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September 2011 – Volume 8, Issue 3

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Announcements

An Opportunity to Serve

James Demetrious, DC, FACO
Editor, *Journal of the Academy of Chiropractic Orthopedists*

I would like to announce that this issue of the ***Journal of the Academy of Chiropractic Orthopedists*** is the last that I will serve as its Editor. Due to familial responsibilities, I am compelled to step down from that responsibility and provide an opportunity for others to step up and into the service of the Academy.

Approximately six years ago, I received a reminder from the Academy of Chiropractic Orthopedists to renew my membership. I renewed my membership and contacted Dr. James Brandt, President of the Academy. I asked Dr. Brandt how I could help the ACO.

Dr. Brandt suggested that I participate as an Academy committee member and invited me to contribute articles to the ***Journal of the Academy of Chiropractic Orthopedists***. I did so. In short order, I was introduced to Dr. Bruce Gundersen, Editor-In-Chief of the journal. Initially, I served as an Editorial Review Board (ERB) member and was later asked to serve as editor of the journal.

I was greatly honored to serve in this capacity. As Editor, I was blessed to work directly with Dr. Gundersen, Dr. Brandt, Dr. Wildenauer and our late, respected colleague, Dr. Stephen Capps. I had the opportunity to work directly with the Academy board and our ERB members. Together, we worked to propel the journal to higher levels of respectability. Together we:

- Obtained indexing through the Index of Chiropractic Literature.
- Expanded our ERB to include international representation.
- Completely redesigned the journal design and format.
- Wrote new copyright, author and editorial guidelines and manuscript submission criteria.
- Wrote and contributed the journal content of the Academy's new website.
- Mentored many authors seeking assistance.
- Improved our journal, enhancing the Academy’s ability to obtain sponsorships that support Academy function.

A new editor has been chosen. Stan Bacso, DC, FACO, FCCO(C), will carry on. He is a respected leader in our profession and I look forward to supporting him to the best of my ability. I would encourage our members to become more active, get involved and support the journal and the ACO.

I have greatly enjoyed my time working on behalf of the journal and I am most grateful for the opportunity to work with such erudite and focused men, women and leaders in our profession.

Best wishes,
James Demetrious, DC, FACO

Image and Art Gallery

The Image Gallery is dedicated to the artistic contributions of our readership. The ***Journal of the Academy of Chiropractic Orthopedists*** invites you to submit drawings, illustrations, or photographs, along with appropriate explanatory information, for consideration of publication within this section. Please forward electronic media via the following Articles Submission hyperlink: aco@dcorthoacademy.com.

Gibbon Falls, Yellowstone National Forest

Submission by: Bruce Gundersen, DC, FACO
Photo by: A. Michael Henrie, DO - August 19, 2011

[The Relationship Between A Chiropractor And Their Favorite Table KNOWS NO BOUNDS]

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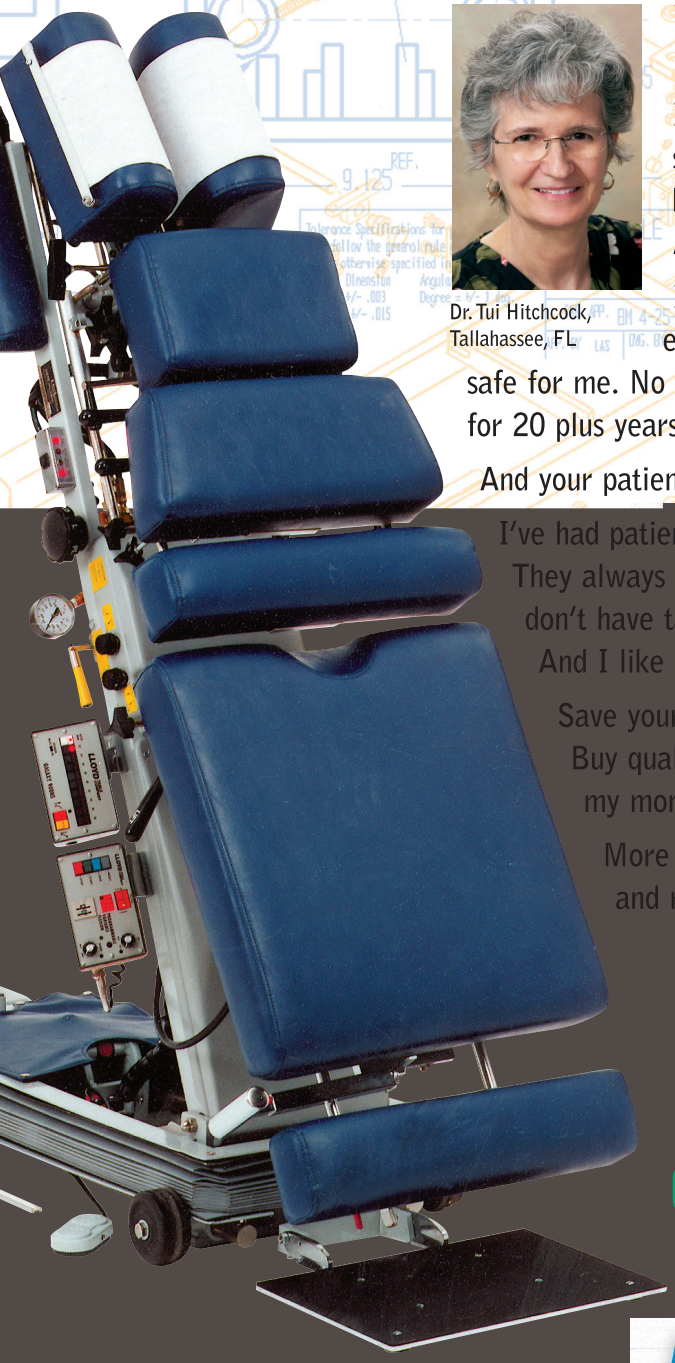

