Human Bone Morphogenetic Protein-2: A Prospective Study of Complications.

Malham GM, Parker RM, et al:

J Neurosurg Spine 2014; 21 (December): 851-860

Since there are extensive data related to complications associated with the use of bone morphogenetic protein in anterior lumbar interbody fusion, spine surgeons should continue to be cautious.

Background: Anterior lumbar interbody fusion (ALIF) is one of the tools in spine surgeries that is used to address discogenic back pain with radiculopathy. It has been shown to have good patient outcome when patients are selected appropriately. However, there is controversy regarding the utilization of bone morphogenetic protein (BMP) in ALIF because of high rate of complication, specifically retrograde ejaculation (RE). The data published in this study showed a lower rate of complications with the utilization of recombinant human bone morphogenetic protein-2 (rhBMP-2).

Objective: To investigate complications related to utilization of rhBMP-2 in ALIF.

Design: Prospective study of a single spine surgeon experience and single fascicle surgeon experience of 131 patients.

Methods: This study was conducted on consecutive patients who underwent ALIF between 2009 and 2012. Indications for surgery were severe discogenic back pain, radiculopathy, and grade 1 and 2 spondylolisthesis. All patients had placement of polyetheretherketone (PEEK) packed with rhBMP-2 after discectomy and secured with anterior plate. Patients were assessed for immediate postoperative complications and followed at 1 week, 1 month, 6 months, and 1 year by evaluating pain visual analog scale (VAS) scores, Oswestry Disability Index (ODI) scores, and SF36 scores. Fusion rate was assessed using high definition CT scan. Male patients were specifically assessed for complication of RE.

Results: 67 patients were male and 64 were women. Average age was 45 years. Majority of patients (89%) had L5-S1 while 7% had L4-5 and 4% had 2 levels L4-S1 ALIF. Overall complication rates were 19.1% with 13.0% experienced in minor complication and 6.0% experienced in major complications. Minor complications were superficial wound infection, diabetes, sympathetic chain injuries, atelectasis, hematoma, and urinary tract infection. Major complications reported were pseudo-obstruction, pleural effusion, deep venous thrombosis, pneumonia, and RE in men. Overall rate of RE was about 1%. Data reported in this publication indicated that >50% symptomatic improvements. The overall fusion rate was 96.9% at 12 months.

Conclusions: Utilization of rhBMP-2 led to a very robust construct with a great fusion rate. This study showed a low rate of complications including RE after ALIF utilizing rhBMP-2 to increase fusion rate.

Reviewer's Comments: This publication showed that utilization of recombinant human bone morphogenetic protein led to a very robust construct with great fusion rate and low complications. The RE rate was about 1%. Even though the results are impressive, this is only a single surgeon and single institution experience. Therefore, further investigation is needed before generalizing the utilization of rhBMP-2 in ALIF. (Reviewer-Fassil B. Mesfin, MD, PhD).

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Keywords: Degenerative Spine, ALIF

Print Tag: Refer to original journal article
Stainless Steel Implants for Fusion Increase Deep Infection Risk

_Bacteriology and Risk Factors for Development of Late (Greater Than One Year) Deep Infection Following Spinal Fusion With Instrumentation._

LaGreca J, Hotchkiss M, et al:

Spine Deformity 2014; 2 (May): 186-190

In patients who have undergone spinal fusion, deep surgical site infection appears to be more common after instrumentation with stainless steel implants than with titanium implants.

**Background:** Deep surgical site infection after spinal fusion is a much-scrutinized topic. The risk of a deep infection is increased in children with neuromuscular disorders. There is also a more recently recognized phenomenon of late infection, which can behave differently than an early infection.

**Objective:** To compare and contrast the characteristics of early versus late deep infections after spinal fusion.

**Design:** Retrospective cohort study.

**Participants:** 1390 patients who underwent instrumented spinal fusion at Children's Hospital of Colorado during a 9-year study interval.

**Methods:** "Late infection" was defined as occurring >1 year after spinal fusion, according to Centers for Disease Control guidelines. Surgical parameters, demographic factors, and infective organisms were compared for early versus late deep infections.

**Results:** 70 early and 42 late infections occurred -- overall rate of infection was 8.2%, which is compatible with other literature on the topic. The latest of the "late" infections occurred at 4 years after surgery. Of infecting organisms identified in the 70 early infections, approximately 44% were *Staphylococcus aureus*, 18% were enteric organisms, and 15% were *S epidermidis*. Of the infecting organisms identified in the 42 late infections, 50% were *Propionobacterium* and only 10% were *S aureus*. The prevalence of coagulase-negative *Staphylococcus* was about the same in both groups. The infection rate was 11% in patients with stainless steel implants versus 3% in patients with titanium implants. No growth of an organism occurred in approximately 4% each of early and late infections.

