

SPINAL SURGERY REFERENCES AND RESOURCES:

DIAGNOSIS, IMAGING / INVESTIGATIONS:

- **Diagnostic Imaging for Low Back Pain: Advice for High-Value Health Care From the American College of Physicians.** Chou et al. *Ann Intern Med.* 2011;154:181-189:

“Diagnostic imaging is indicated for patients with low back pain only if they have severe progressive neurologic deficits or signs or symptoms that suggest a serious or specific underlying condition. In other patients, evidence indicates that routine imaging is not associated with clinically meaningful benefits but can lead to harms.

Addressing inefficiencies in diagnostic testing could minimize potential harms to patients and have a large effect on use of resources by reducing both direct and downstream costs. In this area, more testing does not equate to better care. Implementing a selective approach to low back imaging, as suggested by the American College of Physicians and American Pain Society guideline on low back pain, would provide better care to patients, improve outcomes, and reduce costs.”

- **NB: This link to a page on the American Academy of Orthopaedic Surgeons (AAOS) website:**
www.aaos.org/news/aaosnow/sep10/cover1.asp

“Critical analysis leads to formal endorsement: For the first time ever, the AAOS has endorsed clinical practice guidelines generated by another medical specialty society. At its meeting in June, the AAOS Board of Directors approved the endorsement of the American Pain Society’s Guideline on Management of Low Back Pain ...”

- **‘Choosing Wisely’: a growing international campaign.** Levinson et al. *BMJ Qual Saf* 2015;24:167-174 and <http://www.choosingwisely.org.au/>
- **Early imaging for acute low back pain: one-year health and disability outcomes among Washington State workers.** Graves et al. *Spine* 2012 Aug 15;37(18):1617-27.
- **Are first-time episodes of serious LBP associated with new MRI findings?** Carragee et al. *Spine J.* 2006 Nov-Dec;6(6):624-35. Epub 2006 Oct 11:

“RESULTS: During the 5-year observation period of 200 subjects, 51 (25%) subjects were evaluated with a lumbar MRI for clinically serious LBP episodes, and 3/51 (6%) had a primary radicular complaint. These 51 subjects had 67 MR scans. Of 51 subjects, 43 (84%) had either unchanged MR or showed regression of baseline changes. The most common progressive findings were disc signal loss (10%), progressive facet arthrosis (10%), or increased end plate changes (4%). Only two subjects, both with primary radicular complaints, had new findings of probable clinical significance (4%). Subjects having another MR were more likely to have had chronic pain at baseline (odds ratio [OR]=3.19; 95% confidence interval [CI] 1.61-6.32), to smoke (OR=5.81; 95% CI 1.99-16.45), have baseline psychological distress (OR 2.27; 95% CI 1.15-4.49), and have previous disputed compensation claims (OR=2.35; 95% CI 0.97-5.69). Subjects involved in current compensation claims were also more likely to have an MR scan to evaluate the LBP episode (risk ratio=4.75, p<.001), but were unlikely to have significant new findings. New findings were not more frequent in subjects with LBP episodes developing after minor trauma than when LBP developed spontaneously.

CONCLUSION: Findings on MR imaging within 12 weeks of serious LBP inception are highly unlikely to represent any new structural change. Most new changes (loss of disc signal, facet arthrosis, and end plate signal changes) represent progressive age changes not associated with acute events. Primary radicular syndromes may have new root compression findings associated with root irritation.”

- **Disc degeneration and chronic low back pain: an association which becomes nonsignificant when endplate changes and disc contour are taken into account.** Kovacs et al. *Neuroradiology.* 2013 Nov 5
- **Prevalence of disc degeneration in asymptomatic Korean subjects. Part 1 : lumbar spine.** Kim et al. *J Korean Neurosurg Soc.* 2013 Jan: 53 (1):31-8
- **Does lumbar disc degeneration on magnetic resonance imaging associate with low back symptom severity in young Finnish adults?** Takatalo et al. *Spine* 2011 Dec
- **Prevalence of degenerative imaging findings in lumbar magnetic resonance imaging among young adults.** Takatalo et al. *Spine* 2009 Jul 15;34(16):1716-21
- **Degenerative magnetic resonance imaging changes in patients with chronic low back pain: a systematic review.** Chou et al. *Spine.* 2011 Oct 1;36

- **Imaging the back pain patient. Maus. Phys Med Rehabil Clin N Am. 2010 Nov;21(4):725-66:**

“Imaging is an integral part of the clinical examination of the patient with back pain; it is, however, often used excessively and without consideration of the underlying literature. The primary role of imaging is the identification of systemic disease as a cause of the back or limb pain; magnetic resonance imaging (MRI) excels at this. Systemic disease as a cause of back or limb pain is, however, rare. Most back and radiating limb pain is of benign nature, owing to degenerative phenomena. There is no role for imaging in the initial evaluation of the patient with back pain in the absence of signs or symptoms of systemic disease. When conservative care fails, imaging may be undertaken with due consideration of its risks: labeling the patient as suffering from a degenerative disease, cost, radiation exposure, and provoking unwarranted minimally invasive or surgical intervention. Imaging can well depict disc degeneration and disc herniation. Imaging can suggest the presence of discogenic pain, but the lack of a pathoanatomic gold standard obviates any definitive conclusions. The imaging natural history of disc herniation is resolution. There is very poor correlation between imaging findings of disc herniation and the clinical presentation or course. Psychosocial factors predict functional disability due to disc herniation better than imaging. Imaging with MRI, computed tomography (CT), or CT myelography can readily identify central canal, lateral recess, or foraminal compromise. Only when an imaging finding is concordant with the patient's pain pattern or neurologic deficit can causation be considered. The zygapophysial (facet) and sacroiliac joint are thought to be responsible for axial back pain, although with less frequency than the disc. Imaging findings of the structural changes of osteoarthritis do not correlate with pain production. Physiologic imaging, either with single-photon emission CT bone scan, heavily T2-weighted MRI sequences (short-tau inversion recovery), or gadolinium enhancement, can detect inflammation and are more predictive of an axial pain generator.”

- **Iatrogenic Consequences of Early MRI in Acute Work-related Disabling Low Back Pain. Webster et al. Spine 2013 Jul 23:**

“Conclusion: Early MRI without indication has a strong iatrogenic effect in acute LBP, regardless of radiculopathy status. Providers and patients should be made aware that when early MRI is not indicated, it provides no benefits, and worse outcomes are likely.”

- **Influence of Low Back Pain and Prognostic Value of MRI in Sciatica Patients in Relation to Back Pain. Barzouhi et al. PLOS ONE March 2014 Volume 9 Issue 3:**

*“Conclusion: Sciatica patients with disabling low back pain reported an unfavorable outcome at one-year follow-up compared to those with predominantly sciatica. **If additionally a clear herniated disc with nerve root compression on MRI was absent, the results were even worse.**”*

- **The modic vertebral endplate and marrow changes: pathologic significance and relation to low back pain and segmental instability of the lumbar spine. Rahme and Moussa. AJNR AmJ Neuroradiol 29:838–42 May 2008**
- **Lumbar disc degeneration: epidemiology and genetic influences. Battie et al. Spine 2004 Dec 1;29 (23):2679-90**
- **Discography- Can we make the diagnosis of discogenic pain? Wilk. Australasian Musculoskeletal Medicine Nov 2007**
- **Lumbar Disc Stimulation (Provocative Discography). Bogduk N, ed. Practice Guidelines; Spinal Diagnostic Treatment Procedures. 1st ed. San Francisco; International Spine Intervention Society, 2004: 20-47.**
- **Carragee EJ, Tanner CM, Khurana S, Hayward C, Welsh J, Date E et al. The rates of false-positive lumbar discography in select patients without low back symptoms. Spine 2000;25:1373-80.**
- **Diagnostic evaluation of low back pain. Carragee & Hannibal. Orthop Clin North Am 2004 Jan: 35(1):7-16:**

“The diagnostic evaluation of chronic LBP is at best a complex and involved undertaking. The most important part of the process lies in the knowledge of the patient and a solid history and physical examination. From there, most of the serious and life-threatening causes of LBP can be elucidated and studies may be used for confirmation. Imaging studies are used most practically as confirmation studies once a working diagnosis is determined. MRI, although excellent at defining tumor, infection, and nerve compression, can be too sensitive with regard to degenerative disease findings and commonly displays pathology that is not responsible for the patient's symptoms. As an example, the high-intensity zones (HIZ) seen on MRI are reliable in determining annular defects in the disc but are not reliable in establishing internal disc disruption as the cause of LBP. Discography is the primary tool used by many physicians to determine the true pain generator when discogenic LBP is suspected. Because the reliability of the patient response is fundamental to

discography, interpreting the test in different settings must be considered. In individuals with disc degeneration and annular defects, discography may elicit LBP with injection whether the patient is symptomatic with serious LBP or not. The pain response may be amplified in those subjects with issues of chronic pain, social stressors, such as secondary gain or litigation claims, or psychologic distress disorder. These factors have been shown experimentally to be associated with an increased risk for a false positive injection. The ability of an individual to differentiate the true site of LBP by the quality of sensation with disc injection (concordancy) of pain produced by the injected disc also may not be reliable. In fact, individuals may not have the neural discrimination to differentiate sclerotomal pain originating from different sites in the low back and pelvis. One may realize that chronic LBP illness may not stem from a mechanical spinal disorder alone. In fact, the mechanical pathology may be just a portion of the problem with amplification by neurophysiologic, social, and psychologic issues. Chronic disabling LBP commonly is confounded by chronic pain, emotional troubles, poor job satisfaction, alcohol and narcotic abuse, and compensation issues, just to identify a few. It would follow that expecting to identify a single cause for this symptom complex is impractical and any single test may not be a reasonable approach. Furthermore, surgical correction of the mechanical portion of chronic LBP, even if correctly identified, then can be expected only to relieve a portion of a patient's symptoms as long as the confounding issues continue to be significant or have become life long adaptive mechanisms. In the end, the discogram and other diagnostic tests are tools that have clear limitations. In this field, clinical judgment begins and ends with an understanding of a patient's life and circumstances as much as with their specific spinal pathology"

- **Annular tears and disk herniation: prevalence and contrast enhancement on MR images in the absence of low back pain or sciatica. Stadnik et al. Radiology. 1998 Jan;206(1):49-55.**
- **Potential of MRI Findings To Refine Case Definition For Mechanical Low Back Pain In Epidemiological Studies: A Systematic Review. Endean et al. Spine (Phila Pa 1976). 2011 January 15; 36(2): 160–169**

"MRI findings of disc protrusion, nerve root displacement/compression, disc degeneration and HIZ are all associated with LBP, but individually, none of these abnormalities provides a strong indication that LBP is attributable to underlying pathology. This limits their value in refining epidemiological case definitions for LBP predictive of an axial pain generator."

