Evolution of the Minimally Invasive Spinal Deformity Surgery Algorithm

An Evidence-Based Approach to Surgical Strategies for Deformity Correction

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KEYWORDS

• MISDEF • Adult spinal deformity • Minimally invasive surgery • Scoliosis

KEY POINTS

- Minimally invasive deformity correction offers the potential to decrease surgical complications associated with open corrections.
- The MISDEF algorithm was developed to help identify appropriate candidates for MIS deformity correction using radiographic parameters.
- Additional factors such as clinical symptoms, pathology, and medical comorbidities must also be included in decision making for deformity patients.

INTRODUCTION

Adult spinal deformity (ASD) is a health care priority because the pathology is increasing in incidence with an aging US population, and affected patients have significant compromise in health status including pain and disability.[1–4] Thoracolumbar scoliosis and kyphosis are resultant from several pathologies including degenerative disk disease, rheumatoid arthritis, pre-existing deformity, trauma, infection, and iatrogenic causes.[5] Primary presenting symptoms include chronic back pain, deformity, and neurogenic claudication resultant from stenosis.[6] Although traditional open surgical techniques are effective in the treatment of ASD,[7,8] they are associated with a high rate of complications. Minimally invasive surgery (MIS) approaches to spinal deformity offer the potential to decrease surgical complications associated with open corrections.[9–11] MIS approaches are increasingly recognized as effective and save, with the opportunity to reduce trauma to soft tissue, decrease intraoperative blood loss, and minimize surgical site infections.[12–14] These advantages may be particularly critical in an

Disclosure Statement: Choy, Miller, Chan: no disclosures Park: royalties from Globus; consultant for Globus, NuVasive, Zimmer Biomet, and Medtronic. Fu: consultant for SI-BONE. Devin: consultant for Stryker Spine and Medtronic; clinical or research support for study described, Stryker Spine. Mummaneni: consultant for DePuy Spine, Globus, and Stryker; direct stock ownership in Spinicity/ISD and Globus; clinical/research support for this study from NREF; royalties from DePuy Spine, Thieme Publishers, and Springer Publishers; grant from AOSpine; and honoraria from Globus.

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Neurosurg Clin N Am 29 (2018) 399–406

https://doi.org/10.1016/j.nec.2018.03.007

increasingly elderly patient population with more concomitant medical comorbidities that is affected by lumbar deformity.

Not all patients with ASD are candidates for MIS correction. With the limited exposure inherent to MIS techniques, the MIS approaches may not be appropriate or optimal for severe and rigid deformities, especially in the sagittal plane. Previous studies have suggested that MIS approaches may undercorrect sagittal deformity in some cases.[15–18] Patient selection is critical but remains controversial in MIS for deformity correction. The minimally invasive spinal deformity surgery (MISDEF) algorithm was created to help guide surgeons in identifying which patients are candidates for deformity correction by MIS techniques (Fig. 1).[19] This article describes the modified MISDEF algorithm and presents representative cases.

MINIMALLY INVASIVE SPINAL DEFORMITY SURGERY DESIGN

The goals of treatment of ASD are decompression of neural elements, restoration of global coronal and sagittal alignment, and achievement of solid fusion. Numerous classification schemes have been proposed to guide the management of ASD. In 2010, Silva and Lenke[20] published six levels of operative treatment (I-VI) to guide correction of ASD. The approach was based on several radiographic and clinical factors including presence of neurogenic claudication and radiculopathy, back pain, anterior osteophytes, olisthesis, coronal Cobb angle, lumbar kyphosis, and sagittal alignment. Based on these metrics, the authors recommended six different treatment levels of increasing complexity including decompression, posterior spinal fusion with instrumentation, anterior fusion, and osteotomies. These levels of treatment were meant to guide the surgeon in deciding the optimal open surgical approach to treat a patient's unique spinal pathology.

In recent years, spinopelvic alignment has been shown to be correlated with the impact of deformity on clinical health status and outcomes. To achieve optimal outcomes, a pelvic tilt (PT) less than 20°, pelvic incidence to lumbar lordosis mismatch (PI-LL) less than 10°, and sagittal vertical axis (SVA) less than 5 cm has been proposed. In accordance with these spinopelvic parameters, Mummaneni and colleagues[19] proposed the MISDEF algorithm (see Fig. 1) to provide a systematic guideline for surgeons to identify appropriate patients for a MIS approach for ASD

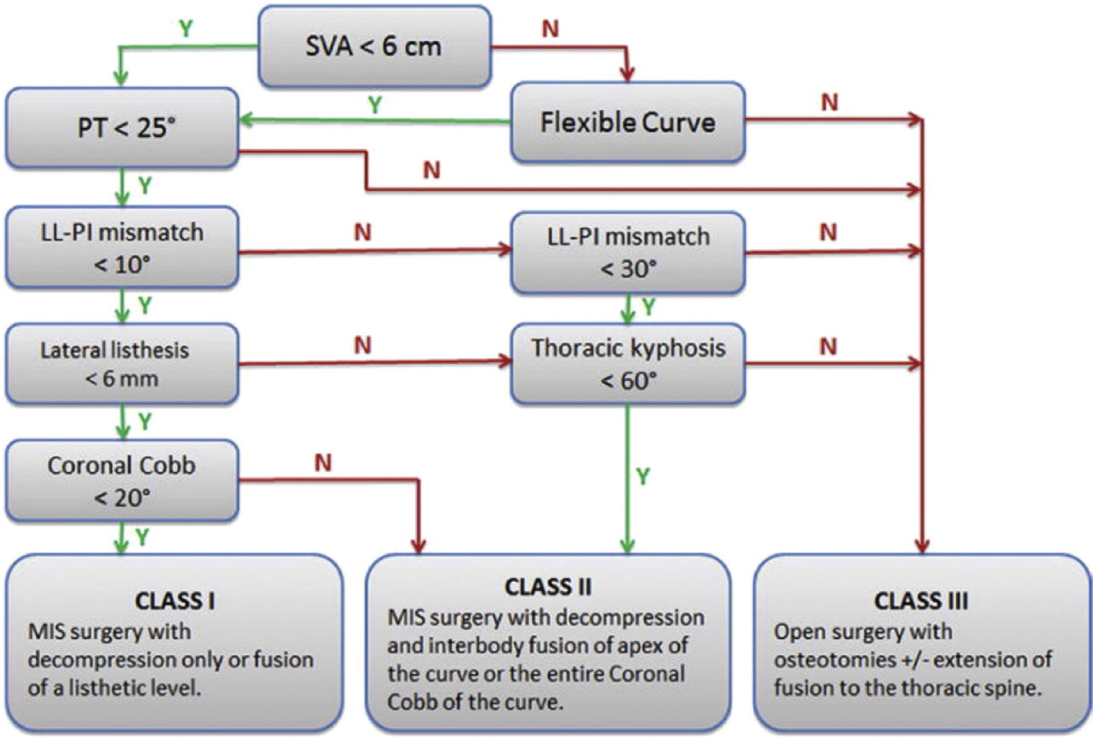

Fig. 1. MISDEF algorithm. LL, lumbar lordosis; N, no; PI, pelvic incidence; PT, pelvic tilt; SVA, sagittal vertical axis; Y, yes. (*From* Mummaneni PV, Shaffrey CI, Lenke LG, et al. The minimally invasive spinal deformity surgery algorithm: a reproducible rational framework for decision making in minimally invasive spinal deformity surgery. Neurosurg Focus 2014;36(5):E6; with permission.)