**Conclusions:** Rate of infection after pediatric spinal surgery is high, and early infections are slightly more common than late infections. *S aureus* is more commonly associated with early infection, whereas *Propionobacterium* is more commonly associated with late infection.

**Reviewer's Comments:** It is important to know about the phenomenon of late deep infection, especially when patients present with unexplained pain. The importance of the implant in this is illustrated by the significant lowering of the infection rate in patients receiving titanium rods, which presumably have more favorable properties of the glycocalyx. Late deep infections are typically treated by rod removal and a short course of antibiotics: they almost never result in long-term persistence of the infection. However, there may be some loss of deformity correction after implants are removed. (Reviewer-Paul D. Sponseller, MS, MD, MBA).

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Keywords: Scoliosis Surgery, Fusion, Complications, Early vs Late Deep Infection

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Ankle Dorsiflexion Good Postop Test for LE Neurologic Function

Weak or Absent Dorsiflexion: The Most Sensitive Indicator of Motor Deficits Following Spinal Deformity Surgery.

Andras L, Louie K, Skaggs DL:

Spine Deformity 2014; 2 (May): 198-202

Ankle dorsiflexion is a 100% sensitive and specific test of lower extremity neurologic function after spinal deformity surgery.

**Background:** Neurologic deficit is perhaps the most feared complication after surgery for spinal deformity. Although a complete neurologic examination in the postoperative period is the gold standard, this degree of rigor is not always possible when the patient is poorly cooperative or partially sedated. It is also a challenge to repeat this multiple times after surgery is complete.

**Objective:** To determine if ankle dorsiflexion is a sensitive indicator of lower extremity (LE) neurologic injury after spinal deformity surgery.

**Design:** Retrospective single-center review.

**Participants:** The authors reviewed 1274 consecutive spine deformities treated at Children's Hospital Los Angeles during an 8-year study interval. The diagnoses included scoliosis, kyphosis, spondylolisthesis, and fractures or trauma.

**Methods:** The authors tested the sensitivity of various physical examination components for identifying LE neurologic injury in the early postoperative and later periods. They paid special attention to patients with delayed neurologic deficit.

**Results:** 12 patients (1%) had LE neurologic deficits postoperatively, but not all deficits were permanent. The LE neurologic deficit was present immediately postoperatively in 8 cases and was delayed in 4. Eight had complete neurologic deficits, and 4 had partial deficits. In all 12 cases, ankle dorsiflexion was weak or absent. The authors found that ankle dorsiflexion was 100% sensitive and specific for LE neurologic injury. There were several cases of incomplete deficit in which ankle plantarflexion weakness was not appreciated but ankle dorsiflexion weakness was detected.

**Conclusions:** Ankle dorsiflexion is the most sensitive and specific test of cord motor function after spinal deformity surgery. In this series, ankle dorsiflexion was completely sensitive and specific for detecting LE neurologic injury postoperatively.

**Reviewer's Comments:** This is an interesting concept. It is common to ask patients to wiggle their toes after surgery. It is recognized that plantarflexion can occur more readily, perhaps because of the normal plantar inclination of the foot in bed. The strength of these large muscles is sometimes hard to fully overcome. However, dorsiflexion comes less naturally, and the maximum strength of the ankle dorsiflexors, specifically the anterior tibialis, is probably a more sensitive test. This is also important for spondylolisthesis cases. It is important for clinical teams to focus on observing active dorsiflexion on exam after spinal surgery. It is also probably the most practical and discrete function to check on a routine basis. (Reviewer-Paul D. Sponseller, MS, MD, MBA).

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Keywords: Scoliosis Surgery, Complications, Neurologic Injury, Postop Evaluation & Monitoring

Print Tag: Refer to original journal article
Long-Term Results for Burst Fracture Similar for Fusion, Nonfusion

Fusion May Not Be a Necessary Procedure for Surgically Treated Burst Fractures of the Thoracolumbar and Lumbar Spines: A Follow-Up of At Least Ten Years.

Chou PH, Ma HL, et al:

J Bone Joint Surg Am 2014; 96 (October 15): 1724-1731

Fusion of a thoracolumbar or lumbar burst fracture does not significantly improve radiographic or clinical outcomes compared with nonfusion surgical cases.