- **Discographic, MRI and psychosocial determinants of low back pain disability and remission: a prospective study in subjects with benign persistent back pain. Carragee et al. Spine J. 2005 Jan-Feb:**

"CONCLUSION: The development of serious LBP disability in a cohort of subjects with both structural and psychosocial risk factors was strongly predicted by baseline psychosocial variables. Structural variables on both MRI and discography testing at baseline had only weak association with back pain episodes and no association with disability or future medical care."

- **Operative and Nonoperative Treatment Approaches for Lumbar Degenerative Disc Disease Have Similar Long-Term Clinical Outcomes Among Patients with Positive Discography. Smith et al. World Neurosurg. 2013 Sep 15:**

"Comparison of long-term outcomes for patients with back pain and concordant discography did not demonstrate a significant difference in outcome measures of pain, health status, satisfaction, or disability based on whether the patient elected for fusion or nonoperative treatment."

- **Lumbar Diskography and Failed Back Syndrome in Patients Receiving Workers' Compensation. Anderson et al. Orthopedics. 2015; 38(11):e951-e958:**

"Lumbar diskography (LD) is frequently used in the evaluation of patients with degenerative disk disease and diskogenic low back pain. Its safety and diagnostic accuracy are a topic of debate. No study has evaluated the efficacy of LD within the clinically distinct workers' compensation population. Within this setting, the authors wished to determine the effect of undergoing LD before diskogenic fusion on rates of postoperative failed back surgery syndrome (FBSS). Also, the authors compared opioid analgesic use between patients undergoing LD and patients not undergoing LD. ICD-9 diagnoses and CPT procedural codes were used to identify 1591 patients from the Ohio Bureau of Workers' Compensation who underwent diskogenic fusion between 1993 and 2013.

A total of 682 patients underwent LD before fusion, which formed the LD group, with the remaining 909 patients as controls. The authors used a multivariate logistic regression analysis while correcting for relevant covariates. Diskography before fusion was a positive predictor of postoperative FBSS (P=.04; odds ratio, 1.44). The rate of FBSS was 13.9% of the LD group and 8.8% in the control group. Postoperatively, the LD group was supplied with a significantly higher daily opioid analgesic load (P=.04) for an average of 130 additional days (P<.01). Additional predictors of FBSS included the ability to remain at work within 1 week of index fusion (P=.02; odds ratio, 0.54), male sex (P=.03; odds ratio, 1.51), preoperative narcotic use for more than 1 year (P=.02; odds ratio, 1.53), and fusion technique (P=.03).

Diskography should ideally help identify good candidates for lumbar fusion. However, the authors' study raises significant concerns regarding LD's current role within the workers' compensation population."

- **Serial MR Imaging of Annular Tears in Lumbar Intervertebral Disks. Munter et al. AJNR Am J Neuroradiol 23:1105–1109, August 2002:**

"Annular tears of lumbar intervertebral disks are found in both symptomatic and asymptomatic persons; therefore, it is difficult to determine whether these findings indicate acute abnormality. Our purpose was to determine whether the MR imaging findings of tears (ie, hyperintensity and contrast enhancement) of the annulus fibrosus persist or resolve over time ... CONCLUSION: Hyperintensity on T2-weighted MR images and enhancement of annular tears could not be used to determine the tears' acuity over the range of follow-up provided in this study ..."

- **Associations between radiographic lumbar spinal stenosis and clinical symptoms in the general population: the Wakayama Spine Study. Ishimoto et al. Osteoarthritis Cartilage. 2013 Jun;21(6):783-8:**

"Many asymptomatic individuals have radiographic lumbar spinal stenosis (LSS), but the prevalence of symptoms among individuals with radiographic LSS has not yet been established. The purpose of this study was to clarify the association between radiographic LSS and clinical symptoms in the general population ... 938 participants (308 men, 630 women; mean age, 66.3 years; range, 40-93 years) were analyzed. The severity of radiographic LSS, including central stenosis, lateral stenosis, and foraminal stenosis, was assessed by mobile magnetic resonance imaging and rated qualitatively. Assessment of clinical symptoms was based on the definition of symptomatic LSS in the North American Spine Society guideline.

We found that 77.9% of participants had more than moderate central stenosis and 30.4% had severe central stenosis. Logistic regression analysis after adjustment for age, sex, body mass index, and severity of radiographic LSS showed that severe central stenosis was related to clinical symptoms. However, only 17.5% of the participants with severe central stenosis were symptomatic.

Although radiographic LSS was common in our cohort, which resembled the general Japanese population, symptomatic persons were relatively uncommon."

- **Visually Assessed Severity of Lumbar Spinal Canal Stenosis Is Paradoxically Associated With Leg Pain and Objective Walking Ability. Kuitinen et al. BMC Musculoskelet Disord. 2014;15(348):**

"Conclusions There is no straightforward association between the stenosis of dural sac and patient symptoms or functional capacity. These findings indicated that dural sac stenosis is not the single key element in the pathophysiology of LSS."

- **Spondylolysis and spondylolisthesis: prevalence and association with low back pain in the adult community-based population. Kalichman et al. Spine (Phila Pa 1976). 2009 January 15; 34(2): 199–205:**

"Based on CT imaging of an unselected community-based population, the prevalence of lumbar spondylolysis is 11.5%, nearly twice the prevalence of previous plain radiograph-based studies. This study did not reveal a significant association between the observation of spondylolysis on CT and the occurrence of LBP, suggesting that the condition does not appear to represent a major cause of LBP in the general population."

- **Diagnosis and Treatment of Degenerative Lumbar Spondylolisthesis. North American Spine Society Evidence-Based Clinical Guidelines for Multidisciplinary Spine Care. 2008:**

"What is the long-term result (four+ years) of surgical management of degenerative lumbar spondylolisthesis?"

Decompression and fusion is recommended as a means to provide satisfactory long-term results for the treatment of patients with symptomatic spinal stenosis and degenerative lumbar spondylolisthesis.

Grade of Recommendation: C (Poor quality evidence (Level IV or V Studies) for or against recommending intervention.)"

- **Spondylolysis: a critical review. C J Standaert, S A Herring. Br J Sports Med 2000;34:415–422**
- **The natural history of spondylolysis and spondylolisthesis. Fredrickson BE, Baker D, McHolick WJ, et al. J Bone Joint Surg [Am] 1984;66:699–707.**
- **Lumbar spondylolysis: a review. Leone et al. Skeletal Radiol. 2011 Jun;40(6):683-700**
- **Spondylolysis and spondylolisthesis in children and adolescents. Tsirikos, Garrido. J Bone Joint Surg Br. 2010 Jun;92(6):751-9**

- **Section on ‘Instability’ in Chapter 5 The Adult and Pediatric Spine. Volume 1. Frymoyer and Viesel Lippincott Williams & Wilkins, 2004:**

“No uniform consensus of opinion exists as to what constitutes radiographic instability of the lumbar spine. Furthermore, there is no clear correlation between such changes and symptoms ...”

- **A Philosophical Foundation for Diagnostic Blocks, with Criteria for Their Validation. Engel, MacVicar, Bogduk. Pain Medicine 2014; 15: 998–1006:**

“... The eight criteria for diagnostic blocks can be assembled into a metric that can be applied to assess the validity of a given block, either in general or in a particular case. The metric is hierarchical in that certain criteria are essential, others are critical, and others less critical ... duration is an essential criterion. Because local anesthetic agents have a temporary effect, pain should return when that effect wears off, which should be in a matter of hours. If prolonged relief occurs after a block, the block converts into a therapeutic event, and is disqualified as a diagnostic procedure ...”

- **VOMIT (victims of modern imaging technology) - an acronym for our times. Richard Hayward, consultant neurosurgeon. BMJ 2003;326:1273:**

“...The history of imaging since the discovery of x rays has been one of an exponential rise in the volume and accuracy of information, acquired against a background of firstly increasing and then reducing invasiveness—and rising costs ... It is small wonder that the flood of information from these investigations and our knowledge of how to deal with it may be several years out of step ... So where does this leave us doctors? We adapt to a world in which we must accept VOMIT as a reasonable price for our technological advances. But it's also a world in which that well tried and tested concept, the doctor patient relationship, exists to help us translate the anxiety provoking generality into, we hope, the reassuringly individual.”

