The Surgical Spine

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Goals:

- Review Current literature in spinal surgery.
- To utilize evidence based medicine to treat spinal pathology.
“It is much more important to know what sort of a patient has a disease than what sort of a disease a patient has.”

Sir William Osler
Goals of Spine surgery.

- Early Recognition of spinal injury.
- Stabilization of injuries.
- Prevention of additional neurological injuries.
- Relief of symptoms.
- Correct deformity.
- Early mobilization.
Spinal Surgery

- Neoplastic.
- Trauma.
- Infection.
- Scoliosis.
- Degenerative?
Spinal instability

- Not a single disease but a pathological consequence of a variety of different spine disorders such as traumatic fractures, metastatic tumors, and degenerative conditions, each with its own epidemiology, it is not possible or meaningful to determine the incidence and prevalence of spinal instability in the population.

- Furthermore, because of the disagreements on indications for spine fusion (at least for degenerative disease), the incidence of spinal instability does not correlate with the observed frequency of spine fusion.
Fusion Rates

- >300,000 spine fusions are performed in the United States annually.
- The vast majority of these operations are performed for degenerative disease of the spine.
- Between 1996 and 2001, the number of spine fusions in the United States increased 76%.
- Whereas in 1990 about 70% of cervical spine operations consisted of non-fused decompressions, by 2000 about 70% of cervical spine operations consisted of anterior cervical fusions.
- An increase in the incidence of spinal instability could certainly not account for the increase in fusion surgery. While the forces driving this trend remain debated, the standard of care in the United States is clearly shifting toward greater use of fusion surgery.
Tapping into controversial back surgeries

National Averages Per Surgeon

651
Medicare patients seen, 2011-12

43
Medicare patients that surgeon performed a spinal fusion on, representing 7% of patients that they saw

<7
Medicare patients that surgeon performed a complex fusion on (4 or more vertebrae), representing 1% of patients that they saw

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

Decompression alone, simple fusion or complex fusion.
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.

Adjusted mean hospital charges for complex fusion procedures were US $80 888 compared with US $23 724 for decompression alone.
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.
Low Back Pain
Causes of Low Back Pain:

- Sprain or strains
- Fractures
- Herniated discs
- Spinal Stenosis
- Osteoarthritis
- Infections
- Tumors
- Degenerative diseases.
The objective of the North American Spine Society (NASS) Clinical Guideline for the Diagnosis and Treatment of Lumbar Disc Herniation with Radiculopathy is to provide evidence-based recommendations to address key clinical questions surrounding the diagnosis and treatment of lumbar disc herniation with radiculopathy.

THIS GUIDELINE DOES NOT REPRESENT A “STANDARD OF CARE.”
Grades of Recommendation for Summaries or Reviews of Studies

- A: Good evidence (Level I Studies with consistent findings) for or against recommending intervention.
- B: Fair evidence (Level II or III Studies with consistent findings) for or against recommending intervention.
- C: Poor quality evidence (Level IV or V Studies) for or against recommending intervention.
- I: Insufficient or conflicting evidence not allowing a recommendation for or against intervention.
Surgical versus non-surgical treatment of chronic low back pain: a meta-analysis of randomised trials


Meta-analysis of randomised controlled trials to investigate the effectiveness of surgical fusion for the treatment of chronic low back pain compared to non-surgical intervention. Several electronic databases from 1966 to 2005.
Surgical versus non-surgical treatment of chronic low back pain: a meta-analysis of randomised trials

- Of the 58 articles identified, three studies were eligible for primary analysis and one study for sensitivity analysis, with a total of 634 patients.
- Surgical fusion for chronic low back pain favoured a marginal improvement in the ODI compared to non-surgical intervention. This difference in ODI was not statistically significant and is of minimal clinical importance.
- Surgery was found to be associated with a significant risk of complications.
- Therefore, the cumulative evidence at the present time does not support routine surgical fusion for the treatment of chronic low back pain.
Finally, Relief of Chronic Pain

