

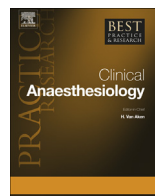


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# Surgical considerations for major deformity correction spine surgery



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Spinal deformity is defined as abnormality in alignment, formation, or curvature of one or more segments of the spine. Its characteristic clinical presentation and radiographic appearance differ according to patient age and the underlying cause. The most common deformity in the pediatric population is adolescent idiopathic scoliosis, whereas in adults many patients present with *de novo* deformity secondary to degenerative disease. Although the specific goals differ between patients, the broad aims include restoration of regional and global alignment, decompression of neural elements as necessary, and establishment of a solid fusion. Surgeons perform deformity correction by various approaches and techniques to achieve the desired correction while minimizing perioperative risk.

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## Introduction

Spinal deformity comprises a spectrum of disease in which there is abnormal alignment, formation, or curvature of the spine. It may be isolated to a single plane or involve a combination of axial, coronal, and sagittal plane deformity. Scoliosis, classically defined as a curvature of  $>10^\circ$  in the coronal plane,

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typically involves concomitant rotational deformity and is often associated with sagittal plane deformity. Recent data, particularly on adult spinal deformity (ASD), have shown the critical importance of deformity in the sagittal plane, which results in global malalignment in the generation of pain and disability [1]. Loss of lumbar lordosis (LL) or flatback syndrome, in isolation or in combination with thoracolumbar kyphosis or thoracic hyperkyphosis, is the most common form of sagittal plane deformity in adults, which may result in an inability to maintain normal upright posture and horizontal gaze when severed [2].

Several disease processes may produce spinal deformity, including congenital anomalies of vertebral formation, neuromuscular disease, intrinsic spinal cord abnormalities (e.g., intramedullary tumor), infection, trauma, and degenerative disease. Scoliosis, in particular, may arise from any combination of these processes; however, there is no common discernable cause, and hence it is termed idiopathic scoliosis. In skeletally immature patients, idiopathic scoliosis – which has its highest incidence in adolescence – is the most common form of scoliosis. In young adults, idiopathic scoliosis remains the most common spinal deformity, whereas in older adults, degenerative scoliosis or kyphoscoliosis and iatrogenic deformities predominate [3]. In the elderly, the prevalence of scoliosis may be as high as 68% [4]. This study focuses on the most common forms of spinal deformity in the skeletally immature and mature spine: adolescent idiopathic scoliosis (AIS) and degenerative kyphoscoliosis, respectively.

### **Rationale for major deformity correction**

The indication for deformity correction differs between adolescents/young adults and older individuals because of distinctions in their respective deformity types and clinical presentation. The former group characteristically present with coronal plane abnormality (scoliosis) and concerns of curve progression and cosmesis, whereas the latter most commonly present with degenerative kyphoscoliosis associated with sagittal malalignment and stenosis, with consequent pain and disability [5,6]. Surgery, when indicated, should address the specific deformity pattern and the patient's clinical presentation.

#### *Adolescent idiopathic scoliosis*

Observation is the appropriate treatment for AIS with small to medium-sized curves (<20–25°) in patients who have reached or surpassed their peak height velocity [6]. Similarly, in adults with idiopathic curves that are asymptomatic or minimally symptomatic, observation is often appropriate. Even in those with superimposed degenerative changes, the expected slow progression supports at least a trial of observation with nonoperative therapies in the majority of cases [6]. In skeletally immature patients with idiopathic scoliosis, bracing is an important nonoperative therapy [7]. It is indicated to slow progression and avoid surgery or permit growth in a child who likely requires surgery, but has not yet reached the peak growth velocity. In general, surgery is indicated for AIS when there is demonstrable or expected curve progression on serial clinical and radiographic examination. Thus, the goal is to treat or prevent development of a significant clinical deformity and its potentially associated functional limitations and cosmetic implications. On the contrary, in adults, operative treatment of idiopathic scoliosis is more commonly directed at relieving symptoms.

#### *Degenerative scoliosis*

Degenerative kyphoscoliosis is the most common deformity that develops *de novo* in adults. This form of scoliosis results from the consequences of degenerative disease affecting the disks and facet joints [8]. Symptoms of ASD include back pain, leg pain, postural fatigue, and difficulty ambulating, and they appear from a combination of neural compression, degenerative disease of the disks and facet joints, and spinal malalignment [9–11]. In particular, positive sagittal malalignment, in which the trunk and head are pitched forward relative to the pelvis and lower extremities, is common in ASD. This form of imbalance is correlated with pain, disability, and decreased health-related quality of

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