**Background:** Burst fractures of the lumbar spine may be treated in a number of ways. Several studies have shown that nonsurgical treatment provides equivalent results to surgical treatment. If surgery is done, is the instrumentation mainly of value as an internal brace, or is fusion critical?

**Objective:** To compare the long-term results of fusion versus nonfusion in adults with surgically treated burst fracture.

**Design:** Long-term follow-up study based on authors’ prior prospective randomized study.

**Methods:** The authors, working in Taiwan, treated patients with burst fractures of the lumbar or thoracolumbar spine in a randomized trial of short-segment instrumentation with or without fusion. They excluded patients with progressive neurologic deficit or those requiring anterior decompression. The instrumentation consisted of a Lordosing screw above and below the fracture, with a screw at the fracture level as well. Those having fusion received iliac crest bone graft. Patients without fusion were encouraged to have the instrumentation removed at follow-up. Some of the fusion patients requested this, as well.

**Results:** At injury, patients had a mean age of 40 years. They underwent annual follow-up, and were followed up for ≥10 years. To eliminate the influence of degenerative changes, patients aged >60 years at injury were excluded. A striking 80% follow-up rate was achieved. There were 22 patients in the nonfusion group and 24 in the fusion group. Static and flexion-extension radiographs were measured, and the Greenough Low-Back Disability Inventory was used for clinical scoring. Implants were removed for 18 patients in the nonfusion group and 9 patients in the fusion group. The authors attribute this to cultural preferences. In both groups, about 15° of correction of the original injury kyphosis was achieved, but 11° of correction were lost at the 10-year follow-up. Clinical scores at 10 years were not significantly different between the 2 groups. Flexion-extension motion increased 4° in the nonfusion group. No infections occurred in either group.

**Conclusions:** Fusion at the time of instrumentation of a thoracolumbar or lumbar burst fracture does not significantly improve radiographic or clinical outcomes. Fusion may add additional blood loss and donor site morbidity. The slight improvement in motion seen in the nonfusion group may be beneficial.

**Reviewer's Comments:** This is a thought-provoking article. We do not have a firm idea of the role of bony fusion in these cases. The fact that 9 patients with fusion had their instrumentation removed may have clouded the analysis. With longer experience, it may become clearer whether maintaining slightly better upright sagittal alignment is preferable to having slightly more motion. In an accompanying commentary, Togawa stresses that some of the more severe fractures were excluded in this study’s design. Also, it is important to remember that nonoperative treatment produces good results, as well. (Reviewer—Paul D. Sponseller, MS, MD, MBA.)

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**Keywords:** Burst Fracture, Thoracolumbar & Lumbar Spine, Surgical Treatment, Fusion

**Print Tag:** Refer to original journal article
Posterior Fusion Risky for Adjacent-Segment Disease


Lee JC, Lee SH, et al:

J Bone Joint Surg Am 2014; 96 (November 5): 1761-1767

Independent risk factors for adjacent-segment degeneration include smoking, female gender, and posterior cervical fusion as the index spinal procedure.

Background: Adjacent-segment disease refers to degeneration of a spinal segment adjacent to a prior spinal procedure. It may be either clinical or radiographic. The theory has been that stress concentration or tissue destabilization may contribute to this condition.

Objective: To investigate the risk factors for adjacent-segment disorders and to compare the incidence of adjacent-segment pathology requiring surgery encountered with different types of spinal procedures.

Participants: Consecutive patients who underwent cervical spine surgery by 1 surgeon during a 10-year study interval and had ≥1 year of follow-up.

Methods: The authors calculated the yearly rate of adjacent-segment pathology that was severe enough to require surgery. They also identified risk factors using regression analysis. They focused on reoperation rather than radiographic findings of adjacent-segment pathology.

Results: 1095 patients underwent cervical arthrodesis (anterior, n=1038; posterior or anterior/posterior combined, n=57), and 214 underwent posterior decompression alone (laminoplasty or foraminotomy). The incidence of adjacent-segment surgery was approximately 2.3% per year on a relatively steady basis. It was calculated that 22% of patients would need a second surgery within 10 years of the initial procedure. The posterior arthrodesis group had a 7-fold higher risk of adjacent-segment surgery being required than did the posterior decompression group. Other risk factors were smoking and female gender. Anterior fusion had no higher rate of adjacent-segment procedures than posterior decompression. Age, diabetes, and number of operated segments were not risk factors for adjacent-segment pathology.