INTERVENTIONS:

- **Association between compensation status and outcomes in spine surgery: a meta-analysis of 31 studies. Cheriyan et al. The Spine Journal 15 (2015) 2564–2573:**

“...Thirty-one studies (13 prospective; 18 retrospective) with a total of 3,567 patients were included in the analysis. Follow-up time varied from 4 months to 10 years. Twelve studies involved only decompression; the rest were fusion. Overall RR (risk ratio) of an unsatisfactory outcome was 2.12 [1.74, 2.58; p<.001] in patients with WC when compared with those without WC after surgery. The RR of an unsatisfactory outcome in patients with WC, compared with those without, was 2.09 [1.38, 3.17]; p<.01 among studies from Europe and Australia, and 2.14 [1.48, 2.60]; p<.01 among US studies ...

Twenty percent of all work-related injuries are back injuries [7,8], and the influence of financial compensation is still a controversial issue in the treatment of low back pain [7]. Within the setting of spine surgery, numerous studies have reported that the impact of compensation status on outcomes is important [1,9–12]. This highlights the importance of considering compensation status when evaluating outcomes of all intervention studies in spine. Furthermore, reported strength of this association has widely varied from 1.31 [13] to 7.22 [14] among published studies. In the evolving environment of health-care economics and cost-efficacy, this association may be an important influence when it comes to economic and clinical decision making [9]. The purpose of this metaanalysis was to consolidate all studies, both prospective and retrospective, to determine the strength of association of compensation status on unsatisfactory outcomes in spine surgery. In addition, an analysis was performed to determine how the impact of compensation status changes based on study design, country of origin, and procedure type ...

Conclusions: There is a two-fold increase of an unsatisfactory outcome in compensated patients when compared with noncompensated patients in spine surgery. Further research investigating the possible etiology of this association is necessary.”

- **Spine surgery outcomes in a workers’ compensation cohort – Harris et al. ANZ J Surg 82 (2012) 625–629:**

“... A total of 476 patients had undergone lumbar spine surgery within the workers' compensation system. The revision surgery rate was 9.2%. The RTW rate and return to PID rate were 50.3% and 14.2%, respectively. The proportion of patients still undergoing treatment was 77.7%. The rates of RTW (or PID) and need for ongoing treatment were significantly worse in patients undergoing fusion and disc replacement, compared with patients undergoing decompressive procedures (laminectomy, discectomy). DISCUSSION: The findings do not support the use of lumbar spine

fusion or disc replacement surgery as a method of achieving RTW and relief of pain in patients treated under workers' compensation."

- **Long-term Outcomes of Lumbar Fusion Among Workers' Compensation Subjects: A Historical Cohort Study.** Nguyen et al. *Spine* 15 February 2011 - Volume 36 - Issue 4 - p 320–331:

"Conclusion. This 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 use, prolonged work loss, and poor RTW status."

- **Chronic Opioid Therapy After Lumbar Fusion Surgery for Degenerative Disc Disease in a Workers Compensation setting.** Anderson et al. *Spine*. 2016;40(22);177&-1784:

"... 1002 Ohio WC subjects who underwent lumbar fusion for degenerative disc disease from 1993 to 2013. Postoperative COT was defined as being supplied with opioid analgesics for greater than 1 year after the 6 week acute period after fusion. 575 subjects fit this criteria, forming the COT group. The remaining 427 subjects formed a temporary opioid group ...

Conclusion: The majority of the study population was on COT after fusion. COT was associated with considerably worse outcomes. The poor outcomes of this study could suggest a more limited role for discogenic fusion among WC patients."

- **ISCR Evidence Review on Lumbar Spinal Fusion.** Clavisi et al. May 2013. Available online via: <http://www.tac.vic.gov.au/providers/clinical-resources/evidence-reviews/lumbar-spinal-fusion>

"What is the effectiveness of spinal fusion on persistent pain, function, quality of life, return to work and medication use?

Chronic low back pain with disc degeneration: The evidence to answer this question is inconclusive.

Discogenic low back pain: The evidence to answer this question is inconclusive.

Isthmic spondylolisthesis: The evidence to answer this question is inconclusive.

Degenerative spondylolisthesis: The evidence to answer this question is inconclusive ...

There is insufficient evidence to conclude that the presence of disc degeneration, discogenic CLBP, degenerative spondylolisthesis, specific comorbid diseases, general health factors, psychological subpopulations, or isthmic spondylolisthesis are either indications for spinal fusion surgery, or predictors of outcomes in patients undergoing spinal fusion or non-surgical treatment."

- **The evidence on surgical interventions for low back disorders, an overview of systematic reviews.** Jacobs et al. *Eur Spine J*. 2013 Sep;22(9):1936-49:

"PURPOSE: Many systematic reviews have been published on surgical interventions for low back disorders. The objective of this overview was to evaluate the available evidence from systematic reviews on the effectiveness of surgical interventions for disc herniation, spondylolisthesis, stenosis, and degenerative disc disease (DDD). An earlier version of this review was published in 2006 and since then, many new, better quality reviews have been published.

METHODS: A comprehensive search was performed in the Cochrane database of systematic reviews (CDSR), database of reviews of effectiveness (DARE) and Pubmed. Two reviewers independently performed the selection of studies, risk of bias assessment, and data extraction. Included are Cochrane reviews and non-Cochrane systematic reviews published in peer-reviewed journals. The following conditions were included: disc herniation, spondylolisthesis, and DDD with or without spinal stenosis. The following comparisons were evaluated: (1) surgery vs. conservative care, and (2) different surgical techniques compared to one another. The methodological quality of the systematic reviews was evaluated using AMSTAR. We report (pooled) analyses from the individual reviews.

RESULTS: Thirteen systematic reviews on surgical interventions for low back disorders were included for disc herniation (n = 6), spondylolisthesis (n = 2), spinal stenosis (n = 4), and DDD (n = 4). Nine (69 %) were of high quality. Five reviews provided a meta-analysis of which two showed a significant difference. For the treatment of spinal stenosis, intervertebral process devices showed more favorable results compared to conservative treatment on the Zurich Claudication Questionnaire [mean difference (MD) 23.2 95 % CI 18.5-27.8]. For degenerative spondylolisthesis, fusion showed more favorable results compared to decompression for a mixed aggregation of clinical outcome measures (RR 1.40 95 % CI 1.04-1.89) and fusion rate favored instrumented fusion over non-instrumented fusion (RR 1.37 95 % CI 1.07-1.75).

CONCLUSIONS: For most of the comparisons, the included reviews were not significant and/or clinically relevant differences between interventions were identified. Although the quality of the reviews was quite acceptable, the quality of the included studies was poor. Future studies are likely to influence our assessment of these interventions."

- **Surgery for low back pain: a review of the evidence for an American Pain Society Clinical Practice Guideline. Chou, Baisden, Carragee, Resnick, Sheffer, Loeser. Spine 2009 May 1;34(10):1094-109:**

“STUDY DESIGN: Systematic review. OBJECTIVE: To systematically assess benefits and harms of surgery for nonradicular back pain with common degenerative changes, radiculopathy with herniated lumbar disc, and symptomatic spinal stenosis.

SUMMARY OF BACKGROUND DATA: Although back surgery rates continue to increase, there is uncertainty or controversy about utility of back surgery for various conditions.

METHODS: Electronic database searches on Ovid MEDLINE and the Cochrane databases were conducted through July 2008 to identify randomized controlled trials and systematic reviews of the above therapies. All relevant studies were methodologically assessed by 2 independent reviewers using criteria developed by the Cochrane Back Review Group (for trials) and Oxman (for systematic reviews). A qualitative synthesis of results was performed using methods adapted from the US Preventive Services Task Force.

RESULTS: For nonradicular low back pain with common degenerative changes, we found fair evidence that fusion is no better than intensive rehabilitation with a cognitive-behavioral emphasis for improvement in pain or function, but slightly to moderately superior to standard (nonintensive) nonsurgical therapy. Less than half of patients experience optimal outcomes (defined as no more than sporadic pain, slight restriction of function, and occasional analgesics) following fusion. Clinical benefits of instrumented versus noninstrumented fusion are unclear. For radiculopathy with herniated lumbar disc, we found good evidence that standard open discectomy and microdiscectomy are moderately superior to nonsurgical therapy for improvement in pain and function through 2 to 3 months. For symptomatic spinal stenosis with or without degenerative spondylolisthesis, we found good evidence that decompressive surgery is moderately superior to nonsurgical therapy through 1 to 2 years. For both conditions, patients on average experience improvement either with or without surgery, and benefits associated with surgery decrease with long-term follow-up in some trials. Although there is fair evidence that artificial disc replacement is similarly effective compared to fusion for single level degenerative disc disease and that an interspinous spacer device is superior to nonsurgical therapy for 1- or 2-level spinal stenosis with symptoms relieved with forward flexion, insufficient evidence exists to judge long-term benefits or harms.

CONCLUSION: Surgery for radiculopathy with herniated lumbar disc and symptomatic spinal stenosis is associated with short-term benefits compared to nonsurgical therapy, though benefits diminish with long-term follow-up in some trials. For nonradicular back pain with common degenerative changes, fusion is no more effective than intensive rehabilitation, but associated with small to moderate benefits compared to standard nonsurgical therapy.”

