Minimally Invasive Spine Surgery

Common Minimally Invasive Spine Surgeries

Minimally invasive discectomy.

Minimally invasive posterior approach to the lumbar spine.

MIS posterolateral fusion (MIS-PLF)

Mini anterior lumbar interbody fusion (mini-ALIF)

Lateral interbody fusion (LLIF),

MIS posterior lumbar interbody fusion (MIS-PLIF)

Minimally invasive transforaminal lumbar interbody fusion (MIS-TLIF).

Endoscopic

Percutaneous Endoscopic Lumbar Discectomy

Percutaneous endoscopic lumbar foraminotomy

Uniportal Full Endoscopic Lumbar Fusion Surgery

Definition

A unifying definition of what constitutes minimal invasive spine surgery is difficult to find and can vary among procedures [1) 2)].

Minimally invasive spine surgery (MISS), does not involve a long incision, it avoids significant damage to the muscles surrounding the spine. In most cases, this results in less pain after surgery and a faster recovery. Minimally invasive spine surgery (MISS) is sometimes called less invasive spine surgery. In these procedures, the surgeon use specialized instruments to access the spine through small incisions.

Learning curve

With the acquisition of more experience, some disadvantages of MISS techniques such as longer operative time and longer X-ray exposure can be substantially reduced. Surgical experience, familiarity of the team with the MISS instrumentation, and good patient selection are crucial for achieving all the benefits of MISS [3)].

The learning curve in MISS is complex and difficult to measure, therefore operating times, conversion to open procedures, VAS and periods of hospital length of stay are used. While assessing complications as a measure of the learning curve, it was noted that nearly all the complications were documented before, and became minimum after the 30th consecutive case. As surgical experience increases, perioperative parameters (operative time, length of hospitalization) improve. The downside of MISS is starting unfamiliar procedures without tactile sensation, working in a narrow restricted surgical field and using endoscopes via 2D imaging. Appropriate instruments, a trained team and an adept radiographer are important assets for a smooth transition during the learning period. Structured training with cadavers and lots of practice, preferably while working under the guidance of experienced surgeons, is helpful. The learning curve can be shortened when a proficient surgeon gains relevant knowledge, understands 3D anatomy, and has surgical aptitude along with manual dexterity [4)].

Indications

Minimally invasive spine surgery was developed to treat spine problems with less injury to the muscles and other normal structures in the spine. It also helps the surgeon to see only where the problem exists in the spine. Other advantages to MISS include smaller incisions, less bleeding, and shorter stays in the hospital.

Minimally invasive techniques are beginning to be used for a wider range of spine procedures, and have been used for common procedures like decompression and spinal fusion since the 1990s.

One of the major drawbacks of open surgery is that the pulling or “retraction” of the muscle can damage the soft tissue. Although the goal of muscle retraction is to help the surgeon see the problem area, it typically affects more anatomy than the surgeon requires. As a result, there is greater potential for muscle injury, and patients may have pain after surgery that is different from the back pain felt before surgery. This can lead to a lengthier recovery period.

Complications

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Although minimally invasive spinal surgery has gained popularity, few nationwide studies have compared the adverse events that occur during endoscopic versus open spinal surgery.

Ohya et al. retrospectively extracted from the Diagnosis Procedure Combination database, a national inpatient database in Japan, data for patients admitted between July 2010 and March 2013. Patients who underwent lumbar discectomy without fusion surgery were included in the analysis, and those

with an urgent admission were excluded. The authors examined patient age, sex, Charlson Comorbidity Index, body mass index, smoking status, blood transfusion, duration of anesthesia, type of hospital, and hospital volume (number of patients undergoing discectomy at each hospital). One-to-one propensity score matching between the MED and open discectomy groups was performed to compare the proportions of in-hospital deaths, surgical site infections (SSIs), and major complications, including stroke, acute coronary events, pulmonary embolism, respiratory complications, urinary tract infection, and sepsis. The authors also compared the hospital length of stay between the 2 groups.

A total of 26,612 patients were identified in the database. The mean age was 49.6 years (SD 17.7 years). Among all patients, 17,406 (65.4%) were male and 6422 (24.1%) underwent MED. A propensity score-matched analysis with 6040 pairs of patients showed significant decreases in the occurrence of major complications (0.8% vs 1.3%, p = 0.01) and SSI (0.1% vs 0.2%, p = 0.02) in patients treated with MED compared with those who underwent open discectomy. Overall, MED was associated with significantly lower risks of major complications (OR 0.62, 95% CI 0.43-0.89, p = 0.01) and SSI (OR 0.29, 95% CI 0.09-0.87, p = 0.03) than open discectomy. There was a significant difference in length of hospital stay (11 vs 15 days, p < 0.001) between the groups. There was no significant difference in in-hospital mortality between MED and open discectomy.

The microendoscopic technique was associated with lower risks for SSI and major complications following discectomy in patients with lumbar disc herniation [5].

Complications

It has been proposed that MIS procedures may have a lower complication rate and thus use fewer hospital resources compared to traditional open spine surgeries [6] [7] [8].

Indications

Future studies are necessary to confirm the durability and further define indications for minimally invasive lumbar spine procedures. [9].

Minimally invasive spinal surgery (MISS) has many favorable attributes that would be of great benefit to patients with an adult spinal deformity.

Economic Impact

Minvasive lumbar spine surgery appears to have the potential to be a cost-effective intervention. Moreover, novel less invasive procedures are less destabilizing and may therefore be utilized in certain indications that traditionally required arthrodesis procedures. However, there is a lack of studies analyzing the economic impact of minimally invasive spine surgery. [10].

Societies

Society for Minimally Invasive Spine Surgery www.smiss.org/

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