Conclusions: Smoking and posterior fusion procedures may cause an increased risk for adjacent-segment pathology. This is the first time that posterior fusion has been identified as an independent risk factor. Perhaps the stripping of posterior musculature, capsules, or ligaments contributes to this risk. Also the posterior constructs may be stiffer.

Reviewer's Comments: This was an interesting study. The small number of patients in the posterior fusion group may have limited the authors' ability to identify some other risk factors. (Reviewer-Paul D. Sponseller, MS, MD, MBA).

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Keywords: Cervical Spine Operations, Adjacent-Segment Pathology, Risk Factors

Print Tag: Refer to original journal article
The rate of iliac screw fixation failure is 27% in a neuromuscular population that undergoes pelvic fixation to help manage progressive spinal deformity. Spastic muscle tone is predictive of iliac screw failure.

**Background:** Spine fixation in neuromuscular patients with progressive spinal deformity is challenging. Most require fixation to the pelvis to prevent late adding-on. This places significant strain on the implant. The construct is vulnerable to failure, especially since the sacroiliac joint is mobile adjacent to the implants.

**Objective:** To quantify the rate of iliac screw failure in a population with neuromuscular spinal deformity and to identify risk factors associated with failure of pelvic fixation.

**Design:** Retrospective cohort study.

**Participants:** All patients (n=108; average age, 13.8 years) treated at Children's Hospital Colorado during an 8-year study interval who were followed up for ≥2 years.

**Methods:** Sacral-alar-iliac (SAI) fixation was not used. Most patients had cerebral palsy, but the next most common diagnoses were Duchenne muscular dystrophy, other neuromuscular syndromes, myelomeningocele, and spinal cord injury. Risk factors investigated by the authors included a number of distal anchor points (total possible, 8) between L4 and the sacrum, muscle tone, use of a crosslink distal to L4, implant alloy, and iliac screw diameter.

**Results:** The rate of iliac screw failure was 27%. Most failures consisted of a disengaged screw or rod. Failures were not related to implant density. The presence of spastic muscle tone was the factor most predictive of iliac screw failure, with a trend also being shown to the use of a distal crosslink.

**Conclusions:** The rate of iliac screw fixation failure is high in a neuromuscular population that undergoes pelvic fixation to help manage progressive spinal deformity. Spastic patients and those without a distal crosslink are at increased risk of iliac screw fixation failure. Since reporting this series, the authors have switched to the use of SAI screw fixation.

**Reviewer's Comments:** This was a sobering article. Along with the 30% failure rate noted by Myung, the results of this study show that the implant construct could be better designed. The use of SAI screws, engaging extra cortices at the sacroiliac joints, and also crossing perpendicular to them, offers promise of better durability of the construct. I believe that having adequate implant density is key. For me, the most practical means of fixation is L4, S1, and SAI screws, which are not a specialized screw but, rather, are a different trajectory crossing the sacroiliac joint, traveling one-third in the ala and two-thirds in the ilium. The use of a distal crosslink is a useful way to strengthen the construct. (Reviewer-Paul D. Sponseller, MS, MD, MBA).

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**Keywords:** Neuromuscular Spine Deformity, Pelvic Fixation, Iliac Screw Failure, Risk Factors

**Print Tag:** Refer to original journal article
Posterior reversible encephalopathy syndrome can involve the spinal cord. On MRI, it appears as a longitudinally extensive lesion of the central cord that starts at the cervicomedullary junction.