- **Surgery for degenerative lumbar spondylosis. Gibson, Waddell. Cochrane Database Syst Rev. 2005 Oct 19;(4):**

“MAIN RESULTS: Thirty-one published RCTs of all forms of surgical treatment for degenerative lumbar spondylosis were identified. The trials varied in quality: only the more recent trials used appropriate methods of randomization, blinding and independent assessment of outcome. Most of the earlier published results were of technical surgical outcomes with some crude ratings of clinical outcome. More of the recent trials also reported patient-centered outcomes of pain or disability, but there is still very little information on occupational outcomes. There was a particular lack of long term outcomes beyond two to three years. Seven heterogeneous trials on spondylolisthesis, spinal stenosis and nerve compression permitted limited conclusions. Two new trials on the effectiveness of fusion showed conflicting results. One showed that fusion gave better clinical outcomes than conventional physiotherapy, while the other showed that fusion was no better than a modern exercise and rehabilitation programme. Eight trials showed that instrumented fusion produced a higher fusion rate (though that needs to be qualified by the difficulty of assessing fusion in the presence of metal-work), but any improvement in clinical outcomes is probably marginal, while there is other evidence that it may be associated with higher complication rates. Three trials with conflicting results did not permit any conclusions about the relative effectiveness of anterior, posterior or circumferential fusion. Preliminary results of two small trials of intradiscal electrotherapy showed conflicting results. Preliminary data from three trials of disc arthroplasty did not permit any firm conclusions.

AUTHORS' CONCLUSIONS: Limited evidence is now available to support some aspects of surgical practice. Surgeons should be encouraged to perform further RCTs in this field.”

- **Lumbar fusion compared with conservative treatment in patients with chronic low back pain: a meta-analysis. Saltychev et al. International Journal of Rehabilitation Research 2014, 37:2-8:**

“... There is strong evidence that LF is not more effective than conservative treatment in reducing perceived disability because of CLBP among patients with degenerative spinal diseases. It is unlikely that further research on the subject would considerably affect this conclusion.”

- **Meta-analysis of randomized trials comparing fusion surgery to non-surgical treatment for discogenic chronic low back pain. Wang et al. J Back Musculoskelet Rehabil. 2014 Dec 2. [Epub ahead of print so currently only abstract available on this systematic review]:**

“CONCLUSIONS: Fusion surgery was not superior to nonsurgical treatment in terms of changes in ODI scores for DLBP (discogenic low back pain). Fusion surgery resulted in surgical complications. Longer follow-up observation is necessary regarding condition-specific disability, pain, and life satisfaction.”

- **North American Spine Society practice guidelines evidence reviews. Available online via:**
<https://www.spine.org/Pages/ResearchClinicalCare/QualityImprovement/ClinicalGuidelines.aspx>
- **Spinal Surgery for Chronic Low Back Pain: Review of Clinical Evidence and Guidelines. Australian Safety and Efficacy Register of New Interventional Procedures – Surgical. The Royal Australasian College of Surgeons - report produced for the Victorian Government Department of Health June 30 2014:**

“... An overview of seven SRs and two additional SRs provided evidence on the comparative effectiveness of surgery versus conservative management for CLBP. For the treatment of spinal stenosis, intervertebral process devices were more effective than conservative treatment. While individual studies with a high risk of bias suggested that surgery improved short-term pain relief for disc herniation with radiculopathy, compared with conservative management, no differences were observed at the one-year follow-up. Pooled data showed no statistically significant difference in effectiveness between lumbar fusion and conservative management. Decompressive surgery was reported to be more effective than exercise for the management of lumbar spinal stenosis, based on one SR. While the quality of reviews included in the overview was acceptable, studies included in the reviews showed a high risk of bias and methodological flaws. Evidence from SRs supported the recommendations from the CPGs that surgery only seems to provide long-term benefit in a small subset of patients.

Victorian GPs need further information about the pathophysiology of back pain and the facilities and treatments available in their state. Patients need to be informed about options for self-management, educated and supported in taking a more active role in managing their pain over the long term and apprised of the risks and benefits of surgical interventions. According to experts, access to physiotherapy in the private system is limited by cost and there is a lack of adequate access to pain management programmes in Victoria. It is thought that physiotherapy-led clinics are helping to reduce over-referral to specialists and improve patient outcomes. Decision makers need to consider that patients may experience long wait times for short periods of treatment and to develop strategies to improve access to care. Spinal care pathways may offer a means of further reducing over-referral to specialists in the manner of the Saskatchewan Spine Pathway, which was effective in reducing MRI utilisation and referrals to surgery.”

- **Spinal-Fusion Surgery — The Case for Restraint – Deya et al. n engl j med 350;7 February 12, 2004**
- **It's time for change with the management of non-specific chronic low back pain. O'Sullivan. Br J Sports Med March 2012 Vol 46No 4**
- **Efficacy of classification-based cognitive functional therapy in patients with non-specific chronic low back pain: A randomized controlled trial. Fersum et al. Eur J Pain. 2013 Jul**
- **Comparison of spinal fusion and nonoperative treatment in patients with chronic low back pain: long-term follow-up of three randomized controlled trials. Mannion et al. Spine J. 2013 Nov 4:**

“CONCLUSIONS: After an average of 11 years follow-up, there was no difference in patient self-rated outcomes between fusion and multidisciplinary cognitive-behavioral and exercise rehabilitation for cLBP. The results suggest that, given the increased risks of surgery and the lack of deterioration in nonoperative outcomes over time, the use of lumbar fusion in cLBP patients should not be favored in health care systems where multidisciplinary cognitive-behavioral and exercise rehabilitation programmes are available.”

- **Impact of a multidisciplinary pain program for the management of chronic low back pain in patients undergoing spine surgery and primary total hip replacement: a retrospective cohort study. Von der Hoeh et al. Patient Safety in Surgery 2014, 8:34**

“Of the 256 patients admitted for multidisciplinary pain program, fifteen were indicated to benefit from a surgical intervention during multidisciplinary pain program. Ten patients received spine surgery. THA was indicated in five patients. In all cases, the peri- and postoperative clinical courses were uneventful. Only two of the patients subjected to spine surgery and three patients who had THA were improved after 12 months. One patient reported a worsened condition. All patients presented with good functional outcomes and normal radiological findings.

Conclusions: The indication for surgical intervention in patients with chronic low back pain and degenerative diseases must be critically assessed. THA in this cohort should focus on functional aspects, such as the improvement of range of motion, rather than the reduction of pain. Spine surgery in chronic low back pain patients after multidisciplinary pain program including cognitive – behavioral therapy cannot be recommended due to its questionable success.”

- **The case for restraint in spinal surgery: does quality management have a role to play? Deyo et al. Eur Spine J (2009) 18 (Suppl 3):S331–S337**
- **Overtreating Chronic Back Pain: Time to Back Off? Deyo et al. JABFM January–February 2009 Vol. 22 No. 1:**

“Chronic back pain is among the most common patient complaints. Its prevalence and impact have spawned a rapidly expanding range of tests and treatments. Some of these have become widely used for indications that are not well validated, leading to uncertainty about efficacy and safety, increasing complication rates, and marketing abuses. Recent studies document a 629% increase in Medicare expenditures for epidural steroid injections; a 423% increase in expenditures for opioids for back pain; a 307% increase in the number of lumbar magnetic resonance images among Medicare beneficiaries; and a 220% increase in spinal fusion surgery rates. The limited studies available suggest that these increases have not been accompanied by population-level improvements in patient outcomes or disability rates. We suggest a need for a better understanding of the basic science of pain mechanisms, more rigorous and independent trials of many treatments, a stronger regulatory stance toward approval and post-marketing surveillance of new drugs and devices for chronic pain, and a chronic disease model for managing chronic back pain.”

- **Clinical decision making in spinal fusion for chronic low back pain. Results of a nationwide survey among spine surgeons – Willems et al. BMJ Open 2011:**

“Conclusions: The present survey showed a lack of consensus among spine surgeons on the appreciation and use of predictive tests. Prognostic patient factors were not consistently incorporated in their treatment strategy either. Clinical decision making for spinal fusion to treat chronic low back pain does not have a uniform evidence base in practice ...”

- **Spinal fusion for chronic low back pain: systematic review on the accuracy of tests for patient selection. Willems et al. The Spine Journal 13 (2013) 99–109:**

“... CONCLUSIONS: No subset of patients with chronic LBP could be identified for whom spinal fusion is a predictable and effective treatment. Best evidence does not support the use of current tests for patient selection in clinical practice.”

- **Pain Intensity and Patients' Acceptance of Surgical Complication Risks With Lumbar Fusion. Bono et al. Spine. 2013;38(2):140-147:**

“Conclusion. The current investigation indicates that the intensity of LBP is the most influential factor affecting a patient's decision to accept risk of complication and symptom persistence when considering lumbar fusion. This relationship has not been previously shown for any surgical procedure. These data could potentially change the manner in which patients are counseled to make informed choices about spinal surgery. With growing interest in adverse events and complications, these data could be important in establishing guidelines for patient-directed surgical decision making.”

- **Nationwide Trends in the Surgical Management of Lumbar Spinal Stenosis. Bae et al. SPINE Volume 38, Number 11, pp 916–926:**

“Conclusion. This study demonstrates that the rate of simple fusion surgery has increased for treatment of LSS compared with decompression only.”

- **Trends, Major Medical Complications, and Charges Associated With Surgery for Lumbar Spinal Stenosis in Older Adults. Deyo et al. JAMA, April 7, 2010—Vol 303, No. 13:**

“... 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.”

- **Arguments for the choice of surgical treatments in patients with lumbar spinal stenosis – a systematic appraisal of randomized controlled trials. Burgstaller et al. BMC Musculoskeletal Disorders (2015) 16:96:**

“... Conclusions: The main argument identified in this appraisal for and against decompression alone in patient with lumbar spinal stenosis was whether or not instability should be treated with (instrumented) fusion procedures. However, there is disagreement on how instability should be defined. In a first step it is important that researchers and clinicians agree on definitions for important key concepts such as instability and reoperations.”

