Evidence Basis/Outcomes in Minimally Invasive Spinal Scoliosis Surgery

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KEYWORDS

• Adult scoliosis • Minimally invasive spine surgery • Evidence basis • Outcomes

KEY POINTS

- Minimally invasive spinal surgery (MISS) scoliosis correction may allow for adult scoliosis correction with significantly less tissue destruction and less blood loss than open procedures.
- MISS scoliosis correction without osteotomies has limits using present technologies in terms of correcting sagittal plane deformity and has a ceiling effect of about 40° of coronal Cobb correction.
- MISS scoliosis correction has a different complication profile from traditional open scoliosis correction; this may be largely reflective of the use of the lateral transpsoas approach and reduced blood loss.
- Long-term level II and III studies are needed to compare outcomes between MISS and open adult scoliosis correction.

INTRODUCTION: NATURE OF THE PROBLEM

The principal goal of adult scoliosis surgery is obtaining both sagittal and coronal balance of the spine.[1] However, traditional scoliosis correction has been associated with high-volume blood loss and significant medical complications.[2–4] Given this situation, minimally invasive spinal surgery (MISS) for the treatment of adult scoliosis is particularly attractive. MISS techniques have been used for the treatment of lumbar degenerative scoliosis, iatrogenic scoliosis, and adult idiopathic scoliosis. Theoretically, blood loss can be limited, and medical complication rates can possibly be reduced with less invasive procedures. Nevertheless, clinical and radiographic outcomes of MISS scoliosis correction need to be comparable with open surgery before recommending widespread adoption of these techniques for the treatment of adult scoliosis. MISS principles and surgical techniques used in MISS scoliosis correction are reviewed in this article, as well as outcomes, complications, and limitations of this rapidly evolving area of spinal surgery.

THERAPEUTIC OPTIONS OR SURGICAL TECHNIQUE(S)

Indications for adult scoliosis correction include deformity progression, sagittal or coronal imbalance with unremitting back pain, radiculopathy on the side of the concavity of the curve caused by foraminal stenosis, lumbar hyperlordosis, patients with a history of flat-back syndrome and back pain, fixed lateral listhesis within the degenerative curve when motion is present on side-bending

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films, and when extensive decompression including facetectomy or the violation of the pars is planned.[5] A relative indication is progressively worsening deformity with pain as the rib cage abuts the pelvis.

In our practice, adult patients who undergo MISS scoliosis surgery are typically being treated for symptomatic back and leg pain (Fig. 1). These patients include those with adult idiopathic scoliosis, iatrogenic scoliosis, and lumbar degenerative scoliosis. Patients have tried numerous conservative measures, including physical therapy and epidural and facet injections, before being considered for surgery. The main indication for correction of adult scoliosis is mechanical low back pain. This pain is typified by stiffness in the morning, with progressive worsening of pain with activity that increases throughout the day. Often, but not always, this pain may be accompanied by radiculopathy or claudication.[6]

The main principle of adult scoliosis correction is achieving a balanced spinal alignment and addressing symptomatic levels. Radiographic evaluation of the patient with adult deformity, whether being treated with traditional open correction or MISS, involves measurement of the Cobb angle in the coronal plane, the amount of correction on side-bending films, and the amount of deviation of the apical vertebrae to the central sacral vertical line.[7] In the sagittal plane, a plumb line is drawn from the center of the C7 vertebra to the sacrum. Normally, this line should be within 5 cm of the posterior aspect of the sacrum. In addition, regional alignment and pelvic parameters, such as pelvic incidence and pelvic tilt, are calculated. In planning for adult scoliosis, the patient's symptoms, stenosis, and disk degeneration must be considered.

Interbody fusion techniques are used to improve lordosis, help correct lateral listhesis, and, potentially, increase fusion rates. For lumbar degenerative scoliosis, proximal fusions are typically stopped at a stable vertebra.[7] Others have advocated stopping at T10.[8] In terms of where to begin and end a fusion, this topic has been discussed in detail elsewhere and is not the focus of this article.[7,9] If a thoracolumbar fusion is extended to the sacrum, interbody fusion and pelvic fixation should be considered.[9]

Segmental pedicle screw fixation allows for greater pullout strength than previous generation instrumentation systems (ie, hooks, cables). Pedicle screws may allow for shorter fusion length and less operative blood loss than hooks.[7,10,11]

Fig. 1. (*A, B*) Anteroposterior and lateral 91 cm (36-inch) films of a 68-year-old man with a history of back pain and leg pain refractory to conservative measures. He was noted to have lumbar degenerative scoliosis with a curve measuring 37° from L1 to L5, with the apex to the left.