**Background:** Posterior reversible encephalopathy syndrome (PRES) typically involves the occipital and parietal lobes but can also involve the frontal and temporal lobes, basal ganglia, cerebellum, and brain stem. **Objective:** To report PRES affecting the spinal cord. **Methods:** The authors reported 2 of their own cases and 6 cases from the literature. **Results:** Patient ages ranged from 14 to 50 years old. Their mean age (31 years) was less than that of most PRES patients (47 years). The cause of PRES was extreme hypertension (mean, 217/135 mm Hg) in all 8 patients. None had eclampsia, immunosuppressant medication exposure, or systemic inflammatory disease as the cause of PRES. They presented with typical PRES symptoms, including headache, vomiting, confusion, drowsiness, loss of vision, and blurry vision. Only 1 of the 8 patients had seizures, which is much less than the usual seizure frequency (range, 70% to 92%) in PRES patients. Three patients had spinal cord findings, including paraparesis, urinary urgency and incontinence, hyperreflexia, and Babinski sign. All 8 patients had hypertensive retinopathy (arteriolar narrowing, flame hemorrhages, cotton-wool patches, and macular star), and 5 had papilledema. The CSF showed no signs of inflammation. MRI of the head showed typical findings of PRES in the cerebral hemispheres that extended to the cerebellum, pons, and medulla. In all 8 patients, T2-weighted MRI of the spine showed a longitudinally extensive lesion in the center of the cord that consisted of confluent abnormal signal from the cervicomedullary junction to C5 or lower. The cord was slightly expanded but there was no contrast enhancement to suggest myelitis and no restricted diffusion to suggest infarction. Antihypertensive treatment resulted in rapid improvement of cerebral signs and gradual improvement of spinal signs. Repeat MRI of the brain and spinal cord also showed improvement as early as 2 weeks after treatment. **Conclusions:** PRES can involve the spinal cord. On MRI, it appears as a longitudinally extensive lesion of the central cord that starts at the cervicomedullary junction. **Reviewer’s Comments:** The authors speculated on the mechanism of spinal cord involvement in PRES. The extremely high blood pressure leads to failure of vascular autoregulation, with vasogenic edema as a result. The vertebrobasilar circulation is especially susceptible to that process. The anterior spinal artery arises from the vertebrobasilar system, and that is why the upper cervical spinal cord is the most frequently involved portion in PRES. It is not clear why the patients with spinal cord involvement were younger than most patients with PRES and why they had seizures less frequently. Also unclear is whether spinal cord involvement occurs only in PRES due to hypertension or also in cases of PRES caused by other things. (Reviewer-Marc Winkelman, MD).

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Keywords: Posterior Reversible Encephalopathy Syndrome, Spinal Cord Involvement

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Diagnosis, Treatment of Cervical Sympathetic Chain Schwannomas

*Diagnostic Approach, Treatment, and Outcomes of Cervical Sympathetic Chain Schwannomas: A Global Narrative Review.*

Navaie M, Sharghi LH, et al:

Otolaryngol Head Neck Surg 2014; 151 (December): 899-908

Complete excision of cervical sympathetic chain schwannomas is associated with Horner syndrome and first-bite syndrome.

**Background:** Schwannomas are unusual benign tumors. An estimated 20% to 40% of schwannomas occur in the head and neck region. Of course, otologists see these cases as acoustic neuromas, but most head and neck schwannomas are nonvestibular; of these, most originate from the vagal nerve. Unfortunately, the knowledge base of cervical sympathetic chain schwannomas is limited by the fact that the literature is littered with case series reports from single institutions, except for 1 review article from 1997.

**Objective:** To perform an updated literature review from 1998 to 2013.

**Methods:** The authors identified 156 articles, of which 51 were reviewed in detail. These 51 reports encompassed 89 schwannomas from the cervical sympathetic chain. The clinical presentations of these 89 cases were summarized in this report.

**Results:** Nearly 70% of the time, these lesions were asymptomatic on presentation with a size that ranged from 2 cm to 4 cm. Average age at presentation was 43 years. CT and/or MRI were used for imaging. Fine-needle aspiration (FNA) was used in about one-third of cases, but these were rarely diagnostic. The imaging modality used tended to be MRI in the United States versus CT scan outside the U.S. Correct diagnosis was noted preoperatively in only 11% of cases. Most of these schwannomas were treated with complete excision, and the postoperative sequelae consisted of Horner syndrome in 91% of cases. The rate of first-bite syndrome was present in 21% of cases. Both sequelae occurred together in about 16% or cases.

**Conclusions:** The clinical history of these unusual schwannomas is summarized. The authors recommend less-than-complete excisions since the postoperative sequelae of these cases are associated with such high morbidity rates.

**Reviewer’s Comments:** There are several implications from this descriptive analysis of cervical sympathetic chain schwannomas. FNA is not required, and MRI is recommended for diagnosis. On imaging, there were no cases of these lesions splaying the jugular vein from the carotid artery. In terms of surgery, the morbidity rates associated with full excision were high. Enucleation methods should be strongly considered, given that these are predominantly benign processes. (Reviewer-Young J. Kim, MD, PhD).

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Keywords: Cervical Sympathetic Chain Schwannomas, Clinical History, Postop Complications

Print Tag: Refer to original journal article
In patients with Bell palsy, the addition of intratympanic steroids to standard treatment with systemic steroids and antiviral medications appears to shorten the recovery time.

**Background:** Idiopathic facial paralysis or Bell palsy is commonly treated with systemic steroids and antiviral medications.

**Objective:** To determine the efficacy of intratympanic (IT) steroids in addition to standard therapy for treatment of Bell palsy.