- **Surgery Versus Nonsurgical Treatment of Lumbar Spinal Stenosis. A Randomized Trial. Delitto et al. Ann Intern Med. 2015;162:465-473:**

“... Limitation: Without a control group, it is not possible to judge success attributable to either intervention. Conclusion: Surgical decompression yielded similar effects to a PT regimen among patients with LSS who were surgical candidates. Patients and health care providers should engage in shared decision-making conversations that include full disclosure of evidence involving surgical and nonsurgical treatments for LSS.”

- **Surgical versus non-surgical treatment for lumbar spinal stenosis. Zaina et al. Cochrane Library 2016, Issue 1:**

“... We have very little confidence to conclude whether surgical treatment or a conservative approach is better for lumbar spinal stenosis, and we can provide no new recommendations to guide clinical practice. However, it should be noted that the rate of side effects ranged from 10% to 24% in surgical cases, and no side effects were reported for any conservative treatment. No clear benefits were observed with surgery versus non-surgical treatment. These findings suggest that clinicians should be very careful in informing patients about possible treatment options, especially given that conservative treatment options have resulted in no reported side effects. High-quality research is needed to compare surgical versus conservative care for individuals with lumbar spinal stenosis.”

- **Adjacent segment disease after lumbar or lumbosacral fusion: review of the literature. Park et al. Spine 2004 Sep**
- **Risk factors for adjacent segment disease after lumbar fusion. Lee et al. Eur Spine J (2009) 18:1637–1643**
- **Long-term Follow-up Suggests Spinal Fusion Is Associated With Increased Adjacent Segment Disc Degeneration but Without Influence on Clinical Outcome. Results of a Combined Follow-up From 4 Randomized Controlled Trials. Mannion et al. Spine. 2014;39(17):1373-1383**
- **Methods of evaluating lumbar and cervical fusion. Gruskay et al. Spine J. 2014 Mar 1;14(3):531-9:**

*“... Pseudarthrosis classically presents with the onset of or return of axial or radicular symptoms during the first postoperative year. **However, this diagnosis is complicated** because other diagnoses can mimic these symptoms (such as infection or adjacent segment degeneration) and because many cases of pseudarthrosis are asymptomatic. ... pseudarthrosis remains a problem, with incidence rates reported in the literature ranging from 0% to 56% ...”*

NB: This article, like so many others, only considers mechanistic explanations for persistent pain.

- **Early Predictors of Lumbar Spine Surgery after Occupational Back Injury. Keeney et al. Spine. 2013; 38(11):953-964**
- **Smoking Threatens Orthopaedic Outcomes. Canale et al. AAOS Now. June 2012 available via <http://www.aaos.org/news/aaosnow/jun12/cover2.asp>**
- **Smoking and the Human Vertebral Column: A Review of the Impact of Cigarette Use on Vertebral Bone Metabolism and Spinal Fusion. Hadley et al. Neurosurgery: July 1997 - Volume 41 - Issue 1 - pp 116-124**
- **Failed back (surgery) syndrome: time for a paradigm shift. Vlegger-Lankamp et al. British Journal of Pain. Feb 20, 2013**
- **Perioperative Complications and Mortality After Spinal Fusions - Analysis of Trends and Risk Factors. Goz et al. Spine. 2013;38(22):1970-1976.**

- **Psychiatric Disorders and Major Spine Surgery: Epidemiology and Perioperative Outcomes.** Mariano et al. *Spine*: 15 January 2014 - Volume 39 - Issue 2.

- **Lumbar Spine Fusion in Obese and Morbidly Obese Patients.** Vaidya et al. *Spine*. 2009;34(5):495-500:

"... The incidence of postoperative complications was significant in 45% of morbidly obese and 44% of obese patients. Conclusion: Obese and morbidly obese patients have multiple comorbidities, and the spinal surgeon should be prepared to encounter perioperative complexities. Operative times are longer in comparison with normal weight patients with a higher incidence of postoperative complications. No weight loss occurs after spinal surgery."

- **Prolonged conservative care versus early surgery in patients with sciatica caused by lumbar disc herniation: two year results of a randomised controlled trial.** Peul et al. *BMJ*. 2008 Jun 14;336(7657):1355-8:

"CONCLUSIONS: Early surgery achieved more rapid relief of sciatica than conservative care, but outcomes were similar by one year and these did not change during the second year."

- **Workers' Compensation Status: Does It Affect Orthopaedic Surgery Outcomes? A Meta-Analysis.** Moraes et al. www.plosone.org 1 December 2012. Volume 7 / Issue 12

- **Association Between Compensation Status and Outcome After Surgery.** Harris et al. *JAMA*, April 6, 2005—Vol 293, No. 13

- **Radiofrequency denervation for chronic low back pain.** Maas et al. *Cochrane Database of Systematic Reviews* 2015, Issue 10:

"... The evidence is current to May 2014. This review includes 23 randomised controlled trials with a total of 1309 participants whose chronic low back pain was evaluated with nerve blocks or other diagnostic tests. Both men and women, with a mean age of 50.6 years, were included. Patients with a positive response to a diagnostic block or to discography were given radiofrequency denervation, a placebo or a comparison treatment.

Key results No high-quality evidence shows that radiofrequency denervation provides pain relief for patients with chronic low back pain. Similarly, no convincing evidence suggests that this treatment improves function. Moderate-quality evidence suggests that radiofrequency denervation might better relieve facet joint pain and improve function over the short term when compared with placebo.

Evidence of very low to low quality shows that radiofrequency denervation might relieve facet joint pain as well as steroid injections. For patients with disc pain, only small long-term effects on pain relief and improved function are shown. For patients with SI joint pain, radiofrequency denervation had no effect over the short term and a smaller effect (based on one study) one to six months after treatment when compared with placebo. For low back pain suspected to arise from other sources, the results were inconclusive. Radiofrequency denervation is an invasive procedure that can cause a variety of complications.

Quality of the evidence: The studies in this review were not of adequate quality and size to document how often complications occur. Given the poor quality of the evidence, large, high-quality studies are urgently needed to determine whether radiofrequency denervation is safe and effective."

- **Safe prescribing of opioids for persistent non-cancer pain.** McDonough. *Aust Prescr* 2012;35:20–4

PAIN / NEUROSCIENCE / BIOPSYCHOSOCIAL:

- **Is neuroplasticity in the central nervous system the missing link to our understanding of chronic musculoskeletal disorders?** Pelletier et al. *BMC Musculoskeletal Disorders* (2015) 16:25:

"Background: Musculoskeletal rehabilitative care and research have traditionally been guided by a structural pathology paradigm and directed their resources towards the structural, functional, and biological abnormalities located locally within the musculoskeletal system to understand and treat Musculoskeletal Disorders (MSD).

However the structural pathology model does not adequately explain many of the clinical and experimental findings in subjects with chronic MSD and, more importantly, treatment guided by this paradigm fails to effectively treat many of these conditions.

Discussion: Increasing evidence reveals structural and functional changes within the Central Nervous System (CNS) of people with chronic MSD that appear to play a prominent role in the pathophysiology of these disorders. These neuroplastic changes are reflective of adaptive neurophysiological processes occurring as the result of altered afferent stimuli including nociceptive and neuropathic transmission to spinal, subcortical and cortical areas with MSD that are initially beneficial but may persist in a chronic state, may be part and parcel in the pathophysiology of the condition and the development and maintenance of chronic signs and symptoms. Neuroplastic changes within different areas of the CNS may help to explain the transition from acute to chronic conditions, sensory-motor findings, perceptual disturbances, why some individuals continue to experience pain when no structural cause can be discerned, and why some fail to respond to conservative interventions in subjects with chronic MSD. We argue that a change in paradigm is necessary that integrates CNS changes associated with chronic MSD and that these findings are highly relevant for the design and implementation of rehabilitative interventions for this population.

Summary: Recent findings suggest that a change in model and approach is required in the rehabilitation of chronic MSD that integrate the findings of neuroplastic changes across the CNS and are targeted by rehabilitative interventions. Effects of current interventions may be mediated through peripheral and central changes but may not specifically address all underlying neuroplastic changes in the CNS potentially associated with chronic MSD. Novel approaches to address these neuroplastic changes show promise and require further investigation to improve efficacy of current approaches."

- **Neuroplasticity and pain: what does it all mean? Recent findings have implications for how we conceptualise, assess and treat pain – Siddall. MJA 198 (4) 4March 2013**
- **Epidemiology chronic pain. Croft et al. 2010 (Oxford University Press)**
- **Explain Pain (2nd Edn). Butler and Moseley. Noigroup Publications (2013) and evidence base document available via:**
http://www.noigroup.com/documents/noi_explain_pain_2nd_edn_evidence_base_0813.pdf
- **A Future Without Chronic Pain: Neuroscience and Clinical Research. Borsook. Cerebrum, June 2012. Available online via: <http://dana.org/news/cerebrum/detail.aspx?id=39160>**
- **The Pain Truth ... and Nothing But! An Easy to Understand Patient Education Handbook on Pain Management. Jam 2010 (APTEI). Available online via:**
<http://www.painmaps.com/wp-content/uploads/2014/09/The-Pain-Truth...and-Nothing-But-ebook.pdf>
- **Nociceptors: the sensors of the pain pathway. Dubin and Patapoutian. The Journal of Clinical Investigation <http://www.jci.org> Volume 120 Number 11 November 2010**
- **Central sensitization: Implications for the diagnosis and treatment of pain. Woolf. Pain. 2011 March ; 152**
- **Towards a theory of chronic pain. Apkarian et al. Prog Neurobiol. 2009 February ; 87(2): 81–97**
- **Mechanisms of Neuropathic Pain. Campbell & Myer. Neuron. 2006 October 5; 52(1): 77–92:**

"Neuropathic pain refers to pain that originates from pathology of the nervous system. Diabetes, infection (herpes zoster), nerve compression, nerve trauma, "channelopathies," and autoimmune disease are examples of diseases that may cause neuropathic pain. The development of both animal models and newer pharmacological strategies has led to an explosion of interest in the underlying mechanisms. Neuropathic pain reflects both peripheral and central sensitization mechanisms.

