

Rotational injury of cervical facets: CT analysis of fracture patterns with implications for management and neurologic outcome

Shanmuganathan K, Mirvis SE, Levine AM.
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Objective. Imaging studies of patients with rotational facet injuries of the cervical spine were retrospectively reviewed to determine the prevalence and pattern of associated fractures, to correlate injury pattern with recommended surgical stabilization, and to assess neurologic outcome.

Materials and methods. Radiographs and CT scans obtained for 40 consecutive patients with rotational facet injuries of the cervical spine during a 70-month period were retrospectively reviewed to determine injury level, presence, and orientation of facet fractures, and concurrent nonfacet injuries. Imaging findings were reviewed to assess the likelihood of instability and to determine the most appropriate stabilization requirement. Medical records were reviewed to ascertain mechanism of injury, initial neurologic deficit, and surgical findings.

Results. Among the 40 patients with cervical rotational facet injuries, 11 (27%) had pure unilateral facet dislocation or subluxation without associated fractures, and 29 (73%) had concurrent facet fractures involving the inferior facet of the rotated vertebra ($n = 13$), the superior facet of the subjacent vertebra ($n = 9$), or both ($n = 7$). Injury of the rotated vertebra was unilateral in 22 patients but bilateral in 18 patients. Facet fractures frequently extended into the ipsilateral lamina or articular pillar or both. An avulsion fracture from the posteroinferior aspect of the rotated vertebral body, indicating disk disruption, occurred in 10 patients (25%), and seven patients (17%) had complete isolation of an articular pillar. Facet fractures were confirmed for 27 patients who underwent surgical stabilization. Neurologic deficits developed in 29 (73%) of the 40 patients and included radiculopathy in 11 patients and cord syndromes in 18 patients. Pure dislocation without a facet fracture was more likely to lead to a cord syndrome ($p = .006$).

Conclusion. Cervical rotational facet injuries are often accompanied by facet fractures and bilateral damage of the rotated vertebra. These injuries contribute to rotational instability and require specific internal fixation based on a precise delineation of all injuries. Facet dislocations without fractures have a significantly higher association with cord syndromes than do rotational facet injuries with fractures. CT, particularly with parasagittal reformations, is valuable in identifying all injuries of the rotated and subjacent vertebrae.

Quality assessment and improvement: what radiologists do and think

Deitch CH, Chan WC, Sunshine JH, Zininger MD, Cascade PN, Cochran ST. AJR 1994; 163:1245-1254.

Objective. The main objectives of the study were as follows: first, to study the nature and extent of radiologists' involvement in and their attitudes toward quality assessment (QA) and continuous quality

improvement (CQI)/total quality management (TQM) in hospitals and in offices; and second, to ascertain whether differences in size, type, and location among hospitals and nonhospital radiology offices affect the QA and CQI/TQM activities of radiologists. We analyzed data from a national survey conducted by the American College of Radiology (ACR) in 1993.

Materials and methods. Questionnaires about QA and CQI/TQM activities and attitudes were mailed to 216 hospital-affiliated diagnostic radiology group practices using a sample selected from the ACR master list of radiology practices in the United States. The response rate was 90%. A stratified random sample ensured representation of different geographic regions, various group sizes, and both academic and nonacademic groups. Responses were weighted so that our data show what answers about hospitals would have been if (i) the survey had been answered by all hospital radiology departments in the United States (except for those few staffed by solo practitioners or nonradiologists) and (ii) our questions about nonhospital offices had been answered by all radiology groups in the United States (except those few having no hospital activity).

Results. The majority (86%) of hospital radiology departments report having a program to monitor and evaluate physicians' performances. Fifty-one percent collect incorrect diagnoses by specific radiologist. Twenty-eight percent collect some of their QA data through computerized information systems. We found some statistically significant differences by hospital size and location, with larger hospitals and urban hospitals being more likely to engage in some QA activities. Multivariate analyses, once controlled for hospital size and location, found no significant differences in QA activity between university and community hospitals or between hospitals with and without a residency program. QA and CQI programs were less common in offices than in hospitals. With the exception of mammographic interpretations, most practices did not monitor and evaluate physicians' performances in the office setting. Respondents representing 58% of hospital radiology departments thought that QA and CQI contributed to improvement in patient care. Only 19% of radiology practices answered that CQI has been of cost benefit to their organization.