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Diagnostic Imaging Corner

Comminuted Calcaneus Fracture: Selected Images for Review

James Demetrious, DC, FACO

Published:
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Received: August, 2011
Accepted: September, 2011

Background

A 49-year-old caucasian male fell/jumped from a ladder from a reported height of 7-8 feet. He indicated that he landed on his heels onto concrete pavement. He was transported via ambulance to the local hospital emergency department where imaging was performed. The following images (Figures 1-5) are provided for clinical interest and consideration.

Figure 1. Lateral x-ray view of left ankle. Comminuted calcaneal fracture with loss of Boehler's angle.

Figure 2. CT left foot without contrast. Bone window, sagittal reconstruction reveals comminuted calcaneal fracture with loss of Boehler's angle.

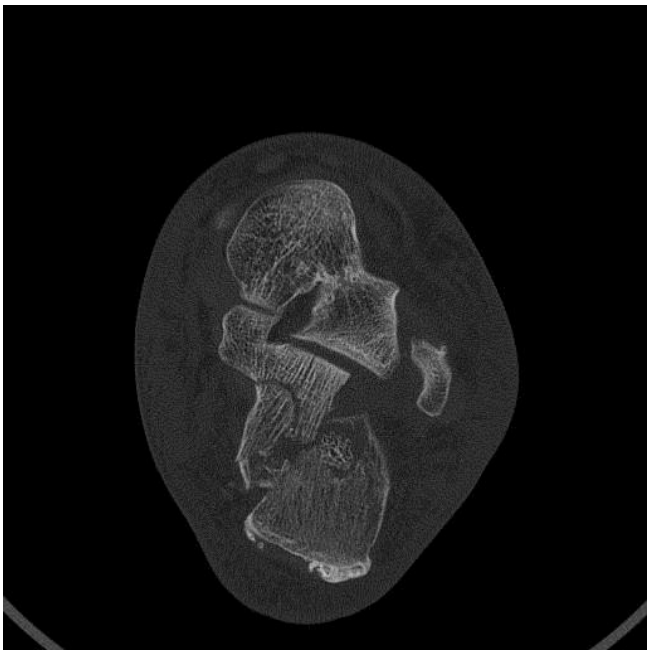

Figure 3. CT left foot without contrast. Bone window, axial view reveals comminuted calcaneal fracture.

Figure 4. CT left foot without contrast. Bone window, coronal reconstruction view reveals comminuted calcaneal fracture.

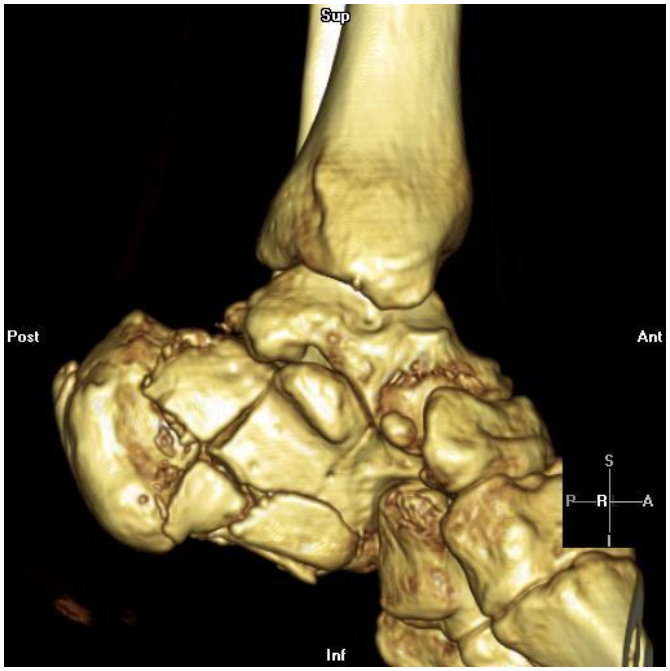

Figure 5. CT, left ankle, 3D color movie image revealing complex, comminuted calcaneal fracture.

Key Points

- Calcaneal fractures comprise 1 to 2 percent of all fractures. Approximately 75% of calcaneal fractures are intra-articular. [1]
- Despite understanding the pathomechanics involved, these fractures remain difficult to treat. [2]
- No single treatment modality for displaced intra-articular calcaneal fractures has proven superior over the other. [3]

References

1. Bajammal S, Tornetta P 3rd, Sanders D, Bhandari M: **Displaced intra-articular calcaneal fractures.** J Orthop Trauma. 2005,**19(5)**:360-4.
2. Swanson SA, Clare MP, Sanders RW: **Management of intra-articular fractures of the calcaneus.** *Foot Ankle Clin.* 2008, **13(4)**:659-78.