Abnormal signals arise not only from injured axons but also from the intact nociceptors that share the innervation territory of the injured nerve. This review focuses on how both human studies and animal models are helping to elucidate the mechanisms underlying these surprisingly common disorders. The rapid gain in knowledge about abnormal signaling promises breakthroughs in the treatment of these often debilitating disorders."

- **Neuropathic Pain: A Maladaptive Response of the Nervous System to Damage. Costigan, Scholz and Woolf. Annu Rev Neurosci. 2009 ; 32: 1–32:**

"Abstract: Neuropathic pain is triggered by lesions to the somatosensory nervous system that alter its structure and function so that pain occurs spontaneously and responses to noxious and innocuous stimuli are pathologically amplified. The pain is an expression of maladaptive plasticity within the nociceptive system, a series of changes that constitute a neural disease state. Multiple alterations distributed widely across the nervous system contribute to

complex pain phenotypes. These alterations include ectopic generation of action potentials, facilitation and disinhibition of synaptic transmission, loss of synaptic connectivity and formation of new synaptic circuits, and neuroimmune interactions.

Although neural lesions are necessary, they are not sufficient to generate neuropathic pain; genetic polymorphisms, gender, and age all influence the risk of developing persistent pain. Treatment needs to move from merely suppressing symptoms to a disease-modifying strategy aimed at both preventing maladaptive plasticity and reducing intrinsic risk.”

- **Neuroinflammation and the generation of neuropathic pain.** Ellis and Bennett. *British Journal of Anaesthesia* 111 (1): 26–37 (2013):
- **The Enduring Impact of What Clinicians Say to People With Low Back Pain.** Darlow et al. *Ann Fam Med.* 2013;11(6):527-534
- **Easy to Harm, Hard to Heal: Patient Views About the Back.** Darlow et al. *Spine (Phila Pa 1976).* 2015 Jun 1;40(11):842-50:

“CONCLUSION: Negative assumptions about the back made by those with LBP may affect information processing during an episode of pain. This may result in attentional bias toward information indicating that the spine is vulnerable, an injury is serious, or the outcome will be poor. Approaching consultations with this understanding may assist clinicians to have a positive influence on beliefs.”

- **Influence of context effects on health outcomes: a systematic review.** Blasi et al. *Lancet* 2001; 357: 757–62
- **Disabling chronic low back pain as an iatrogenic disorder: a qualitative study in Aboriginal Australians.** Lin et al. *BMJ Open.* 2013 Apr 9
- **Emotional distress as a predictor for low back disability: a prospective 12-year population-based study.** Brage et al. *Spine.* 2007 Jan 15;32(2):269-74
- **The role of perceived injustice in chronic pain and related references.** Nov 2013 available via: <http://www.bodyinmind.org/the-role-of-perceived-injustice-in-chronic-pain/>
- **Perceived injustice: a risk factor for problematic pain outcomes.** Sullivan MJ, Scott W, & Trost Z (2012). *The Clinical journal of pain,* 28 (6), 484-8
- **From Acute to Chronic Back Pain: Risk Factors, Mechanisms, and Clinical Implications.** Hasenbring et al. Oxford University Press 2012.
- **Predicting back pain treatment outcomes among workers' compensation patients: important information for clinical neuropsychologists.** Wheeler et al. *Clin Neuropsychol.* 2013;27(1):49-59:

“Low back pain is an increasingly prevalent and costly issue in the United States. It is a particularly relevant problem for Workers' Compensation patients, who typically experience worse surgical and functional outcomes than their non-compensated counterparts. Neuropsychologists often provide intervention and assessment services to compensated patients with back pain, and thus it is critical they possess a basic understanding of the factors that might predispose an injured worker to poor spine surgery outcomes. This paper will review the current literature regarding presurgical biopsychosocial factors which have been implicated in poor back surgery outcomes among injured workers. We provide some tentative guidelines for neuropsychologists to utilize in providing services to injured workers with back pain.”

- **The Role of Emotional Health in Functional Outcomes after Orthopaedic Surgery: Extending the Biopsychosocial Model to Orthopaedics.** AOA Critical Issues. Ayers et al. *J Bone Joint Surg Am.* Nov 6 2013
- **The Effect of Financial Compensation on Health Outcomes following Musculoskeletal Injury: Systematic Review.** Murgatroyd et al. *PLOS ONE* February 13, 2015 via:

<http://www.plosone.org/article/fetchObject.action?uri=info:doi/10.1371/journal.pone.0117597&representation=PDF>

“... There was strong evidence of an association between compensation status and poorer psychological function; and legal representation and poorer physical function. There was moderate evidence of an association between compensation status and poorer physical function; and legal representation and poorer psychological function. There

was limited evidence of an association between compensation status and increased pain. In seven studies the association depended on the outcome measured. No studies reported an association between compensation related factors and improved health outcomes. Further research is needed to find plausible reasons why compensation related factors are associated with poorer health following musculoskeletal injury.”

- **Clinical Depression Is a Strong Predictor of Poor Lumbar Fusion Outcomes Among Workers' Compensation Subjects.** Anderson et al. *Spine*: 15 May 2015 Volume 40 - Issue 10 - p 748–756
- **Fear–Avoidance Beliefs Associated With Perceived Psychological and Social Factors at Work Among Patients With Neck and Back Pain.** Myhre et al. *BMC Musculoskelet Disord.* 2013;14(329)
- **IS WORK GOOD FOR YOUR HEALTH AND WELL-BEING?** Waddell, Burton. 2006
- **Psychosocial predictors and correlates for chronic post-surgical pain (CPSP) – A systematic review.** Hinrichs-Rocker et al. *European Journal of Pain* 13 (2009) 719–730
- **Pain and the Neuromatrix in the Brain.** Melzack. *Journal of Dental Education.* Volume 65, No. 12 Dec 2001
- **Guiding compensable clients out of pain.** Daly. Intouch Publication. Issue 1 2013
- **Back in Control. A spine Surgeon’s roadmap out of chronic pain.** Hanscom. Vertus Press 2012
- **Surgery, the Ultimate Placebo. A Surgeon Cuts through The Evidence.** Harris. NewSouth Publishing 2016.
- **Use of placebo controls in the evaluation of surgery: systematic review.** Wartolowska et al. *BMJ* 2014;348:g3253 doi: 10.1136/bmj.g3253 (Published 21 May 2014):

“Conclusions Placebo controlled trial is a powerful, feasible way of showing the efficacy of surgical procedures. The risks of adverse effects associated with the placebo are small. In half of the studies, the results provide evidence against continued use of the investigated surgical procedures. Without well designed placebo controlled trials of surgery, ineffective treatment may continue unchallenged.”

- **Two-year results of a randomized placebo-controlled trial of vertebroplasty for acute osteoporotic vertebral fractures.** Kroon et al. *J Bone Miner Res.* 2014 Jun;29(6):1346-55
- **Arthroscopic surgery for degenerative knee: systematic review and meta-analysis of benefits and harms.** Thorlund et al. *BMJ* 2015;350:h2747:

“... Conclusions: The small inconsequential benefit seen from interventions that include arthroscopy for the degenerative knee is limited in time and absent at one to two years after surgery. Knee arthroscopy is associated with harms. Taken together, these findings do not support the practise of arthroscopic surgery for middle aged or older patients with knee pain with or without signs of osteoarthritis.”

- **When Words Are Painful: Unraveling The Mechanisms Of The Nocebo Effect.** Benedetti et al. *Neuroscience* 147 (2007) 260–271:

“Abstract—The nocebo effect is a phenomenon that is opposite to the placebo effect, whereby expectation of a negative outcome may lead to the worsening of a symptom. Thus far, its study has been limited by ethical constraints, particularly in patients, as a nocebo procedure is per se stressful and anxiogenic. It basically consists in delivering verbal suggestions of negative outcomes so that the subject expects clinical worsening. Although some natural nocebo situations do exist, such as the impact of negative diagnoses upon the patient and the patient’s distrust in a therapy, the neurobiological mechanisms have been understood in the experimental setting under strictly controlled conditions. As for the placebo counterpart, the study of pain has been fruitful in recent years to understand both the neuroanatomical and the neurochemical bases of the nocebo effect. Recent experimental evidence indicates that negative verbal suggestions induce anticipatory anxiety about the impending pain increase, and this verbally-induced anxiety triggers the activation of cholecystokinin (CCK) which, in turn, facilitates pain transmission.

CCK-antagonists have been found to block this anxiety-induced hyperalgesia, thus opening up the possibility of new therapeutic strategies whenever pain has an important anxiety component. Other conditions, such as Parkinson’s disease, although less studied, have been found to be affected by nocebo suggestions as well. All these findings underscore the important role of cognition in the therapeutic outcome, and suggest that nocebo and nocebo-related effects might represent a point of vulnerability both in the course of a disease and in the response to a therapy.”

- **Nocebo Phenomena in Medicine. Their Relevance in Everyday Clinical Practice.** Hauser et al. *Dtsch Arztebl Int* 2012; 109(26): 459–65
- **Distinct neural representations of placebo and nocebo effects.** Freeman et al. *NeuroImage* 112 (2015) 197–207:

“...Our findings suggest that positive and negative expectancies engage different brain networks to modulate our pain experiences, but, overall, these distinct patterns of neural activation result in a correlated placebo and nocebo behavioural response.”