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

**Participants:** 31 patients with acute facial paralysis of House-Brackmann grade III or worse were enrolled (mean age, 43 years; age range, age 18 to 65 years) who presented at the authors' institution between December 2007 and March 2011.

**Methods:** Controls (n=17) received systemic steroids and antiviral medications, and 14 other patients received added treatment with IT dexamethasone injections given 3 times over 2 weeks. Patients were examined by an otolaryngologist blinded to treatment. Examinations were weekly for the first month and then monthly for 6 months.

**Results:** The primary outcome was complete facial recovery, which was 60% in the IT group and 50% in controls (difference not statistically significant). However, the mean time to improvement was significantly shorter in those given IT steroids (21 days) than in controls (42 days; \( P = 0.04 \)). When patients with more severe paralysis (House-Brackmann grade IV or worse) were considered, complete recovery was 80% in those given IT steroids versus 50% in controls. Although the difference in these recovery rates was not significantly significant, the rate of recovery was still significantly faster in patients receiving IT steroids. Complications of IT steroids were minor and included brief vertigo, pain, and headache that resolved within 30 minutes in all cases.

**Conclusions:** Patients with Bell palsy who receive IT steroids have a significantly shorter recovery time than do those receiving only standard treatment, although the overall rate of recovery is not significantly different for the 2 groups.

**Reviewer's Comments:** Bell palsy has a very high recovery rate for cases with incomplete paralysis at presentation, which encompasses most cases. Thus, it would take a large number of patients to demonstrate the rate of recovery improves with another therapy, and this relative small study did not have that much power. However, in subgroup analysis, the data suggest that patients with more complete paralysis have a higher rate of recovery when given IT steroids. Clearly, more studies are needed, but I think it would be reasonable to treat patients with Bell palsy with IT steroids in addition to systemic steroids. (Reviewer-Benjamin T. Crane, MD).
New Treatment for Childhood Dystonic Cerebral Palsy

Deep Brain Stimulation for the Treatment of Childhood Dystonic Cerebral Palsy.

Keen JR, Przekop A, et al:

J Neurosurg Pediatr 2014; 14 (December): 585-593

Efficacy and outcome of deep brain stimulator for pediatric dystonic cerebral palsy will need longer observation.

**Background:** Cerebral palsy (CP) is a major cause of childhood physical disability. Prevalence is 1 in 500 live births. CP is classified as spastic in 80% of cases and 3% to 17% as dyskinetic. Dystonic CP represents 70% of the dyskinetic type. Since relatively few patients have been treated with variation in functional rating scales reported, the efficacy of deep brain stimulation (DBS) for dystonic CP is unknown compared to primary dystonia in pediatric patients.

**Objective:** To review bilateral globus pallidus internus (GPI) DBS stimulation for dystonic CP.

**Design:** Single-institution retrospective study.

**Methods:** 5 patients aged <21 years were treated between 2010 and 2012 at Loma Linda University Medical Center. Patients included dystonic CP who were refractory to conservative management. Clinic performance was recorded in videotapes pre- and postoperatively. Performance was scored using Barry-Albright Dystonia Scale (BADS) and Burke-Fahn-Marsden Dystonia Rating Scale-movement (BFMDRS-M). All patients underwent bilateral posteroverventrolateral GPI DBS placement under general anesthesia. Cosman-Roberts-Wells head frame was used for localization. Preoperative imaging used Stealth MRI. Micro recording was not used and implantable pulse generators (IPGs) were placed on the same day. Vancomycin powder was sprinkled into subcutaneous pocket before skin closure.

**Results:** Target coordinates were lateral right 20.6 mm (range 19.7 to 21.8 mm), left 20.5 mm (range 19.4 to 21.6 mm) from midcommissural line. Stimulation parameter was 0.5 to 4.0 V for clinical effect. However, children did not tolerate higher than 2.0 to 2.5 V. Pulse width was 130 µsec. Mean amplitude was 3.2 ± 1.0 V, mean frequency 111.8 ± 40.0 Hz, and mean pulse width 167.6 ± 56.6 µsec. Dystonic CP required higher frequency compared to primary CP. All postoperative BADS scores were improved from 23.8 ± 4.9 to 20.0 ± 5.5. BFMDRS-M scores were improved from 73.3 ± 26.6 to 52.4 ± 21.5. The individual body regions differed in outcome depending on the scoring system. BADS showed improvement in axial muscle better than face. The reverse relationship was seen in BFMDRS-M. Therefore, no overall significant difference in laterality of motor function was observed. Two patients had infection and electrodes had to be removed.