1-866-352-8309

NECK PAIN

DISC PAIN

BACK PAIN

Click here for a FREE MRI REVIEW
Clinical Indications for the Procedure

Laser spine surgery in the cervical or lumbar spine is NOT indicated at this time. Due to lack of high quality clinical trials concerning laser spine surgery with the cervical or lumbar spine, it cannot be endorsed as an adjunct to open, minimally invasive, or percutaneous surgical techniques.
Lumbar disc herniation with radiculopathy

- Localized displacement of disc material beyond the normal margins of the intervertebral disc space resulting in pain, weakness or numbness in a myotomal or dermatomal distribution.
Lumbar disc herniation with radiculopathy

In the absence of reliable evidence relating to the natural history of lumbar disc herniation with radiculopathy the majority of patients will improve independent of treatment. Disc herniations will often shrink/regress over time.
Most appropriate diagnostic tests

- In patients with history and physical examination findings consistent with lumbar disc herniation with radiculopathy, MRI is recommended as an appropriate, noninvasive test to confirm the presence of lumbar disc herniation.

- Grade of Recommendation: A
Magnetic Resonance Imaging (MRI)

- **Magnetic resonance imaging** (MRI) is a test that uses a magnetic field and pulses of radio wave energy to make pictures of organs and structures inside the body. In many cases MRI gives different information about structures in the body than can be seen with an X-ray, ultrasound, or computed tomography (CT) scan.
Epidural steroid injections for the treatment of lumbar disc herniation

- Contrast-enhanced fluoroscopy is recommended to guide epidural steroid injections to improve the accuracy of medication delivery.
  - Grade of Recommendation: A

- Transforaminal epidural steroid injection is recommended to provide short-term (2-4 weeks) pain relief in a proportion of patients with lumbar disc herniations with radiculopathy.
  - Grade of Recommendation: A
Surgical vs Nonoperative Treatment for Lumbar Disk Herniation.

- **Interventions** Standard open diskectomy vs nonoperative treatment individualized to the patient.

- **Main Outcome Measures** Primary outcomes were changes from baseline for the Medical Outcomes Study 36-item Short-Form Health Survey bodily pain and physical function scales and the modified Oswestry Disability Index (American Academy of Orthopaedic Surgeons MODEMS version) at 6 weeks, 3 months, 6 months, and 1 and 2 years from enrollment. Secondary outcomes included sciatica severity as measured by the Sciatica Bothersomeness Index, satisfaction with symptoms, self-reported improvement, and employment status.
Results

- Adherence to assigned treatment was limited: 50% of patients assigned to surgery received surgery within 3 months of enrollment, while 30% of those assigned to nonoperative treatment received surgery in the same period. Intent-to-treat analyses demonstrated substantial improvements for all primary and secondary outcomes in both treatment groups. Between-group differences in improvements were consistently in favor of surgery for all periods but were small and not statistically significant for the primary outcomes.

- **Conclusions** Patients in both the surgery and the nonoperative treatment groups improved substantially over a 2-year period. Because of the large numbers of patients who crossed over in both directions, conclusions about the superiority or equivalence of the treatments are not warranted based on the intent-to-treat analysis.
Does discectomy result in better outcomes than medical/interventional treatment for lumbar disc herniation with radiculopathy?

Discectomy is suggested to provide more effective symptom relief than medical/interventional care for patients with lumbar disc herniation with radiculopathy whose symptoms warrant surgical intervention. In patients with less severe symptoms, surgery or medical/interventional care appear to be effective for both short- and long-term relief.

- Grade of Recommendation: B
Optimal timing for surgical intervention?

- Surgical intervention prior to six months is suggested in patients with symptomatic lumbar disc herniation whose symptoms are severe enough to warrant surgery. Earlier surgery (within six months to one year) is associated with faster recovery and improved long-term outcomes.