- **Placebo and Pain. From Bench to Bedside.** Colloca, Flaten and Meissner. Elsevier Publishing 2014
- **Medicine's inconvenient truth: the placebo and nocebo effect.** Arnold, M., Finniss, D., Kerridge, I. (2014). *Internal Medicine Journal*, 44(4), 398-405:

“Placebo and nocebo effects are often regarded by clinicians as either a quaint reminiscence from the pre-therapeutic era, or simply as a technique for establishing the efficacy of therapeutic interventions within the locus of evidence-based practice. However, neither of these explanations sufficiently account for their complexity or their persistence and impact in clinical medicine. Placebo and nocebo effects are embedded in the very fabric of therapeutic relationships and are both a manifestation and outcome of the rituals that characterise clinical practice. They are also a stark reminder of the many personal and environmental factors, including the attitudes, beliefs and expectations of both doctor and patient, that shape the outcomes of health professional-patient interactions.

We describe how recent biological and neuropsychiatric data have clarified the operation of placebo and nocebo effects in clinical practice – demonstrating the ability of the therapeutic context to modulate endogenous biological processes in a targeted manner. This, in turn, illustrates the potent philosophical and sociocultural aspects of medical praxis.”

- **The Effect of Neuroscience Education on Pain, Disability, Anxiety, and Stress in Chronic Musculoskeletal Pain. Systematic Review.** Louw et al. *Arch Phys Med Rehabil* Vol 92, December 2011
- **Other resources are available from this author via:**

<http://www.optp.com/Therapeutic-Neuroscience-Education-Teaching-Patients-About-Pain-A-Guide-for-Clinicians>

- **Therapeutic Neuroscience Education: Teaching Patients About Pain; A Guide for Clinicians.** Louw, Puentedura. OPTP Publications 2013.
- **Preoperative pain neuroscience education for lumbar radiculopathy: a multicenter randomized controlled trial with 1-year follow-up.** Louw et al. *Spine (Phila Pa 1976)*. 2014 Aug 15;39(18):1449-57:

“CONCLUSION: NE resulted in significant behavior change. Despite a similar pain and functional trajectory during the 1-year trial, patients with LS who received NE viewed their surgical experience more favorably and used less health care facility in the form of medical tests and treatments.”

RESEARCH / OUTCOMES:

- **Belief reinforcement: one reason why costs for low back pain have not decreased.** Zusman. *Journal of Multidisciplinary Healthcare* 2013;6 197–204:

“Abstract: Recent figures show that there has been no change in the upward trend of direct and indirect costs for the largely benign symptom of low back pain in Western societies. This is despite greater understanding and the recommendation of a much more conservative and independent approach to its management. Moreover, in recent years, several large-scale education programs that aim to bring knowledge of the public (including general practitioners) more in line with evidence-based best practice were carried out in different countries. The hope was that the information imparted would change beliefs, ie, dysfunctional patient behavior and biomedical practice on the part of clinicians. However, these programs had no influence on behavior or costs in three out of the four countries in which they were implemented. It is argued that one reason for the overall lack of success is that it is extremely difficult to alter the potentially disabling belief among the lay public that low back pain has a structural mechanical cause. An important reason for this is that this belief continues to be regularly reinforced by the conditions of care of a range of “hands-on” providers, for whom idiosyncratic variations of that view are fundamental to their professional existence.”

- **Evidence-based de-implementation for contradicted, unproven, and aspiring healthcare practices. Prasad and Ioannidis. Implementation Science 2014, 9:1**

“Abstract: Abandoning ineffective medical practices and mitigating the risks of untested practices are important for improving patient health and containing healthcare costs. Historically, this process has relied on the evidence base, societal values, cultural tensions, and political sway, but not necessarily in that order. We propose a conceptual framework to guide and prioritize this process, shifting emphasis toward the principles of evidence-based medicine, acknowledging that evidence may still be misinterpreted or distorted by recalcitrant proponents of entrenched practices and other biases.”

- **“And I Think That We Can Fix It”. Mental Models Used in High-risk Surgical Decision Making. Kruser et al. Ann Surg 2015;261:678–684:**

“Conclusions: Although the use of “fix-it” is familiar for explaining medical information to patients, surgeons recognize that the model can be problematic for determining the value of an operation. Whether patients can transition between understanding how their disease is fixed with surgery to a subsequent deliberation about whether they should have surgery is unclear and may have broader implications for surgical decision making.”

- **Minimum acceptable outcomes after lumbar spinal fusion. Carragee, Cheng. The Spine Journal 10 (2010) 313–320:**

“CONCLUSIONS: Patients with spondylolisthesis and DDD both have relatively high minimum acceptable outcomes for spinal fusion. In these cohorts, few subjects considered more commonly proposed MCIDs for pain and function as an acceptable outcome and report that they would not have surgery if they did not expect to achieve more than those marginal improvements. Although there was good concordance between achieving the minimum acceptable outcomes and ultimate satisfaction, patients with significant psychosocial factors (compensation claims, psychological distress, and others) are less likely to associate satisfaction with outcomes with actually achieving these improvements.”

- **Ratings of global outcome at the first post-operative assessment after spinal surgery: how often do the surgeon and patient agree? Lattiq et al. Eur Spine J. 2009 Aug;18**
- **An exploration of patients’ expectation of and satisfaction with surgical outcome. McGregor et al. Eur Spine J. 2013 Dec; 22(12): 2836–2844.**
- **Assessment of spine surgery outcomes: inconsistency of change amongst outcome measurements. Copay et al. The Spine Journal 10 (2010) 291–296:**

“RESULTS: Only 40.5% of patients report consistent outcome changes on all four measures ...

CONCLUSIONS: Efforts should be made to take into account the inconsistency of outcomes and to make clinical relevance more readily understandable by patients and clinicians.”

- **The patient’s perspective on complications after spine surgery. Grob and Mannion. Eur Spine J. 2009 Aug; 18(Suppl 3): 380–385**

- **Bias in Surgical Research. Paradis. Annals of Surgery. 2008;248(2):180-188:**

“The various factors affecting bias in surgical research’s design, execution, and reporting were explored. The impact of these factors on internal and external validity in both observational and randomized controlled trials was examined, and recommendations were made for ameliorating the various biases ...

Conclusions: Familiarity with clinical trials’ potential biases helps surgeons assess the believability and applicability of research results. Though these biases may sometimes be ameliorated by randomization, blinding, and intervention standardization, these remedies can present distinctive problems to surgical research. This poses a unique need and opportunity for innovation in surgical research design and evaluation. It necessitates that further research be done on methods to improve not only the internal and external validity of surgical trials but also their assessment.

The ethical conduct of medical research is more than avoiding fraud, plagiarism, and exploitation. The ethical justification for imposing research risks on human subjects, many of whom are vulnerable by virtue of their disease and trust in their surgeon-researchers, is that these endeavors have the potential to produce generalizable knowledge that will alleviate future patients’ suffering.[1] Such knowledge can only be produced, and will only be used, if research is conducted so as to have validity. This article, by facilitating surgeons’ detection and understanding of how bias compromises validity, will help them apply research to their practices in ways that most benefit and least harm their patients.”

- **Twenty-year perspective of randomized controlled trials for surgery of chronic nonspecific low back pain: citation bias and tangential knowledge. Andrade et al. Spine J. 2013 Nov;13(11):1698-704:**

“After decades of clinical research, the role of surgery for chronic nonspecific low back pain (CNLBP) remains equivocal. Despite significant intellectual, human, and economic investments into randomized controlled trials (RCTs) in the past two decades, the role of surgery in the treatment for CNLBP has not been clarified ...

CONCLUSIONS: The research agenda of RCTs for surgery of CNLBP has not changed substantially in the last 20 years. Technical trials evaluating nuances of surgical techniques significantly predominate. Despite the publication of four RCTs reporting equivocal benefits of surgery for CNLBP between 2001 and 2006, there was no change in the research agenda of subsequent RCTs, and technical trials continued to outnumber indication trials. Rather than clarifying what, if any, indications for surgery exist, investigators in the field continue to analyze variations in surgical technique, which will probably have relatively little impact on patient outcomes. As a result, clinicians unfortunately have little evidence to advise patients regarding surgical intervention for CNLBP.”

OTHER:

- **Neurological diseases and pain. Borsook. BRAIN – A Journal of Neurology. November 2011 – available via:**

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3281476/pdf/awr271.pdf>

“Chronic pain is a frequent component of many neurological disorders, affecting 20–40% of patients for many primary neurological diseases ...”

- **Mechanisms and Management of Diabetic Painful Distal Symmetrical Polyneuropathy. Tesfaye et al. Diabetes Care 36:2456–2465, 2013:**

“...The exact pathophysiological mechanisms of neuropathic pain in diabetes remain elusive although several mechanisms have been postulated (Table 1) ...

Table 1—Mechanisms of neuropathic pain

Peripheral mechanisms
Changes in sodium channel distribution and expression
Changes in calcium channel distribution and expression
Altered neuro-peptide expression
Sympathetic sprouting
Loss of spinal inhibitory control
Altered peripheral blood flow
Axonal atrophy, degeneration, or regeneration
Damage to small fibers
Increased glycemic flux
Central mechanisms
Central sensitization
Changes in the balance of facilitation/inhibition within descending pathways
Increased thalamic vascularity

- **The analgesic effect of morphine on postoperative pain in diabetic patients. Karci et al. Acta Anaesthesiol Scand. 2004 May;48(5): 619-24**

ETC Remember, the database is a work in progress and I have many other supportive articles, particularly on pain neuroscience and the biopsychosocial paradigm.

