Spinopelvic Parameters: Lumbar Lordosis, Pelvic Incidence, Pelvic Tilt, and Sacral Slope
What Does a Spine Surgeon Need to Know to Plan a Lumbar Deformity Correction?

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INTRODUCTION AND HISTORICAL CONTEXT
Observations of spinal deformity date to antiquity. Hippocrates described both the normal contours of the spine as well as deformities of the spine and their causes, grouping abnormal spinal alignments under the umbrella term scoliosis.1 Galen of Pergamum defined the terms kyphosis, scoliosis, and lordosis; their use continues as Galen described them to this day.1 In 1935 Bohler2 described compensatory mechanisms, including pelvic retroversion, for maintaining an upright posture in patients with posttraumatic kyphosis.2
Beginning in the 1970s, the investigations of multiple French surgeons led to a renewed interest in spinal balance.3,4 Building on this, Jean Dubousset and colleagues5 introduced the postural cone of economy that highlighted the

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importance of the maintenance of upright posture with minimal physical effort. Duval-Beaupère, and later Jackson and Hales, quantified sagittal measurements of the pelvis, including pelvic retroversion, LL, and sagittal alignment, establishing the pelvis as central to global sagittal balance and PI the primary determinant of lordosis in a well-aligned lumbo-pelvic region.

In 2005, Glassman and colleagues demonstrated that positive sagittal balance directly correlates with patient-reported self-assessment measures, specifically that increasing positive sagittal imbalance was directly related to worsening symptoms. Lafage and colleagues further refined this idea, demonstrating that pelvic incidence (PI) matches lumbar lordosis (LL) and that increasing pelvic retroversion directly correlates with worsening patient-reported quality-of-life measures. These observations are the cornerstones of contemporary adult spinal deformity surgery and define the goals of reconstructive surgery.

**IMAGING**

Preoperative evaluation of patients with adult spinal deformity begins with full-length standing 36-in posteroanterior and lateral radiographs (Fig. 1). From the lateral image, the physician

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**Fig. 1.** The 36-in standing posteroanterior (A) and lateral radiographs (B) of a patient with sagittal imbalance.