Dynamic Chiropractic

BACK PAIN

Minimally Invasive Spine Surgery: A Potentially Misleading Term

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Applying the term *minimal* to lumbar spine surgery can be misleading, presenting the potential for obscured risks, overstated benefits and inappropriate utilization. This is especially true considering the mindset of the average health care consumer or well-intentioned clinician who may want to believe that *minimal* always equates to *better, safer* or *more accurate*. Let's examine minimally invasive spine surgery (MIS) for the lumbar spine. The goal is to lay the foundation to better understand if and when these procedures may be applicable for our patients, and to avoid being "clinically seduced" by the term *minimal*.

Overview

Minimally invasive spine surgery is designed to preserve spinal architecture, cause less tissue destruction, improve recovery times, and lower surgical risks.[1] The use of such techniques has exploded over the past 20 years, involving smaller incisive corridors and instrumentation to accomplish a variety of operative procedures.[2]

However, as intuitively appealing as these approaches may seem, especially to conservative practitioners and patients, they are not without risk[3-4] and the benefits may be more ostensible than real.[5-6] It is concerning that as these procedures become more popularized and marketed to the public, there remains very little in the way of concrete research to clearly delineate indications for and the comparative effectiveness of these treatments.[7-8]

Historical Perspective

Notwithstanding the increasing awareness (possibly due to marketing efforts) of MIS procedures, they are not new. Depending on one's definition of "minimally invasive," the birth of these techniques dates back to Smith's use of chymopapain in 1963,[9] the introduction of microdiscectomy in the 1970s[10] or possibly the initial use of laser discectomy in the 1980s.[11] Tubular retractor systems and automated percutaneous discectomy, designed to reduce trauma to the paraspinal compartment, were introduced in the 1990s.[12]

From then up until the present, most of the reported technical advances have occurred with variations in the use of endoscopy[13] or novel approaches and devices for instrumented spinal fusion.[14-15]

Interventional Approaches

MIS procedures are diverse in their technical specifics and nomenclature, but share a common theme of having a small portal of entry and narrow surgical corridor.[16-17] It is most logical to classify

MIS interventions based upon three primary surgical end-points: ablation, decompression and fusion-stabilization.

Ablation techniques seek to denervate presumed painful structures (disc, facet) or lyse scar tissue. Common methods include radiofrequency, alcohol, laser or freezing.[18-21] Organizations may promote these in a way to imply that inflammation or other pain generators can be diagnosed in "real time" and sequential treatment of multiple painful sites can be accomplished in one setting.[19]

MIS decompression strives to reduce nerve root contact and/or stimulation of peripheral annular nociceptive fibers. Procedures differ depending on the etiology of compression, extent of tissue extracted or "dissolved," and how this is accomplished.

Internal volume reduction techniques are often employed for contained disc lesions. These presuppose that a retraction of external disc material away from the affected nerve root or reduction in annular nociception occurs when intradiscal pressure is reduced through evaporation, coagulation, dissolution, or mechanical removal of internal nuclear tissue.[22-24] Thermal approaches use laser or radiofrequency energy to either evaporate the nucleus pulposus or coagulate surrounding tissue.[21-22]

Chemonucleolysis, the dissolution of nuclear tissue, first used chymopapain[9] and more recently ozone. Ozone reportedly accomplishes the same result as chymopapain, but with less potential for adverse events.[25]

Mechanical volume reduction is accomplished by extracting nuclear material using a cannula to introduce small cutting and sucking instruments through the annulus into the nucleus. Named procedures within this category include, among others, automated percutaneous discectomy, laser annuloplasty and nucleoplasty.[26-28]

MIS for non-contained discs or boney and ligamentous compressive lesions, in contrast to internal volume reduction, involves external surgical resection/removal of the offending anatomy. Tubular retractors, designed to spare paraspinal muscle tissue are increasingly being utilized to create the surgical portal, although the benefit to this over standard open procedures has yet to be convincingly proven.[28-29]