- Grade of Recommendation: B
# Lumbar Stenosis

<table>
<thead>
<tr>
<th>Factors</th>
<th>Neurogenic</th>
<th>Vascular</th>
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<tbody>
<tr>
<td>Evaluation after walking</td>
<td>Increased weakness</td>
<td>Unchanged</td>
</tr>
<tr>
<td>Palliative factors</td>
<td>Bending over, sitting</td>
<td>Stopping</td>
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<tr>
<td>Provocative factors</td>
<td>Walking downhill</td>
<td>Walking uphill</td>
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<td></td>
<td>Increased lordosis</td>
<td>Increased metabolic demand</td>
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<tr>
<td>Pulses</td>
<td>Present</td>
<td>Absent</td>
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<tr>
<td>&quot;Shopping cart&quot; sign</td>
<td>Present</td>
<td>Absent</td>
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- Surgery for spinal stenosis is widely performed, but its effectiveness as compared with nonsurgical treatment has not been shown in controlled trials.

- METHODS
- Surgical candidates with a history of at least 12 weeks of symptoms and spinal stenosis without spondylolisthesis (as confirmed on imaging) were enrolled in either a randomized cohort or an observational cohort at 13 U.S. spine clinics.

- Treatment was decompressive surgery or usual nonsurgical care. The primary outcomes were measures of bodily pain and physical function on the Medical Outcomes Study at 6 weeks, 3 months, 6 months, and 1 and 2 years.
A total of 289 patients were enrolled in the randomized cohort, and 365 patients were enrolled in the observational cohort.

At 2 years, 67% of patients who were randomly assigned to surgery had undergone surgery, whereas 43% of those who were randomly assigned to receive nonsurgical care had also undergone surgery.

**CONCLUSIONS:** In the combined as-treated analysis, patients who underwent surgery showed significantly more improvement in all primary outcomes than did patients who were treated nonsurgically.
Cervical radiculopathy

- Cervical radiculopathy is the clinical description of pain and neurological symptoms resulting from any type of condition that irritates a nerve in the cervical spine (neck).
Cervical radiculopathy

- It is likely that for most patients with cervical radiculopathy from degenerative disorders signs and symptoms will be self-limited and will resolve spontaneously over a variable length of time without specific treatment.
Role of pharmacological treatment in the management of cervical radiculopathy from degenerative disorders.

- A systematic review of the literature yielded no studies to adequately address the role of pharmacological treatment in the management of cervical radiculopathy from degenerative disorders.
Cervical radiculopathy from degenerative disorders can be defined as pain in a radicular pattern in one or both upper extremities related to compression and/or irritation of one or more cervical nerve roots. Frequent signs and symptoms include varying degrees of sensory, motor and reflex changes as well as dysesthesias and paresthesias related to nerve root(s) without evidence of spinal cord dysfunction (myelopathy).
NASS Clinical Guidelines

- MRI is suggested for the confirmation of correlative compressive lesions (disc herniation and spondylosis) in cervical spine patients who have failed a course of conservative therapy and who may be candidates for interventional or surgical treatment.

- CT myelography is suggested for the evaluation of patients with clinical symptoms or signs that are discordant with MRI findings (e.g., foraminal compression that may not be identified on MRI). CT myelography is also suggested in patients who have a contraindication to MRI.

- The evidence insufficient to make a recommendation for or against the use of EMG for patients in whom the diagnosis of cervical radiculopathy is unclear after clinical exam and MRI.

Careful consideration should be given to evidence suggesting that manipulation may lead to worsened symptoms or significant complications when considering this therapy. Pre-manipulation imaging may reduce the risk of complications.
Selective nerve root block with specific dosing and technique protocols may be considered in the evaluation of patients with cervical radiculopathy and compressive lesions identified at multiple levels on MRI or CT myelography to discern the symptomatic level(s).