The other side of the coin:

NB1: As stated, to date I have only been able to discover, or been provided with lower level research supporting surgical intervention for chronic back pain management. The most common research cited to me in support of related spinal surgery is various publications in relation to the SPORT study in the USA ie:

- ***Comparative Effectiveness Evidence From the Spine Patient Outcomes Research Trial. Tosteson et al. Spine 2011 ; 36 : 2061 – 2068:***

“Conclusion. Comparative effectiveness evidence for clearly defined diagnostic groups from Spine Patient Outcomes Research Trial shows good value for surgery compared with nonoperative care over 4 years.”

In relation to this study I also note:

- ***The Impact of Workers' Compensation on Outcomes of Surgical and Nonoperative Therapy for Patients with a Lumbar Disc Herniation SPORT. Atlas et al. Spine. 2010 January 1; 35(1): 89–97:***

“Conclusion—Patients with a lumbar IDH improved substantially with both surgical and nonoperative treatment. However, there was no added benefit associated with surgical treatment for patients with workers' compensation at 2 years while those in the nonworkers' compensation group had significantly greater improvement with surgical treatment.”

NB2: In addition to this cohort-relevant finding out of the SPORT research my main concern with the SPORT study series is that despite repeated reading I have not been able to discern whether the well-recognised post-surgical ‘chronic pain despite structurally successful surgery’ group has been included in the patient reported outcome and cost analysis. In addition, this is a comparison study with multiple possible confounders based on differences in the health systems etc. It is cited as ‘best available’ evidence as a justification for surgery but in the current newer research climate the absence of sham controlled trials is problematic.

NB2: With respect to the latter point it is worth considering the ramifications of the ‘hot off the press’ research on arthroscopic knee surgery:

- ***Arthroscopic surgery for degenerative knee: systematic review and meta-analysis of benefits and harms. Thorlund et al. BMJ 2015;350:h2747:***

“... Conclusions: The small inconsequential benefit seen from interventions that include arthroscopy for the degenerative knee is limited in time and absent at one to two years after surgery. Knee arthroscopy is associated with harms. Taken together, these findings do not support the practise of arthroscopic surgery for middle aged or older patients with knee pain with or without signs of osteoarthritis.”

Please note carefully that this is based on discovery that sham surgery comparisons in a long accepted, far less contentious and widely implemented procedure with a much safer and more effective profile than spinal surgery based on similar outcome methods **revealed no benefit** ie: the power of the surgical placebo effect. As a result the minimal harms associated with this procedure now do not satisfy the fundamental ‘first, do no harm’ principle. While I recognise that at this stage this research is specific to arthroscopic knee surgery, it is worth serious contemplation of the parallels with other surgeries for pain and pain related disability situations and especially spinal surgery.

The SPORT study series was also analysed with highlighted methodological flaws in the following publication:

- ***Evidence-based Recommendations for Spine Surgery. Fisher et al. Spine. 2015;40(5):E309-E316***

NB3: In one case review I was provided what I was supposed to interpret as impressive evidence for spinal surgery – fusion and disc replacement, via a MSAC submission titled **“Artificial intervertebral disc replacement – lumbar. February 2011. MSAC Application 1090.1. Assessment report”**. I reviewed this document laboriously and noted many salient limitations. First and foremost conclusions were drawn on limited HIC data. This economic evaluation was difficult to follow and was based on limited MBS subsequent expense data only eg: revision procedures. This is nowhere near as comprehensive as the cost analyses available in the compensable system which are manifestly unsupportive of the conclusions. Therefore the conclusions on cost effectiveness are irrelevant to the compensable population group and probably inaccurate in general despite being accepted at the time.

Furthermore, in this submission the evidence in support was extraordinarily contentious and low level and there was a high reliance on local expert opinion from 3 eminent spinal surgeons. I noted in particular the following comments in the analysis which resulted in support for funding of disc replacement surgery at the time:

- **“Most studies utilised well known, validated instruments for the assessment of patient outcomes; however, patients and investigators were not blinded to the treatment, which may have led to bias in the reporting of results. A further limitation of the studies included in this assessment was the length of follow-up reported”**

and:

- **“The authors note that a non-inferiority trial requires the reference treatment to have an established efficacy or be in widespread use; however, in this case the efficacy of the comparator treatment, lumbar fusion, for the treatment of degenerative disc disease (DDD) remains uncertain, especially when it is compared with non-operative care. Evidence that only compares lumbar AIDR with lumbar fusion limits the ability to fully assess efficacy.”**

and:

- **“While the number of patients who remained on narcotics was comparable following lumbar AIDR and lumbar fusion procedures, the clinical expert opinion of the Advisory Panel suggests that this proportion is significantly higher than what is observed in clinical practice in Australia”**

The studies looked at were actually quoted:

- “With respect to narcotic use:

“Two randomised controlled trials were identified that reported narcotic medication use following lumbar AIDR compared with ALIF ... Blumenthal et al (2005) reported that during follow-up, 72.2% (148/205) of lumbar AIDR patients used narcotic medication to control pain, compared with 85.9% (85/99) of ALIF patients (P=0.0083). Of the patients that demonstrated clinical success at 2 years follow-up, 64% (73/114) of lumbar AIDR patients remained on narcotics, compared with 80.4% (37/46) of circumferential fusion patients (P=0.0428).

Zigler et al (2007) reported that at baseline, 84% of patients in the lumbar AIDR group and 76% of patients in the circumferential fusion group used narcotic medication for pain relief. Of the patients that demonstrated clinical success at 2 years follow-up, only 39% of lumbar AIDR patients and 31% of circumferential fusion patients remained on narcotics; however, in patients that did not achieve clinical success, narcotic usage remained relatively unchanged from baseline values (79% lumbar AIDR, 76% fusion).

I would encourage reading of this document so that you can draw your own conclusions.

Furthermore I noted a subsequent Cochrane review which casts serious doubt on the MSAC conclusions:

“Total disc replacement for chronic back pain in the presence of disc degeneration. Jacobs et al. Cochrane Database Syst Rev. 2012 Sep 12;9:

“... We included 40 publications, describing seven unique RCT's. The follow-up of the studies was 24 months, with only one extended to five years. Five studies had a low risk of bias, although there is a risk of bias in the included studies due to sponsoring and absence of any kind of blinding ... CONCLUSIONS: Although statistically significant, the differences between disc replacement and conventional fusion surgery for degenerative disc disease were not beyond the generally accepted clinical important differences with respect to short-term pain relief, disability and Quality of Life. Moreover, these analyses only represent a highly selected population ...”

Other references expressing higher levels of varying qualified support for spinal surgery are:

- **Lumbar fusion versus nonoperative management for treatment of discogenic low back pain: a systematic review and meta-analysis of randomized controlled trials. Brydon et al. J Spinal Disord Tech. 2014 Jul;27(5):297-304**
- **Systematic review of randomized trials comparing lumbar fusion surgery to nonoperative care for treatment of chronic back pain. Mirza and Deyo. Spine (Phila Pa 1976). 2007 Apr 1;32(7):816-23.**
- **Lumbar spine fusion for chronic low back pain due to degenerative disc disease: a systematic review. Phillips et al. Spine.2013;38(7):E409-E422.**
- The latter review offers the most unqualified support but was curiously accepted as a systematic review in Spine despite glaring methodology flaws.
- This study states the following quite boldly:

“Review of the literature on fusion as a treatment of LBP has historically focused only on RCTs of surgery versus nonoperative treatments, which are limited.

The full body of literature on the topic also includes RCTs between fusion and nonfusion surgical procedures and across fusion approaches, as well as prospective and retrospective nonrandomized studies that contribute additional real world findings.

There is consistent evidence from these randomized and nonrandomized clinical studies reviewed, that lumbar spine fusion results in clinically meaningful improvements in pain and function, with acceptable patient satisfaction and low rates of revision in selected patients with chronic LBP related to degeneration of the motion segment.”
- I do not know of many systematic reviews that would not attempt to exclude poor quality data in this manner, let alone ascribe scientific validity to such studies.
- This approach renders this study not only meaningless, but in my opinion actually contributes to the concerns in what could be considered a self-serving industry, particularly as it expresses such strident support contrary to so many other systematic reviews based on the stated aberrant methodology.
- This opinion is bolstered by noting the study originated in an Orthopaedic Department and one of other declared financial conflicts of interest was that there was “Research support received from Nuvasive Inc., San Diego, CA.” which is a spinal surgery prosthetic company - <http://www.nuvasive.com/>

A final comment is offered based on a conversation with an eminent spinal surgeon who is vocal in support of his industry. I discussed with him the problem that sham controlled trials had only been performed in selected procedures and not yet in spinal surgery to assess the true value of the surgery. He responded in the following manner:

- “I found this editorial that might help you when considering sham surgery in spinal surgery ...

- **The applicability of clinical equipoise and sham surgery in patients with symptomatic lumbar radiculopathy due to a herniated disc: the SPORT trial.** Vaccaro AR, Fehlings MG. *Spine*. 2007 Aug 31;32(19):2039–2040

It is worth reading this editorial in its entirety, with various other concerns of this pathway in mind, to see how self-serving this view is, and how it attracted my brief emailed response to this surgeon –

“How convenient. I suppose then we will never truly know what works via structurally targetted surgery and what works via a placebo construct. Doesn't really satisfy the 'null hypothesis' research requirement ...”

PS: a discovered definition of the word ‘equipoise’ is “balance of forces or interests”; quite appropriate.

This same surgeon also offered the following in firm support of his methods:

- **Policy Statement on Lumbar Spinal Fusion Surgery.** International Society for the Advancement of Spine Surgery (ISASS) – undated and available online via: https://www.isass.org/public_policy/2011-07-15_policy_statement_lumbar_surgery.pdf

Please read this document, note the authoring group’s stated perspective, and form your own opinions.