The primary difference between MIS *fusion* and "open" procedures basically amounts to a smaller portal of entry and shorter operative time. These procedures are being increasingly utilized, but there is a paucity of evidence to illustrate any improvement in outcomes or significant surgical morbidity as compared to open procedures.[30]

Most open fusion procedures performed in the past are now being done in a "minimally invasive" fashion with innovations in approach sites and angles enabled by the smaller portals of entry. Some of these approaches are TLIF (transverse lateral interbody fusion), XLIF (extreme lateral interbody fusion) and AXLIF (axial interbody fusion using a pre-sacral approach).[31]

Clinical Assessment and Decision-Making for MIS Intervention: 3 Questions

Determination of an appropriate candidate for MIS procedures involves taking into account three questions. In actuality, these questions apply to any form of care, but increase in importance when considering more aggressive measures.

Question #1: Is the "target" of an MIS procedure really the source of a patient's pain? In other words, the size of the "hole" is irrelevant if the target is wrong. To this end, MIS procedures are susceptible to the same primary challenge, especially in nonspecific back pain, as most any other procedure: the inability, in a large majority of cases, to reliably determine the anatomic structure responsible for a patient's pain.[32-33]

This is true regardless of what is seen on imaging,[34-37] the bedside tests used during clinical examination,[38-39] or any type of anesthetic or provocative injection procedure that may be used to ostensibly provide clear diagnostic confirmation.[40-43]

Understanding the imprecise nature of diagnosing spinal pain becomes even more important to those patients who may have encountered a website where it is implied that "[t]he doctor finds inflammation and actually diagnoses the source of pain."[44] Such proclamations, possibly appearing in some form on other sites offering MIS procedures, are at best, unsubstantiated by the literature and misleading.

The diagnosis of radiculopathy, often felt to be more straightforward, is not without challenges. This is especially true when the imaging and neurologic exam are not unequivocally abnormal and highly congruent. In a systematic review, Al Nezari, et al., found that, in most cases, the tests we use for lumbar radiculopathy are inaccurate and not clinically useful.[45] Another study, looking at cervical radiculopathy, found that tests vary considerably in their specificity and sensitivity and are more accurate when used in combination.[46]

Although combining such tests with imaging may improve diagnostic accuracy, we must also keep in mind the considerable number of disc protrusions, and even herniations, seen in asymptomatic individuals.[35]

Question #2: What are the indications for MIS intervention? At present, no formally adopted guidelines exist that are specific to MIS procedures or discuss clear indications for appropriate utilization. Thus, it must be assumed that MIS procedures would currently follow guidelines for "non-MIS" interventions directed at similar pathology.

However, even these guidelines can be extremely vague and lacking in scientific evidence. For example, guidelines pertaining to lumbar spinal fusion (various types) published on the American Association of Neurological Surgeons website state; "There is insufficient evidence available to support a treatment guideline."[47]

The inability to clearly define appropriate indications for any type of surgery, including MIS procedures, is better understood when one recognizes that most of the current surgical research focuses on developing and implementing new technology, not the determination of when and for whom these procedures are applicable.[48]

These authors pointed out that over the past 20 years, 33 technical (device) trials have been completed and only six indication trials. In summary, they stated, "We note that there have been 39 RCTs involving lumbar fusion; yet, the vast majority has avoided a fundamental, and still controversial, question: is surgery superior to non-operative management?"

Lacking an answer to this important question, the indications for MIS interventions are likely to remain as obscure and individualized to a particular procedural provider as are any other of the

present "non-MIS" procedures. This is a great concern, especially when considering that the U.S. already has a 20-fold geographic variation in how spinal surgery is utilized, with little clinical evidence to support such variability.[49] Even more alarming is that, despite this variability, the rate of spinal fusion has risen threefold since 1998 and national costs have increased by a factor of eight.[50]

Lacking a formal consensus for indications on most all MIS procedures, some guidance can currently be found in selected papers, professional society publications, insurance bulletins, and publications sponsored by device manufacturers.[51-53] The article by Woeltjen and Jones[53] provides a nice overview of the current status of various MIS procedures, including indications and contraindications for use. The interested reader will note the paucity of randomized controlled trials associated with most all of the procedures discussed and also readily recognize the potential conflict of interest in any publication produced by a company marketing their devices.