3. Schepers T, Patka P: **Treatment of displaced intra-articular calcaneal fractures by ligamentotaxis: current concepts' review.** *Arch Orthop Trauma Surg*. 2009, **129(12)**: 1677–1683.

Consent

Written informed consent was obtained from the patient for publication of the images presented. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Competing Interests

None declared.

Abstracts & Literature Review

Vascularization and Morphological Changes of the Endplate after Axial Compression and Distraction of the Intervertebral Disc

Hwan Tak Hee, MD, Yon Jin Chuah, BSc, Bryan Hsi Ming Tan, MD,
Tony Setiobudi, MD, and Hee Kit Wong, MD

SPINE Volume 36, Number 7, pp 505–51,

JACO Editorial Reviewer: Ralph A. Kruse, D.C. FACO

Published:
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September 2011, Volume 8, Issue 3

Authors' Abstract:

Study Design: An *in vivo* study of the rabbit's endplate and intervertebral disc (IVD).

Objective: To assess the histologic features and vascularization of the endplate after axial compression and distraction, along with the degeneration and regeneration status of IVD.

Summary of Background Data: Current studies mainly focus on the changes in the IVD in response to degeneration and regeneration. However, the basic science regarding degenerative changes of the vertebral endplate and its actions on the IVD is lacking. The endplate is responsible for nutrient flow to the IVD through diffusion. It has been postulated that changes in the endplate may be responsible for the degeneration of the IVD.

Methods: Twenty New Zealand white rabbits were equally divided into 4 groups as follows: group A, 28 days of compression only; group B, 28 days of disc compression followed by 28 days of unloading; group C, 28 days of disc compression followed by 28 days of distraction; and group D, sham operated animals with apparatus placement only. At the end of the study, lumbar segments in the four groups were harvested for analysis of disc height, vascularity, and histologic examination.

Results: Compression decreased the disc height and the rabbits showed signs of disc degeneration. Ossified endplates with decreased cells and extracellular matrix, and decreased vascular channel volume were observed. Cellular and morphologic regeneration were observed on unloading and distraction of the compressed discs, although the cartilaginous endplates were partially ossified. The volume of vascular channels increased significantly after distraction. Fluorescent vascular tracer showed the presence of active blood flow in the vascular channels near the cartilaginous endplates.

Conclusion: Compression resulted in degeneration of the cartilaginous endplate and a decrease in the osseous endplate vascular channel volume - both of which led to the degeneration of the IVD. Unloading and distraction allowed the regeneration of the extracellular matrix in both the endplate and the recovery of vascular channels.

JACO Editorial Summary:

- This manuscript was written by medical doctors affiliated with the Department of Orthopedic Surgery, Yong Loo Lim School of Medicine,

National University of Singapore and the University Spine Center and Department of Orthopedic Surgery at the National University Hospital, Singapore.

- The objective of this study was to assess the histologic features and vascularization of the vertebral body endplate after compression and distraction of the rabbit intervertebral disc. The application of controlled and quantified axial mechanical loads was the method of iatrogenic disc degeneration.

- Twenty rabbits were randomly assigned to four groups all having undergone surgical insertion of pins into the L4 and L5 vertebral bodies. In three of the groups, a disc compressive force of 177 N was applied to the L4/5 disc for 28 days. Data was collected after 28 days in Group A. In group B, the compressive force was removed for 28 days before collecting data. In Group C, the compressive force was removed and a distraction force of 120 N for 28 days was applied before collecting data. Group D was the sham group having no compression or distraction.

- Disc height was found to be *decreased* in the compression-only group, whereas the group undergoing compression and subsequent decompression showed a significant *increase* in disc height.

- Compression resulted in a reduction in the pericellular matrix capsule surrounding the nucleus pulposus and the annulus fibrosis was ruptured and disorganized with significantly fewer annulus fibrosis cells. The cartilaginous endplate was almost completely ossified, and decreased matrix and chondrocytes was observed.

- Unloading after compression allowed the pericellular matrix capsules of the nucleus pulposus cells to enlarge. Restoration of the organization of the annulus with fewer ruptured fibers and more distinct border between the nucleus pulposus and annulus fibrosis as well as an increase in number of chondrocytes was observed.

- The group undergoing distraction after compression demonstrated continued improvement of the annulus, nucleus and endplate architecture with enlarged pericellular matrix capsules with an increase in extracelluar matrix, thus restoring the gel-like appearance of the nucleus implying a more hydrated matrix.

- Vascular channels supplying nutrition to the disc predominate around the cartilaginous endplate. Compression led to a decrease in vascular channel volume, thus impeding nutrition to the disc. Distraction led to the recovery of vascular channel volume which was observed in regeneration of discs.

- Proteoglycan molecules are critical for the maintenance of water content within the disc. Hydration of the nucleus pulposus was observed and implied the increase in proteoglycan aggrecans in the event of unloading and distraction.