Selective nerve root block may also be considered to confirm a symptomatic level in patients with discordant clinical symptoms and MRI or CT myelography findings.
Surgical intervention is suggested for the rapid relief of symptoms of cervical radiculopathy from degenerative disorders when compared to medical/interventional treatment.

Both ACD and ACDF are suggested as comparable treatment strategies, producing similar clinical outcomes, in the treatment of single level cervical radiculopathy from degenerative disorders.

The addition of an interbody graft for fusion is suggested to improve sagittal alignment following ACD.

The addition of a cervical plate is suggested to improve sagittal alignment following ACDF.
Compared to PLF, ACDF is suggested for the treatment of single level degenerative cervical radiculopathy from central and paracentral nerve root compression and spondylotic disease.

ACDF and total disc arthroplasty (TDA) are suggested as comparable treatments, resulting in similarly successful short term outcomes for single level degenerative cervical radiculopathy.
Late deterioration occurred from 2 to 68 months postoperatively. Four (12%) patients who had undergone anterior procedures had additional posterior procedures, and seven (13.7%) patients who had undergone posterior procedures had additional decompressive surgery. The final functional status at last follow-up examination for the 33 patients in the anterior group was improved in 18, unchanged in nine, and deteriorated in six. Of the 51 patients who underwent posterior decompression, 19 benefited from the surgery, 13 were unchanged, and 19 were worse at last follow up than before their initial surgical procedure.

Age, severity of disease, number of levels operated, and preoperative grade were not predictive of outcome. The only factor related to potential deterioration was the duration of symptoms preoperatively.
Prospective study of patients who underwent surgery from December 2005 to October 2007. Results

There were 57 men and 24 women with a mean age of 57 years (range 32–88 years). The mean duration of symptoms was 25.2 months (range 1–120 months).

There was a significant functional recovery from baseline to 6 months after surgery (p < 0.01). Postoperative complications occurred in 18.5% of cases.

Analysis showed that patients who developed complications were significantly older than patients who had no complications (p = 0.018). However, none of the studied factors were significantly associated with clinically relevant functional recovery after surgical treatment for CSM.
Spondylolisthesis

- **Type 1:** The dysplastic (congenital) A high rate of associated spina bifida occulta and a high rate of nerve root involvement exist.

- **Type 2:** The isthmic (early in life) type results from a defect in pars interarticularis, which permits forward slippage of the superior vertebra, usually L5. The following 3 subcategories are recognized:
  - Lytic (ie, spondylolysis) or stress fracture of the pars
  - Elongated yet intact pars
  - Acutely fractured pars
Grades of spondylolisthesis

- Normal spine
- Grade 1: <25% slippage
- Grade 2: 25-50% slippage
- Grade 3: 50-75% slippage
- Grade 4: >75% slippage
Spondylolisthesis

- Type 3: The degenerative (late in life) type is an acquired condition resulting from chronic disc degeneration and facet incompetence, leading to long-standing segmental instability and gradual slippage, usually at L4-5.
- Spondylosis is a general term reserved for acquired age-related degenerative changes of the spine (ie, discopathy or facet arthropathy) that can lead to this type of spondylolisthesis.
- Type 4: The traumatic (any age) type results from fracture of any part of the neural arch or pars that leads to listhesis.
- Type 5: The pathologic type results from a generalized bone disease, such as Paget disease or osteogenesis imperfecta.
The long-term effect of posterolateral fusion in adult isthmic spondylolisthesis: a randomized controlled study.
Ekman P, Moller H, Hedlund R.

- Prospective, randomized controlled study comparing a 1-year exercise program with instrumented and non-instrumented posterolateral fusion with average long-term follow-up of 9 years (range, 5-13).

- 111 patients aged 18 to 55 years with adult lumbar isthmic spondylolisthesis at L5 or L4 level of all degrees, and at least 1-year's duration of severe lumbar pain with or without sciatica.