Conclusion. Radiology practices engage in a variety of QA and CQI activities in hospitals. However, this is less true in offices, in which radiologists have more discretion, and radiologists remain skeptical about the usefulness of CQI.

Abdominal aortic aneurysm morphology: CT features in patients with ruptured and nonruptured aneurysms

Siegel CL, Cohan RH, Korobkin M, Alpern MB, Courneya DL, Leder RA. AJR 1994; 163:1123-1129.

Objective. We evaluated a variety of internal architectural features in ruptured and nonruptured abdominal aortic aneurysms to determine whether any features are associated more frequently with ruptured abdominal aortic aneurysms. These features may be useful in identifying subtle ruptures when no obvious retroperitoneal hematoma is present and may be helpful in predicting unstable aneurysms at risk

for rupture.

Materials and methods. The CT scans of 52 patients with ruptured abdominal aortic aneurysms were reviewed and compared with those of 56 patients with asymptomatic nonruptured aneurysms exceeding 4.5 cm in diameter. All aneurysms were evaluated for size, rim calcification, thrombus amount, thrombus calcification, and lumen irregularity. In addition, four different thrombus patterns were identified and evaluated, including homogeneous, diffusely heterogeneous, periluminal halo, and crescent patterns. Statistical comparisons, were adjusted for differences in size between the two groups.

Results. Age, gender, and aneurysm length were not statistically different between the two groups. A larger diameter was found in the ruptured aneurysm group: 7.4 (anteroposterior) x 7.9 (transverse) cm versus 5.9 x 6.1 cm ($p = .00001$). More thrombus surrounded the nonruptured aneurysms ($p = .014$). Thrombus calcification was seen in 25% (14/56) of the control group and in 13% (7/52) of the rupture group ($p = .01$). Two thrombus patterns, homogeneous and periluminal halo, were encountered with similar frequencies in both groups. The diffusely heterogeneous pattern was seen more in the control group. A crescent of increased attenuation was encountered only in patients with ruptured aneurysms, at an incidence of 21% (11/52) ($p = .0005$). Thick and thin wall calcifications were seen in both groups, but a focal discontinuity in circumferential calcification was seen only in association with ruptured aneurysms, at an incidence of 8% (4/52) ($p = .008$). There was no significant difference in the number of patients whose patent lumen was irregular.

Conclusion. In our series, detection of a high-attenuation crescent or focal gap of otherwise circumferential wall calcification is associated with aneurysm rupture. The homogeneous, diffusely heterogeneous, and periluminal halo patterns are not specifically associated with aortic rupture. There were no significant differences in the amount of wall calcification or frequency of luminal irregularity between patients with ruptured and those with nonruptured aneurysms.

The use of alternative medicine by children

Spiegelblatt L, Laine-Amara G, Pless IB, Guyver A.
Pediatrics 1994; 94(6):811-814.

Objective. Alternative medicine (AM) is of growing interest to the general public. Although several studies have been published concerning its use in adults, the use by children is less well known. The purpose of this study is to determine the frequency with which alternative medicine is employed in a pediatric population that also uses conventional medicine. A second goal is to investigate the sociodemographic factors that influence the choice of these forms of therapy.

Methods. Parents of children consulting the general outpatient clinic of a university hospital completed a self-administered questionnaire asking about previous use of AM for themselves or their children.

Results. Based on 1911 completed questionnaires, 208 children (11%) previously consulted one or more AM practitioners. Chiropractic, homeopathy, naturopathy, and acupuncture together accounted for 84% of use. Children who used AM differed significantly from those who only used conventional medicine in that they

were older than the nonusers, their mothers were better educated, and their parents also tended to use AM.