**Conclusions:** The efficacy and long-term outcome of DBS for dystonic CP is rarely reported. Comparison of results to primary dystonia seems similar. Longer periods of observation and larger patient groups are needed. (Audio review recorded by N. Scott Litofsky, MD, FACS.)

**Reviewer’s Comments:** Dystonic CP is not a major type of CP. The patient with dystonic CP has impaired in motor ability. Treatment of dystonic CP is limited. DBS may have some potential to help these patients. However, larger patient groups and longer observation periods are needed to determine efficacy. (Reviewer-Tomoko Tanaka, MD).

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Keywords: Deep Brain Stimulation, Dystonia, Cerebral Palsy, Pediatrics, Functional Neurosurgery

Print Tag: Refer to original journal article
Isolated Scalp Hematomas in Children With Minor Blunt Head Trauma

Risk of Traumatic Brain Injuries in Children Younger Than 24 Months With Isolated Scalp Hematomas.

Dayan PS, Holmes JF, et al:

Ann Emerg Med 2014; 64 (August): 153-162

In children aged <2 years with minor blunt head trauma and isolated scalp hematomas, the risk of clinically important brain injury is low. A higher risk is seen in infants aged <3 to 6 months and in those with larger temporal or parietal scalp hematomas.

Objective: To determine the association between isolated scalp hematoma characteristics and traumatic brain injury in children aged <24 months with minor blunt head trauma.

Design/Participants: An analysis of >10,000 children who were seen in 25 pediatric EDs from 2004 to 2006.

Methods: Hematoma location was determined as either parietal, temporal, or occipital. For children with isolated scalp hematomas who are otherwise clinically well, the authors determined the association between the hematomas and clinically important traumatic brain injury or traumatic injury on CT. Clinically important traumatic brain injury was defined as death, neurosurgery for the injury, intubation >24 hours for a brain injury, or a positive CT scan that required hospitalization for ≥2 days.

Results: Of approximately 10,500 children aged <24 months who were enrolled, 29% (about 3000 children) had isolated scalp hematomas. Only 12 children (0.4%) had clinically important brain injuries, and none required surgery. A total of 570 children had CT scans, which constituted 19% of those with isolated scalp hematomas. Of the children, 9% had CT evidence of traumatic brain injuries, including subdural, extra-axial, and epidural hematomas. Factors that were associated with traumatic brain injury on CT included younger age, non-frontal scalp hematoma, increased scalp hematoma size, and severe injury mechanism.

Conclusions: A minority of children aged <24 months seen in an emergency department with isolated scalp hematomas received CTs. Although there was an occasional presence of traumatic brain injuries on CT, the prevalence of clinically important traumatic brain injury was very low and no patient among the 3000 required neurosurgery. In a young asymptomatic child with an isolated scalp hematoma following minor head trauma, clinicians should use patient age, scalp hematoma location, and size and injury mechanism to help determine which children should undergo neuroimaging.

Reviewer’s Comments: Increased risk for abnormal CT findings was highest in infants aged <3 months, with an adjusted odds ratio of 17 compared to a child aged >1 year. Compared to frontal hematomas, temporal/parietal and occipital hematomas had increased (albeit smaller) risks with odds ratios of 3.0 to 4.5, which was similar to increased risks from large hematomas (defined as >3 cm). Conversely, small hematomas (<1 cm or barely palpable) had a much lower risk than 1- to 3-cm hematomas. For infants aged <3 months with large temporal/parietal hematomas, 50% (8 of 16) had abnormal CT scans. Four of 6 infants ages 3 to 6 months with large occipital hematomas also had abnormal CT scans. Data indicate that a low threshold for neuroimaging should be maintained, particularly in infants aged <3 months with signs of scalp trauma. This does need to be balanced against the risks of ionizing radiation in this younger age. The potential issue of child abuse with the need for radiographic evaluation becomes an additional part of the equation. (Reviewer-Mark F. Ditmar, MD).

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Keywords: Isolated Scalp Hematoma, Brain, Head, Blunt Trauma, Injury

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To complete the quiz for credit, log onto www.practicalreviews.com. If you have not previously registered at the site, click on "New Customer Registration" located in the right navigational bar and follow the directions. You will need your account number (located above your name on the Table of Contents) and your mailing zip code. To access the quiz, click on the “Take a Quiz” link located in the right navigational bar. Enter the quiz code and select your answers. Once you click Submit, you will receive immediate notification of your score.