Summary

The results of this study revealed compression at the L4/5 spinal level in rabbits resulted in disc degeneration including ossification and decreased vascularity of endplates, and a reduction in glycosaminoglycans. Histological analysis of the annulus fibrosis and nucleus pulposus revealed distraction of the intervertebral disc led to recovery of vascular channels, regeneration of the disc and restoration of disc height.

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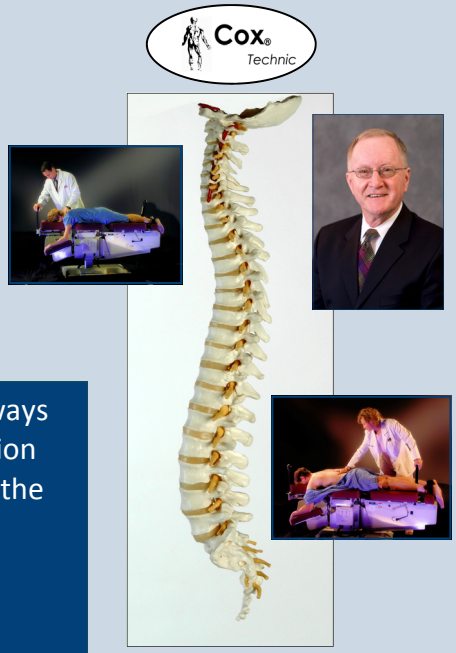

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Abstracts & Literature Review

Degenerative Marrow (Modic) Changes on Cervical Spine Magnetic Resonance Imaging Scans Prevalence, Inter- and Intra-Examiner Reliability and Link to Disc Herniation

Eugen Mann, Cynthia K. Peterson, RN, DC, MMedEd, and Juerg Hodler, MD, MBA

SPINE Volume 36, Number 14, pp 1081-1085

JACO Editorial Reviewer: Keith R. Kamrath, DC, FACO

Published:
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September 2011, Volume 8, Issue 3

Authors' Abstract:

Study Design: A prevalence and reliability study of Modic changes (MCs) in the cervical spine.

Objective: To assess the prevalence and reliability of diagnosing and classifying MCs and their relationship to disc herniations (DHs) in the cervical spine.

Summary of Background Data: Degenerative marrow (Modic) changes in the spine can be seen on MRI with some evidence linking them to pain. Many studies have been published on MCs in the lumbar spine, but only one small prevalence study focusing on MCs in the cervical spine has been reported.

Methods: The cervical magnetic resonance imaging (MRI) scans of 500 patients over the age of 50 were retrospectively evaluated for the prevalence, type, and location of MCs and DHs. Two hundred of these same scans were independently analyzed by a second observer to evaluate inter-observer reliability of diagnosis with 100 re-evaluated by the same observer 1 month later to assess intra-observer reliability. The SPSS program and Kappa statistics were used to assess prevalence and reliability. The risk ratio comparison of DHs and MCs was calculated.

Results: Four hundred and twenty-six patients (85.2%) met the inclusion criteria. MCs were observed in 40.4% of patients (14.4% of all motion segments). 4.3% were type 1 and 10.1% were type 2. DHs were seen in 78.2% of patients (13.3% of motion segments).

Both MCs and DHs were most frequently observed at C5/6 and C6/7. Disc extrusions were positively associated with MCs (RR = 2.4).

CONCLUSIONS

A high prevalence of MCs was observed in the cervical spine in patients over the age of 50, with type 2 predominating. The reliability of identifying and classifying Modic changes in this spinal region is good and a definite link between Modic changes and DHs at the same segmental level was found. Further prevalence studies on MCs in the cervical spine should be conducted with samples from

clinical, occupational, and general populations, including patients below the age of 50. An association of MCs with neck pain or radiculopathy should be a further subject of investigation.

JACO Editorial Summary:

- This article was written by authors from the Radiology Department, Orthopedic University Hospital Balgrist, Zurich, Switzerland - an institution that specializes in orthopedic and rheumatologic conditions.
- Since most of the published literature has concentrated on Modic changes in the lumbar spine, the purpose of this article is to assess the reliability of radiologic diagnosis and the prevalence of Modic changes and their association to disc herniations in the cervical spine.
- The authors retrospectively reviewed 500 cervical magnetic resonance imaging scans of patients over age 50. The prevalence, type, and spinal level location of Modic changes and disc herniations were evaluated. A radiologist and medical intern were used to determine interobserver and intraobserver reliability which was found to be good despite one of the observers being very inexperienced.
- The C5/6 and C6/7 motion segments are the most commonly involved spinal levels for Modic changes and disc herniations.
- Type 2 Modic changes (chronic) are more common than type 1 Modic changes (acute).
- Disc herniations occur at spinal levels with Modic changes at a rate that is nearly 2.5 times that of motion segments without Modic changes.
- While cervical disc herniations are common, occurring in 78.2% of patients in this study, only 40.4% of patients presented Modic changes. A number of patients with disc herniation do not have associated Modic changes. A possible explanation might be a genetic predisposition in this subgroup.

Summary:

The results of this study indicate that interobserver and intraobserver reliability is quite good in evaluating cervical MRI scans for Modic changes and disc herniations. Modic Type 1 changes tend to present as a more acute MRI signal and precede Modic Type 2 changes. A possible explanation may be that as the acute inflammatory process of Modic changes resolve after the initial disc injury (Modic Type 1), the vertebral endplate marrow becomes infiltrated with fatty deposits and enters a more chronic stage (Modic Type 2).