Conclusion. The findings indicate that AM is an aspect of child health care that no longer can be ignored. Being aware of these practices will enable physicians to discuss alternative therapies with parents in order to ensure the continuity of essential conventional treatments.

Variation in Cobb angle measurements in scoliosis

Prujts JEH, Hageman MAPE, Keessen W, van der Meer R, van Wieringen JC. Skeletal Radiol 1994; 23:517-520.

In order to determine the reliability of the Cobb angle measurement as it is used in the clinical management of scoliosis, a methodological survey was carried out. In the measurement of a Cobb angle two phases can be distinguished: (a) the production of a spinal radiograph and (b) the measurement of the angle itself. In respect of the first phase, the variation in production of the radiographs was calculated on Cobb angle measurements made by one investigator on serial radiographs of patients who underwent spinal fusion for scoliosis and therefore had a fixed spinal curvature. For the second phase, the accuracy of Cobb angle measurement was investigated by comparing measurements on the same radiographs of 46 scoliosis patients obtained by three investigators, namely two orthopaedic surgeons and an orthopaedic fellow who was assigned to a school screening project. Results were expressed as a Spearman correlation coefficient and a standard deviation of the differences. The Spearman correlation coefficient was 0.98 for the repeated radiographs (production variation) and also 0.98 for the repeated measurements on one radiograph (interobserver measurement variation). The standard deviation of the differences in Cobb angle for the repeated radiographs amounted to 3.2° and for the repeated measurements on one radiograph it was 2.0°. Although there is a good reproducibility of the Cobb angle measurement between different investigators, the variation in production of a spinal radiograph is an important source of error. This should be taken into account when making decisions in scoliosis management.

The quantitative anatomy of the atlas

Doherty BJ, Heggeness MH.
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Study design. This study is based on direct quantitative caliper measurements of 88 isolated anatomic specimens of the C1 vertebra.

Objectives. The study was undertaken to establish the range and variability of the external dimensions of the atlas and to describe the cortical thicknesses and trabecular distribution of this unique vertebra.

Summary of background data. Before this study, Francis in 1952 reported the total anterior and posterior diameter of 285 atlas vertebrae. Liu et al reported detailed external dimensions and facet joint surface morphologies on a total of three C1 vertebrae.

Methods. Measurements were made of overall dimensions, canal diameters, and the dimensions of the anterior and posterior arches of

88 dried human C1 vertebrae. Eight specimens were sectioned in the frontal plane, eight in the sagittal plane, and four in the coronal plane. The anatomy of these sections was documented by radiographic imaging. Cortical thicknesses on the sections were then obtained by direct measurement.

Results. The canal diameter ranged from 32 mm (SD 2 mm) in the sagittal plane, and 29 mm (SD 2 mm) in the lateral dimension. The mean thickness of the anterior ring was 6 mm (SD 1 mm) and posteriorly was 8 mm (SD 2 mm). Cortical bone was thinnest posteriorly.

Conclusions. These measurements indicated remarkably constant dimensions for the ring itself, suggesting there may be significant functional restraints on the canal size of this unique vertebra. In contrast, a significant variability was noted in objective measurements of lateral mass height and sagittal plane widths of the entire bone.

A prospective randomized three-week trial of spinal manipulation, transcutaneous muscle stimulation, massage and corset in the treatment of subacute low back pain

Pope MH, Phillips RB, Haugh LD, Hsieh C-YJ, MacDonald L, Haldeman S. *Spine* 1994; 19(22):2571-2577.

Study design. A randomized prospective trial of manipulation, massage, corset and transcutaneous muscle stimulation (TMS) was conducted in patients with subacute low back pain.

Objectives. The authors determined the relative efficacy of chiropractic treatment to massage, corset, and TMS.

Summary of background data. Although all of these treatments are used for subacute low back pain treatment, there have been few comparative trials using objective outcome criteria. Patients were enrolled for a period of 3 weeks. They were evaluated once a week by questionnaires, visual analog scale, range of motion, maximum voluntary extension effort, straight leg raising and Biering-Sorensen fatigue test. The dropout rate was highest in the muscle stimulation and corset groups and lowest in the manipulation group. Rates of full compliance did not differ significantly across treatments. A measure of patient confidence was greatest in the manipulation group.