- **OUTCOME MEASURES**: (VAS), the Disability Rating Index (DRI), the Oswestry Disability Index (ODI) work status, and global assessment of outcome by the patient into much better, better, unchanged or worse. Quality of life was assessed by the SF-36.

- The patients were randomly allocated to treatment with 1) a 1-year exercise program (n=34), 2) posterolateral fusion without pedicle screw instrumentation (n=37), or 3) posterolateral fusion with pedicle screw instrumentation (n=40).
CONCLUSIONS:

- Posterolateral fusion in adult lumbar isthmic spondylolisthesis results in a modestly improved long-term outcome compared with a 1-year exercise program. Although the results show that some of the previously reported short-term improvement is lost at long term, patients with fusion still classify their global outcome as clearly better than conservatively treated patients.

- Furthermore, because the long-term outcome of the patients conservatively treated most likely reflects the natural course, one can also conclude that no considerable spontaneous improvement should be expected over time in adult patients with symptomatic isthmic spondylolisthesis. Substantial pain, functional disability and a reduced quality of life will in most patients most likely remain unaltered over
The combination of baseline symptoms, medical variables (pain duration, previous spine operations, number of levels treated, operative procedure) and psychosocial factors

Previous studies establishing the sensitivity to change of the core-set, we have shown that a large proportion of the variance in its scores after surgery could be predicted by “well-known” medical and psychosocial predictor variables. This substantiates the recommendation for its further use in registry systems, quality management projects, and clinical trials.
The best recommendation is to ensure, firstly, that the indication for surgery is absolutely clear-cut (i.e. that surgically remediable pathology exists) and then to consider the various factors that may influence the "typical" outcome.

Consistent risk factors for a poor outcome regarding return-to-work include long-term sick leave/receipt of disability benefit. Hence, every effort should be made to keep the individual in the workforce, despite the ongoing symptoms and plans for surgery.

Patients with a high level of distress may benefit from psychological treatment, before and/or accompanying the surgical treatment. The opportunity (time), encouragement (education and positive messages), and resources (referral to appropriate support services) to modify risk factors that are indeed modifiable should be offered, and realistic expectations should be discussed with the patient before the decision to operate is made.
Spinal instability

- Not a single disease but a pathological consequence of a variety of different spine disorders such as traumatic fractures, metastatic tumors, and degenerative conditions, each with its own epidemiology, it is not possible or meaningful to determine the incidence and prevalence of spinal instability in the population.
Case S.K.

- Prior radiation to multiple metastasis including jaw, femur, humerus and C-T-L spine.
- Severe back pain and brisk patellar reflex and Babinski.
Case J.C.

- 50 yo Male s/p fall from ladder 25 feet.
- Sever neck pain, slight loss of sensation in lower extremities. Minimal movement in lower extremities.
- Head Tilted to right. Bilateral Biceps 3/5, Triceps 2/5, Grip 0/5, Right lower extremity 0/5, Left Hip flexion 2-3/5, DF 2/4, EHL 2/5. Sensory slight decrease light touch C4 down.
- Priapism.
Case C.S.

- 25 yo Male IV drug user. Frequent ER visitor for pain meds.
- Multiple skin abscesses and severe back pain.
- Neurologically intact.
References.

- AANS (American Association of Neurologic Surgeons) and CNS (Congress of Neurologic Surgeons) Guidelines: An Evidenced-Based Approach to Lumbar Fusion
New Technology?
Knowledge Assessment

1. What is included in the standards of care in spine surgery?
   a) Therapeutic Exercise
   b) Prescription of assistive devices
   c) Physical Therapy
   d) There are no standards, only recommendations

2. What is the natural history of a radiculopathy without neurological deficit?
   a) Regression
   b) Improvement with treatment
   c) Improvement independent of treatment

3. What are the causes of claudication?
   a) Vascular
   b) Neurogenic
   c) Both
   d) Neither
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