The fact that disc herniations occur without associated Modic changes may be caused by genetic predisposition. It may be possible that these herniations do not demonstrate an active inflammatory response and are not symptomatic. Further investigation to determine an association between cervical Modic changes and cervical pain/radiculopathy should be undertaken.

Abstracts & Literature Review

Quantitative Measures of Modic Changes in Lumbar Spine Magnetic Resonance Imaging Intra- and Inter-rater Reliability

Yue Wang, MD, Tapio Videman, MD, PhD, Riikka Niemeläinen, PhD,
Michele C. Battié , PhD

SPINE Volume 36, Number 15, pp 1236-1243

JACO Editorial Reviewer: Jonice Owen, DC, FACO, DACRB

Published:
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September 2011, Volume 8, Issue 3

Authors' Abstract

Study Design. A measurement reliability study.

Objective. To develop quantitative measures for Modic changes (MCs) on magnetic resonance (MR) images and evaluate measurement reliability.

Summary of Background Data. MCs have been studied for more than 20 years but the clinical significance remains controversial. Little effort has been made to improve the measurement of MCs.
Methods. The study was approved by the responsible institutional review board. On the basis of Modic classification, a series of quantitative dimension and signal intensity measures were developed for assessing MCs. Midsagittal T1- and T2-weighted MR images from 83 lumbar spines were then qualitatively and quantitatively assessed by two observers independently. Kappa and intraclass correlation coefficient (ICC) were used to examine intra and inter-rater reliability. Pearson correlation coefficient was used to assess the relationships between the quantitative measurements of MCs. Mean absolute deviation (MAD) and Bland-Altman plots also were used to evaluate measurement errors and limits of agreement for selected measures.

Results. For Modic classification, intrarater agreement was excellent ($\kappa = 0.88$) and inter-rater agreement was substantial ($\kappa = 0.79$). Intrarater agreement also was excellent when obtaining dimension measurements (ICC = 0.82–0.96) from T1- or T2-weighted images and inter-rater agreement was slightly greater using T1-weighted images (ICC = 0.73–0.88) than T2-weighted images (ICC = 0.66– 0.82). Signal intensity measurements on T2-weighted images were found to have almost perfect intra- and inter-rater reliability (ICC = 0.92–0.99). The correlation analysis demonstrated that the quantitative measures represent different constructs. The MAD and Bland-Altman Plots further confirmed the high reliability of the area ratio, MCs mean signal intensity and MCs total signal intensity measurements.

Conclusion. Three quantitative measures are suggested to assess the severity of MCs, which provide reliable, precise measurements for research on the etiology, pathogenesis, and clinical relevance of MCs.

JACO Editorial Summary:

This relevant article apprised me of new information in an area important to me, use of the

lumbar MRI. As a chiropractic orthopedist, we must make informed decisions regarding if, when, and which diagnostic studies are indicated. The article both informed me about Modic changes (MC), as well as offered structured, coherent, cutting-edge information regarding MRI T1 and T2-weighted images of the lumbar spine.

When invited to local MRI presentations, I make a habit of attending. The local Radiologist will always encourage the audience to contact him or her, regarding any questions, etc. I have taken up this invitation to request comment upon Modic Changes. I have also had the opportunity of read MRI reports, which included discussion of Modic Changes.

I learned more about Modic changes to date than I have from lectures and from reading this article. This appears to be the first study to introduce quantitative measures for MCs and examine their reliability. The authors included that to date, only one recently published study attempted to measure signal intensity of MCs and reliability of the measure had not been reported.

This article offers great opportunity for collegial discussion when the occasion arises, and warrants consideration as supporting literature in selection of Lumbar MRI when the need arises.

The Key Points noted at the close of the article:

- The traditional Modic classification (MC) was confirmed to be reliable.
- A series of quantitative dimension and signal intensity measures were developed of MCs and the intra-rater and inter-rater reliabilities were found to be substantial or excellent
- Three highly reliable quantitative measures (area ratio, cerebrospinal fluid adjusted MCs mean signal intensity and MCs total signal intensity) were suggested to assess the severity of MCs.

I would add additional highlights:

- Clear organization of the Materials and Methods section.
- Clear copies of Lumbar spine MRI with outlines included in copies.
- Limitations for T2 signal intensity measures were included.
- Helpful “nutshell” of Type1, Type 2, and Type 3 Modic changes.

Abstracts & Literature Review

Evidence-Based Recommendations for Spine Surgery

Charles G. Fisher, MD, Alexander R. Vaccaro, MD, PhD, Peter G. Whang, MD, Srinivas K. Prasad, MD, Peter D. Angevine, MD, MPH, Kishore Mulpuri, MBBS, MHSc, Kenneth C. Thomas, MD, MHSc, and Alpesh A. Patel, MD

SPINE Volume 36, Number 14, pp E897-E903

JACO Editorial Reviewer: Larry L. Swank, DC, MS, FACO

Published:
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September 2011, Volume 8, Issue 3

JACO Editorial Summary:

- This article is a systematic review of six (6) studies by a group of eight (8) authors all representing the medical profession. Each review included a study summary, a methodological review and a recommendation on impact to clinical practice.

