Minimally Invasive Surgery: A Conceptual Review

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ABSTRACT

We are living in an era that performs minimally invasive approaches to many surgical aspects, and spine surgery is not an exception. Nowadays, minimally invasive spine surgery is a routine procedure in many countries around the world. It began in the mid-twentieth century and has now developed into a large field of progressive spinal surgery. This paper will review the philosophy, indications, patient selections, advantages, and disadvantages of minimally invasive spinal surgery.

Keywords: spine surgery, complications, endoscopy, advantages, learning curve


INTRODUCTION

The surgical technique in spine surgery has been developed from the traditional bilateral laminectomy to hemilaminectomy, laminotomy and laminoplasty (open to mini-open surgery), and minimally invasive surgery (MIS) as the latest developed technique. The goals of spine surgery are both alike between MIS and open surgery, like neurological improvement, resolving instability, and corrections of deformity by decompression, fusion, or realignment.

Bear in mind that although the term is MIS, it should be maximally effective. Six basic concepts in any MIS technique are decreasing muscle crush injuries during retraction, avoiding detachment of tendons to the posterior bony elements, maintaining the integrity of the dorsolumbar fascia, limiting bony resections, utilizing known neurovascular planes, and decreasing the size of the surgical access.

There are some known advantages in performing MIS. They include less muscle damage, decreased blood loss, decreased infection rate, decreased postoperative pain, shorter hospital stay, shorter recovery time, patient's cost, better cosmetics, and easier surgical techniques for obese patients. These advantages can be beneficial if supported with the proper case selections and great surgeon's skill with this technique.

Of course, some disadvantages arise from MIS. The needs of high tech and expensive instruments (e.g. endoscopic system, tubular retractor, microscope, fluorescent imaging), the steep and long learning curve of the technique (e.g. mastering the spatial and 3D orientation on a 2D monitor, different anatomic orientation with manipulation on limited working space), and not to mention some complications are difficult to treat.

Every technique in MIS has its own learning curve. Each has different learning curves, different techniques, and different possible complications.

Challenges in Minimally Invasive Surgery

There are so many challenges in performing MIS, especially if we are used to an open surgery. Those challenges make MIS questionable for the needs to change from the traditional open surgery with the clear-cut advantages of the open surgery. Some of those challenges include incomplete treatment due to the limited exposure, recurrence and reoperation rate might increase, avoidance of complications is difficult through the limited portals, restricted vision and mobility, no tactile perception, and difficult hand-eye coordination.

Indications and Patient Selection

When it was first introduced, the indications were very limited. But within time, due to better proficiency and improved techniques, the MIS indications have been expanded to lumbar disc herniation, cervical disc herniation, thoracic disc herniation, vertebral augmentation, thoracic and lumbar pedicle screw fixations, spinal tumours, fusion surgery, anterior spinal pathologies, and other spinal pathologies.

Patient selection is essential in MIS. Indications depend on the patient's pathology but patient selection depends on the surgeon. Patient selection is critical to achieve a successful surgery and outcomes. Bad judgment in patient selection will make the MIS advantages become less beneficial.

Sometimes there is a need to combine both approaches. The best approach is achieved with the proper case selection in the right indications. MIS alone can be maximally beneficial in the right selected cases.
COMPLICATIONS

Reported complications of MIS are still limited due to the lack of long-term outcome data. Some known complications include dural tear, implant malposition, neural injury, and non-union. The familiarity of anatomical endoscopic view is extremely important in MIS. Sometimes we need to convert from to open surgical approach to treat the complications.  

CONCLUSIONS

Although using the term ‘minimally’, MIS should be maximally effective. Understanding indications, patient selections, advantages, and pitfalls of each MIS technique are essential. Each technique has different learning curves and different possible complications.

REFERENCES