Results. After 3 weeks, the manipulation group scored the greatest improvements in flexion and pain while the massage group had the best extension effort and fatigue time, and the muscle stimulation group the best extension.

Conclusion. None of the changes in physical outcome measures (range of motion, fatigue, strength or pain) were significantly different between any of the groups.

C1 burst fracture

Trojanovich S.
J Manipulative Physiol Ther 1994; 17(8):558-561.

Objective: The presentation of a patient to a chiropractic office with an undiagnosed C1 burst fracture (Jefferson fracture) secondary to head trauma from a motor vehicle accident is introduced.

Clinical features: A 67-yr-old real estate manager suffered from neck pain and stiffness following release from a major metropolitan medical center. Anteroposterior open mouth radiographic examination of the cervical spine revealed 10-mm displacement of the lateral masses of C1 relative to the superior articulating facets of C2, indicating the presence of a C1 burst fracture with possible disruption of the transverse ligament.

Intervention and outcome: The patient was transferred by ambulance to a local medical center where a CT scan of the cervical spine and neurosurgical evaluation were obtained. The patient's cervical spine was immobilized in a Philadelphia collar for 3 months. Follow-up radiographic evaluation indicated nonunion of the fracture fragments and the patient was referred for further neurosurgical consultation.

Conclusion: The presumption of proper and competent prior medical treatment, without confirmation by radiographic examination and review of records, could have resulted in catastrophic consequences for this patient, had chiropractic manipulation been performed. A history of trauma should be a clear signal to the chiropractic practitioner that they should proceed with caution, regardless of the patient's prior history of examination and treatment.

The effects of transforaminal ligaments on the sizes of T11 to L5 human intervertebral foramina

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Objective: This study was designed to determine the effects of the presence of transforaminal ligaments (TFL) on the superior-to-inferior dimension (SI) and anterior-to-posterior dimension (AP) of the compartment containing the ventral ramus of the spinal nerve (VR) in the intervertebral foramen (IVF).

Design: Four lumbar spines, including T12 and in one case T11, were obtained from embalmed cadavers and carefully dissected to expose the contents of the IVF. All ligamentous structures in the vicinity of the IVF were preserved. The greatest SI and AP of each IVF were measured. When present, TFL help define a compartment at the exit zone of the IVF that contains the VR. The SI and AP of these compartments were also measured.

Results: Of 49 IVF examined at least one TFL was present in 35. In the 34 IVF with horizontally oriented TFL, the mean SI of the compartments for the VR was 31.5% smaller than that of the IVF (one-way ANOVA, $p < .01$). No significant differences were seen between the AP of the IVF and compartments for the VR in the levels with vertically oriented TFL ($n = 11$).

Conclusions: TFL were found to be present in 71% of lower thoracic and lumbar IVF. If TFL were present, the SI of the compartment containing the VR in the IVF was significantly decreased (mean = 31.5%). This finding suggests that often there may be less space at the exit zone of the IVF for the ventral ramus than traditionally thought, which could contribute to the incidence of neurological symptomatology in this region, especially after trauma or degenerative changes.

The effect of neck and leg flexion and their sequence on the lumbar spinal cord

Lew PC, Morrow CJ, Lew AM.

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Study design. Fresh cadavers of five baboons were used to assess lumbar spinal cord movement. Window dissection at the L3 level was performed to observe the relative displacement of the cord to bony landmark, when the neck and hip were moved.

Objectives. To examine the effect of the neck and hip flexion alone and in combination on the movements of the lumbar spinal cord relative to the third lumbar vertebral body. To investigate also the effect of the sequence of flexions.

Summary of background data. Several clinical studies claim that cervical flexion together with straight leg raise tensions the lumbar nerve root. Although previous studies describe the effect of each of these movements, there have been no measurements of the combined effect or the effect of the sequence of movements.