- The first two studies are primarily randomized clinical trials (RCTs) addressing the issue of reducing the rate of post surgical infections. The two studies are:

  - **Preventing Surgical-Site Infections in Nasal Carriers of Staphylococcus Aureus** (Bode L, Kluytmans J, Wertheim H, et al. *NEJM* 2010; 362(1): 9-17).

    - In this study the authors investigated a protocol for screening and treatment of Staphylococcus Aureus bacteria using mupirocin nasal ointment and chlorhexidine soap.
    - The authors concluded that a protocol for S. Aureus screening and mupirocin-chlorhexidine treatment can reduce the rate of infection.
    - The impact to clinical practice is that the cost effectiveness was *not* part of the investigation and should be considered before a universal screening or standardized treatment protocol recommended.

  - **Chlorhexidine-Alcohol *versus* Povidone-Iodine for Surgical-Site Antisepsis** (Darouiche R, Wall M, Itani K, et al. *NEJM* 2010; 362(1): 18-26).

    - The authors in this study investigated the effectiveness of one antisepsis to another in preoperative skin cleansing on patients.
    - The authors concluded preoperative cleansing of the patient's skin with chlorhexidine-alcohol was superior to providone-iodine skin cleansing. A concern in this study is that the products used are not equivalent. One being a alcohol base product and the other not.
    - The methodological review pointed out that there is a conflict of interest in that the sponsoring company produced both products and cost effectiveness data was weak.

- The next four (4) articles (studies) investigate common spinal lesions that may lead to spinal surgery. The systematic review noted concerns of a non-blinded study: no patient clinical outcomes, disparities in the care of individuals by different surgeons and the number of subjects actually included in the analysis all leading to extensive limitations affecting validity of the studies. The four (4) studies are:

  - **Vertebroplasty versus Conservative Treatment in Acute Osteoporotic Vertebral Compression Fractures (Vertos II): An Open-Label Randomized Trial** (Klazen C, Lohle P, deVries J, et al. *Lancet* , August 2010).

    - This study addresses the management of osteoporotic vertebral compression fractures which is a common health care concern in the aging population. This is a randomized clinical trial (RCT) and non-blinded. A 2 ½ year study, 50 years old with back pain of 6 weeks or less and a confirmed vertebral compression fracture
    - Secondary outcomes were estimated as cost-effective while tertiary outcomes were quality of life measures using Quality of Life Questionnaire of the European Foundation for Osteoporosis (QUALEFFO) and the Roland-Morris disability questionnaires.
    - The patients undergoing vertebroplasty seemed to enjoy quicker and more significant pain reduction than the conservatively treated patients.
    - This study showed vertebroplasty is considered cost-effective.
    - A concern in this study shows that there were no sham procedures performed coupled with being non-blinded and leads to a weak recommendation to incorporate into clinical practice.

  - **Trends, Major Medical Complications, and Charges Associated with Surgery for Lumbar Spinal Stenosis in Older Adults** (Deyo R, Mirza S, Martin B, et al. *JAMA* 2010;303(13): 1259–65).

    - This study is a retrospective review using Medicare data between 2002 and 2007 examining surgical treatment rendered to all Medicare beneficiaries older than 65 years with lumbar stenosis.
    - This study identified a significant increase in fusion rate between 2002 and 2007.
    - The data collected is from an administrative database. There are no clinical outcomes data which leads to significant limitations and should have no impact on either clinical practice or health care policy.

  - **Factors Associated with Recurrent Back Pain and Cyst Recurrence after Surgical Resection of One Hundred Ninety-Five Spinal Synovial Cysts** (Xu R, McGirt MJ, Parker SL, et al. *Spine* 2010;35:1044-53).

    - This study looks at the recurrence of cyst formation following lumbar spinal surgery. Sample size consisted of 167 patients during a 19 year period. Most common level at L4-L5.
    - Patients who had undergone bilateral laminectomy had a higher risk of recurrence.
    - Weakness in this study is due to disparities of different surgeons performing procedures, how the cyst recurrence was diagnosed or level of pain being measured.

  - **Does an Interspinous Device (Coflex TM) Improve the Outcome of Decompressive Surgery in Lumbar Spinal Stenosis? One-Year Follow-up of a Prospective Case Control Study of 60 Patients** (Richter A, Schutz C, Hauck M, et al. *Eur Spine J* 2010;19: 283-9).

- This study population consisted of 60 subjects in the analysis to evaluate the effectiveness of a Coflex implant as an adjunct to lumbar decompression for spinal stenosis.
- The findings showed that there were no significant differences between the clinical results of the two cohorts at one year in this study.
- The authors of this review note that further data is necessary to justify the adoption of this technique.

Summary:

The above studies cover common clinical conditions seen by the chiropractic orthopedists. Identifying and making the most appropriate patient-care plans must be based on the best "Evidence-Based" recommendations available to the health care professional. Knowing the best results and a cost-effective approach is imperative to a patient treatment plan. These studies show weaknesses in methodology in an attempt to answer important questions within the study. Conservative approaches continue to be just as effective as the surgical procedures. It is most important to know when to refer and what alternative measure is best for the patient.