Question #3: Are the outcomes of an MIS procedure superior to alternative approaches or what is currently being done for the patient? Laser facet joint denervation is considered to be "investigational" by some, if not most, insurance companies based upon the limited evidence upon which to judge effectiveness.[54-55] Iwatsuki, et al., noted a > 70 percent pain reduction in 17 of 21 patients undergoing laser neurolysis to the lumbar dorsal facet capsule, with the four failures being among the six patients who had undergone prior spine surgery.[56]

Andres, et al., found no difference in VAS outcomes between the laser denervation group, showing 3.5 improvement as compared to those having standard facet denervation, with 3.3 improvement.[57] Even more important to the conservative practitioner is that these levels of "success", generally amounting to a > 50 percent reduction in pain, or a 2-3 point improvement on the VAS scale,[58] may be no better than what had already been achieved from the non-allopathic care that had been provided.

Intradiscal electrothermal therapy (IDET) is felt to be an option for patients in the subacute stage of back pain. Selection criteria include: no neurologic deficit, T2 images of disc desiccation, >50 percent of disc height remaining, concordant pain on low-pressure discography, and annular disruption seen on post-discogram CT scan. One study notedthat three out of four patients meeting these criteria will experience a minimally clinically important improvement in pain, considered to be at least 2 points on a 10-point scale.[59]

Another study found that 40 percent of patients attained > 50 percent relief, while 50 percent experienced no clinical benefit.[60] And Freeman, et al., found no difference between IDET and sham treatment.[61]

A Cochrane review in 2007 illustrated the paucity of evidence regarding minimally invasive percutaneous disc surgery. They concluded that microdiscectomy had comparable results to standard discectomy, three small RCTs of laser discectomy provided no evidence of efficacy, and that evidence was lacking regarding other percutaneous discectomy techniques.[62]

Since then, a few others have also studied these interventions. Chang, et al., found that patients undergoing MIS disc decompression had similar outcomes, longer operative times, a shorter hospital stay, less blood loss, and a greater chance of recurrent herniation than those undergoing standard discectomy.[63] Smith, et al., noted that four randomized trials after the 2007 Cochrane

review showed no difference in outcomes between microdiscectomy, endoscopic discectomy, and standard discectomy; and that the largest trial showed an increase in complication rate in the endoscopic discectomy group.[64]

Almost any spinal fusion procedure can now be performed in a "minimally invasive" fashion. However, as with the other procedures discussed, a lack of high-quality comparative research limits our ability to reliably determine the benefit of and indications for of these procedures. The learning curve is steep, with an estimated 11 percent complication rate including durotomy, neural injury, hardware malposition and non-union.[65]

A recent study of MIS-TLIF for chronic low back pain, non-responsive to conservative care, noted that average VAS and Oswestry scores improved from 7.0 and 43.1 percent preoperatively to 3.5 and 28 percent postoperatively. The authors considered a 2.5 reduction in VAS and 40 percent improvement in Oswestry as being indicative of clinical benefit. Interestingly, out of the 210 chronic pain patients who received unsuccessful conservative care, only 11 were seen by a doctor of chiropractic.[66]

The Take-Home Message

The lure of anything "minimally invasive" can be significant, especially when promoted to those suffering debilitating pain. As educated clinicians, it is up to us to provide our patients with rational and balanced guidance, and avoid falling prey to hype that may supersede reality.

It is not that these procedures discussed, which are just the tip of the iceberg, are inappropriate; it is that they should not be considered a "cure-all." This is especially true for those receiving conservative who may already have attained results comparable to what can be expected with these more aggressive measures.

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