Methods. Five fresh baboon cadavers were dissected to expose the L3 nerve root. The movement of the lumbar cord at that level was measured relative to a pin on the L3 vertebra. The neck and leg of the cadavers were moved by two operators.

Results. Cervical flexion always moved the lumbar cord in a cephalad direction. The degree of displacement was more pronounced if the cervical flexion followed hip flexion rather than hip extension. Hip flexion also moved the lumbar cord in a cephalad direction. However, the difference in cord displacement attributable to different sequences in hip movements were not found to be statistically significant. Cervical flexion elicited a greater cord displacement than traction.

Conclusions. These findings would advocate that a test that comprises both neck and hip movements would be more sensitive in assessing nerve root movements than one that only uses neck or hip movements. Such a test should also consider the use of various sequences of neck and hip movements.

The validity of thoracolumbar paraspinal scanning EMG as a diagnostic test: an examination of the current literature

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Objective: The purpose of this literature review was to assess the current validity of thoracolumbar paraspinal scanning EMG as practiced by the chiropractic profession within the context of adequate and acceptable epidemiological standards for validating a new diagnostic test.

Data sources, study selection and data extraction: Sources for the primary literature citations were obtained from several indexing services (MEDLINE - April 1993 to 1989; Index to Chiropractic Literature - 1991 to 1980, Chiropractic Research Archives Collection - Vol. I-IV and Chiropractic Literature Analysis and Retrieval System) and hand searched under the subject heading of electromyography. For MEDLINE this was combined with electromyography as a title/

abstract word and limited to "human." Primary literature citations were included in this review if the author, institution or journal was associated with the chiropractic profession and the paper dealt with thoracolumbar scanning EMG. Thirty-seven primary publications were identified and were systematically evaluated for contribution to any of the twelve key criteria used to validate a new diagnostic test. Secondary or tertiary citations from all sources were included if referenced in the primary literature as previous investigations supporting one of the key criteria. Additional secondary sources were included providing that the author was aware of them and the subject matter was germane to the EMG subtopic.

Data synthesis: Based upon this review, none of the 12 key criteria used to validate a new diagnostic test have been adequately satisfied.

Conclusions: It is concluded that thoracolumbar paraspinal scanning EMG is premature for clinical application as a paraclinical diagnostic test. Recommendations for evaluation directions in the immediate future are provided.

Thermal deficit in lumbar radiculopathy: correlations with pain and neurologic signs and its value for assessing symptomatic severity

Takahashi Y, Takahashi K, Moriya H.

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Study design. The relationship between areas of thermal deficit and areas exhibiting other symptoms and neurologic signs, and the significance of the magnitude of thermal deficit in lumbar radiculopathy were analyzed.

Objectives. To determine the clinical significance and value of thermal deficit as a sign of lumbar radiculopathy.

Summary of background data. Thermal deficit has been discussed as a factor in the diagnosis of involved nerve roots. However, it has not been previously correlated with any particular symptoms or signs.

Methods. Sixty-eight healthy subjects and one hundred nine patients with lumbar radiculopathy due to intervertebral disc herniation underwent thermography. Sensitivity, specificity, and the agreement rate of thermal deficit to symptoms and neurologic signs were calculated in ten body regions. Total temperature difference of the affected limb was compared with the Japanese Orthopaedic Association scoring system.

Results. The agreement rates of thermal deficit with pain, muscle tenderness, motor weakness, and sensory disturbance were 60.9, 69.3, 71.8, and 71.8%, respectively. Sensitivity and specificity of thermal deficit to symptoms and signs were approximately 30% and 80%, respectively. The correlation coefficient of temperature decrease of the affected limb and the Japanese Orthopaedic Association score was 0.57, indicating a moderate correlation.

Conclusions. Thermal deficit should be considered an independent sign of lumbar radiculopathy. The relatively high specificity suggests that a normal temperature may indicate an asymptomatic region. Symptomatic severity of lumbar radiculopathy may be assessed by measuring the magnitude of thermal deficit in the affected limb.