Abstracts & Literature Review

Long-term Outcomes of Lumbar Fusion Among Workers' Compensation Subjects

Trang H. Nguyen, MD, PhD, David C. Randolph, MD, MPH, James Talmage, MD, Paul Succop, PhD, Russell Travis, MD

Spine 2011; 36: 320-331

JACO Editorial Reviewer: Michael Henrie, DO

Published:
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Authors' Abstract

Study Design: Historical cohort study.

Objective: To determine objective outcomes of return to work (RTW), permanent disability, postsurgical complications, opiate utilization, and reoperation status for chronic low back pain subjects with lumbar fusion. Similarly, RTW status, permanent disability, and opiate utilization were also measured for nonsurgical controls.

Summary of Background Data: A historical cohort study of workers' compensation (WC) subjects with lumbar arthrodesis and randomly selected controls to evaluate multiple objective outcomes has not been previously published.

Methods: A total of 725 lumbar fusion cases were compared to 725 controls who were randomly selected from a pool of WC subjects with chronic low back pain diagnoses with dates of injury between January 1, 1999 and December 31, 2001. The study ended on January 31, 2006. Main outcomes were reported as RTW status 2 years after the date of injury (for controls) or 2 years after date of surgery (for cases). Disability, re-operations, complications, opioid usage, and deaths were also determined.

Results: Two years after fusion surgery, 26% (n = 188) of fusion cases had RTW, while 67% (n = 483) of nonsurgical controls had RTW ($P \leq 0.001$) within 2 years from the date of injury. The re-operation rate was 27% (n = 194) for surgical patients. Of the lumbar fusion subjects, 36% (n = 264) had complications. Permanent disability rates were 11% (n = 82) for cases and 2% (n = 11) for non-operative controls ($P \leq 0.001$). Seventeen surgical patients and 11 controls died by the end of the study ($P \leq 0.26$).

For lumbar fusion subjects, daily opioid use increased 41% after surgery, with 76% (n = 550) of cases continuing opioid use after surgery. Total number of days off work was more prolonged for cases compared to controls, 1140 and 316 days, respectively ($P \leq 0.001$). Final multivariate, logistic regression analysis indicated the number of days off before surgery odds ratio [OR], 0.94 (95% confidence interval [CI], 0.92–0.97); legal

representation OR, 3.43 (95% CI, 1.58–7.41); daily morphine usage OR, 0.83 (95% CI, 0.71–0.98); reoperation OR, 0.42 (95% CI, 0.26–0.69); and complications OR, 0.25 (95% CI, 0.07–0.90), are significant predictors of RTW for lumbar fusion patients.

Conclusion

Lumbar fusion for the diagnoses of disc degeneration, disc herniation, and/or radiculopathy in a WC setting is associated with significant increase in disability, opiate usage, prolonged work loss, and poor RTW status.

JACO Editorial Summary:

- This is a retrospective cohort study with data gathered from the Ohio Bureau of Workers' Compensation database. The purpose of this study was to assess return to work status two years after lumbar fusion.
- The study contained a large number of subjects (725 study subjects who had lumbar fusion and 725 controls that were randomly selected) with a wide age range (18 to 70 years, median age of 39 years). All subjects were healthy working individuals prior to injury.
- For the most part the subjects were appropriately selected. There were a number of diagnoses included in the subjects. Both groups consisted of subjects with axial and radicular causes of pain, but approximately 72% of the diagnoses for all subjects were disc degeneration and disc herniation. Subjects were excluded if they had spinal fracture, injury that involved other body parts, injury that involved cervical or thoracic areas, head trauma or pregnancy. Legal representation, current smokers and female gender were more common in the surgical case group compared to the non-surgical control group, which may have introduced selection bias.
- The primary outcome measure was return to work (RTW) status. Secondary outcome measures were permanent disability awards, complications, re-operations, and opiate utilization. For cases, return to work was considered successful if the injured worker returned two years after the date of surgery. For controls, a successful outcome was a return to work (RTW) two years after the date of injury. Return to work was deemed unsuccessful if the subject failed to return in any capacity.
- This study showed that workers compensation subjects undergoing lumbar fusion had poor return to work status two years after surgery and had higher disability status compared to controls. This difference was seen across all diagnoses included in the study.
- Negative predictors for return to work in surgical cases were: a larger number of missed days; lower weekly wages; surgical complications; re-operations; and, larger doses of opioid use.
- Across all subjects the total number of days off was the most important predictor of return to work status. Legal representation and the use of opioids also decreased the odds of returning to work.
- Although frequently performed, lumbar fusion is a controversial operation for axial low back pain secondary to degenerative disc disease and lumbar disc herniation. To date there has been a paucity of published studies evaluating lumbar fusion outcomes in workers compensation subjects in the US. Unemployment following an injury has important social and economic implications. Therefore, return to work is an important outcome measure when evaluating the effectiveness of a treatment.
- This paper was able to evaluate a large number of objective outcomes in a large group of injured workers and controls, and had a reasonable length of follow-up. However, some limitations exist with this study design. A retrospective cohort study is not the best method for evaluating the effectiveness of a procedure. Although much more difficult to design, a prospective, randomized, controlled study should be considered in the future.