Quiz Questions

1. In patients with subdural hematoma, in-hospital mortality is higher for those with status epilepticus.  
   Circle one: True  False
2. The Glasgow Coma Scale was created to support categorization of brain injury as mild, moderate, or severe.  
   Circle one: True  False
3. Patients determined to be receiving futile care by critical care fellows are more likely to die than those deemed to be receiving futile care by critical care attending physicians.  
   Circle one: True  False
4. At 10 years after a cerebral aneurysm ruptures, the risk of death or dependency is reduced after treatment with coiling compared to treatment with clipping.  
   Circle one: True  False
5. Most glioblastomas are sensitive to temozolomide.  
   Circle one: True  False
6. In a recent study by Malham, the major complication rate of anterior lumbar interbody utilizing bone morphogenetic protein is about 19%.  
   Circle one: True  False
7. After spinal fusion, deep surgical site infection appears to be more common after instrumentation with stainless steel implants than with titanium implants.  
   Circle one: True  False
8. Ankle dorsiflexion is a sensitive test of lower extremity neurologic function after pediatric spinal deformity surgery.  
   Circle one: True  False
9. Fusion and nonfusion of lumbar burst fractures both produce similar clinical and radiographic results at 10 years after surgery.  
   Circle one: True  False
10. Patients undergoing a posterior cervical fusion have an increased risk of adjacent-segment degeneration.  
    Circle one: True  False
11. The rate of iliac screw fixation failure is 27% in a neuromuscular population that undergoes pelvic fixation to help manage progressive spinal deformity.  
    Circle one: True  False
12. On MRI, posterior reversible encephalopathy syndrome that involves the spinal cord appears as a longitudinally extensive lesion of the central cord.  
    Circle one: True  False
13. After excision of cervical sympathetic chain schwannomas, first-bite syndrome occurs in <1% of cases.  
    Circle one: True  False
14. In patients with Bell palsy, the addition of intratympanic steroids to standard treatment with systemic steroids and antiviral medications appears to shorten the recovery time.  
    Circle one: True  False
15. Deep brain stimulation requires same frequency in dystonic cerebral palsy and primary cerebral palsy, according to a recent study by Keen et al.  
    Circle one: True  False
16. The risk of clinically important brain injury is low in children aged <2 years with minor blunt head trauma and isolated scalp hematomas.  
   Circle one: True  False
1. T More than 50% patients with bilateral fixed dilated pupils with epidural hematoma may have a favorable outcome after surgery.

2. T Headaches have been shown to be a common feature of postconcussion syndrome in children.

3. T Prediction of new brain metastases after radiosurgery treatment may be possible by considering tumor type, number of brain metastases, and presence of extracranial metastases.

4. F Progression-free survival in recurrent glioblastoma is improved by bevacizumab therapy alone.

5. F In a study by van Etten et al, patients with incidental lobar microbleeds but without symptomatic lobar intracerebral hemorrhage and otherwise meeting criteria for cerebral amyloid angiopathy (CAA) did not have CAA at autopsy.

6. T Factors other than duration of ischemia appear to determine the size of cerebral infarction following total occlusion of the proximal middle cerebral artery.

7. T Postsurgical seizure recurrence after early antiepileptic drug withdrawal (6 to 12 months postoperatively) suggests failure to resect the epileptogenic region.

8. T Hippocampal sclerosis is by far the most common cause of temporal lobe epilepsy, present in 60% to 80% of surgical and autopsy specimens.

9. T In patients with vertebral compression fracture undergoing vertebroplasty, a routine vertebral biopsy during surgery will optimize the diagnosis of potential malignancies.

10. F Complete response to I-131 treatment occurs in >90% of those patients who have I-131 avid spinal metastases.

11. T Use of kaolin-impregnated hemostatic dressing for wound packing significantly reduces the estimated blood loss during pediatric posterior scoliosis surgery.

12. T In adults undergoing spine surgery, the total dose of propofol appears to be the most predictive variable in time to emergence after total IV anesthesia.

13. T Trabecular bone score identifies two-thirds of women with fracture who are not classified with osteoporosis by bone mineral density alone.

14. T Administration of bisphosphonates before age 6 years slows the rate of scoliosis progression in patients with type-III osteogenesis imperfecta.

15. T In natalizumab-treated multiple sclerosis patients, the outcome of progressive multifocal leukoencephalopathy is better when the diagnosis is made before symptoms appear rather than after patients become symptomatic.

16. T Evaluations of CT scans in infants have found normative ranges of anterior fontanelle closure greater than those previously reported, with about 10% remaining patent at 20 to 24 months.