- A number of independent variables were included in this study; however, there are likely other significant variables that were not considered. Additionally, the results are somewhat limited by the categories of diagnoses used. For example, we do not know the severity or extent of lumbar radiculopathy that existed in either the case subjects or control subjects.

Summary

Lumbar spinal fusion *does not* seem to be an effective treatment option for Ohio workers compensation subjects who have degenerative disc disease, disc herniation and/or lumbar radiculopathy. However, it remains possible or even likely that there are sub-group populations of subjects within each of these diagnoses that may benefit from lumbar fusion. When non-surgical spine specialists are treating lumbar spine injury in workers compensation patients, the results of this study should also be considered.

Abstracts & Literature Review

Trends, Major Medical Complications, and Charges Associated With Surgery for Lumbar Spinal Stenosis in Older Adults

Richard A. Deyo, MD, MPH; Sohail K. Mirza, MD, MPH; Brook I. Martin, MPH; William Kreuter, MPA; David C. Goodman, MD, MS; Jeffrey G. Jarvik, MD, MPH

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Authors' Abstract:

Context: In recent decades, the fastest growth in lumbar surgery occurred in older patients with spinal stenosis. Trials indicate that for selected patients, decompressive surgery offers an advantage over non-operative treatment. However, surgeons often recommend more invasive fusion procedures. Comorbidity is common in older patients, so benefits and risks must be carefully weighed in the choice of surgical procedure.

Objective: To examine trends in use of different types of stenosis operations and the association of complications and resource use with surgical complexity.

Design, Setting, and Patients: Retrospective cohort analysis of Medicare claims for 2002-2007, focusing on 2007 to assess complications and resource use in US hospitals. Operations for Medicare recipients undergoing surgery for lumbar stenosis (n=32, 152 in the first 11 months of 2007) were grouped into three gradations of invasiveness:

i) Decompression alone
ii) Simple fusion (1 or 2 disk levels, single surgical approach),
iii) Complex fusion (more than 2 disk levels or combined anterior and posterior approach).

Main Outcome Measures: Rates of the 3 types of surgery, major complications, postoperative mortality, and resource use.

Results: Overall, surgical rates declined slightly from 2002-2007, but the rate of complex fusion procedures increased 15-fold, from 1.3 to 19.9 per 100,000 beneficiaries. Life threatening complications increased with increasing surgical invasiveness, from 2.3% among patients having decompression alone to 5.6% among those having complex fusions. After adjustment for age, comorbidity, previous spine surgery, and other features, the odds ratio (OR) of life-threatening complications for complex fusion compared with decompression alone was 2.95 (95% confidence interval [CI], 2.50-3.49). A similar pattern was observed for re-hospitalization within 30 days, which occurred for 7.8% of patients undergoing decompression and 13.0% having a complex fusion (adjusted OR, 1.94; 95% CI, 1.74-2.17). Adjusted mean hospital charges for complex fusion procedures were US $80,888 compared with US $23,724 for decompression alone.

Conclusions: Among Medicare recipients between 2002 and 2007, the frequency of complex fusion procedures for spinal stenosis increased while the frequency of decompression surgery and simple fusions decreased. In 2007, compared with decompression, simple fusion and complex fusion were associated with increased risk of major complications, 30-day mortality, and resource use.

JACO Editorial Summary:

This article was written by authors with affiliation with the following institutions: Departments of Family Medicine and Medicine, Oregon Health and Science University, and the Kaiser Permanente Center for Health Research, Portland (Dr. Deyo); Department of Orthopaedics, Dartmouth Medical School; Hanover, New Hampshire (Dr. Mirza and Mr Martin); Departments of Health Services (Mr. Kreuter) and Radiology and Neurological Surgery (Dr. Jarvik), University of Washington, Seattle; and Center for Health Policy Research at the Dartmouth Institute for Health Policy and Clinical Practice, Lebanon, New Hampshire (Dr. Goodman).

- The purpose of the study was to examine the current trends in use of different types of stenosis operations with special notation of the complexity, complications, and resource use with selected surgical procedures.

- The researchers provide an investigative retroactive statistical assessment of lumbar stenosis surgery trends over time (2002 -2007). The data revealed that the frequency of complex surgery, economic costs and complication all increased; while the frequency of decompression surgery and simple fusions decreased.

- Age, co-morbidity and previous hospitalizations remained independently associated with life-threatening complications. Complex fusion procedures had an odds ratio of 2.95 (95% confidence interval, 2.50-3.49) for life-threatening complications compared with decompression alone.

- The reason for the increase in surgical complexity is unclear; however, the authors opine that it seems unlikely that the number of patients with the complex spinal pathology increased 15-fold in just six years. The authors continue to opine that possible reasons could include the surgeons' belief systems, the introduction and marketing of new fusion devices, or economic pressures associated with decreasing reimbursements for medical services.

Summary

These results suggest that physicians should consider avoiding the use of complex spinal fusion for lumbar stenosis as they are associated with increased risk of major complications, mortality and economic resources. Although the authors did not review the topic, more attention might also be given to patient selection. Additionally, there is some limited data supporting the use of chiropractic/physical medicine for spinal stenosis which warrants additional research and inter-professional cooperation.

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