The “S” Curve, or, when is selective thoracic fusion indicated?
A curva “S”, ou, quando deve ser indicada a fusão torácica?

ABSTRACT

The selection of arthrodesis levels in patients with double curve pattern of idiopathic scoliosis still present a challenger for the surgeons. Short arthrodesis has been done with the goal to preserve the vertebral segments. Different parameters have been used to determine if it is possible to do shorter arthrodesis in double curve pattern. The author present a revision about shorter arthrodesis performed in the double curve pattern based on idiopathic scoliosis classifications.

KEYWORDS: Arthrodesis; Thoracic vertebrae/surgery

BACKGROUND

Inductive logic and scientific data suggest that the more mobile lumbar motion segments spared following a long fusion for scoliosis, the better the prognosis for survival of the unfused lumbar spine. Scoliosis surgeons have sought a reliable method of distinguishing true double curves that require fusion of both thoracic and lumbar components from “false” double curves where only the thoracic component can be selectively fused.

LITERATURE

In 1983 King, Moe, et al. published a classification of thoracic idiopathic scoliosis. This classification was not meant to be comprehensive in its scope, but described approximately 85% of all idiopathic scoliosis curve patterns. One of the primary motivations for this historic work was to provide a means for surgeons to determine which patients who could undergo a selective thoracic fusion and safely allow the lumber curve to remain mobile. Double structural curves are designated as Type I and are characterized by thoracic and lumbar prominences with forward bending, both curves cross the midline and the curves have nearly equal flexibility on side bending. The King-Moe Type II, or false double curve, is one in which both curves cross the midline, there is minimal lumbar prominence and the lumbar curve is significantly more mobile than the thoracic curve on side bending radiographs. A good clinical outcome can be achieved without the need to fuse the lumbar component of Type II curves. In 1998, Lenke et al. introduced a new classification for idiopathic scoliosis that was intended to include both lumbar and thoracic curves. More than 96% of all idiopathic curves fit within the six categories and, unlike the King-Moe classification, a modifier was included for the sagittal contour thus identifying hypokyphosis (less than 10° kyphosis from T3 to T12), normal thoracic kyphosis and excess kyphosis (greater than 40° from T3 to T12). An A, B and C modifier describes the severity of translation of the apical vertebra in the lumbar curve. If the center sacral line falls within the concave pedicle it is given the B-modifier and if the entire lumbar apical vertebra falls lateral to the center sacral line it is given the C-modifier. The A-modifier is given if the center sacral line is between the mid-portion of the

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apical vertebra and the concave pedicle. Both classifications suffer from inter-and intraobserver errors although the King-Moe classification is marginally more consistent.

Multiple authors have reported their success with selective thoracic fusion. It is not always evident that there is a clear distinction between successful selective fusion in King-Moe Type II curves, a previously well documented practice, or a successful selective thoracic fusion of a King-Moe Type I curve, a clinically important innovation. Lenke et al. reported that when two of their three criteria (1. Thoracic curve magnitude vs. Lumbar curve >1.2, 2. apical vertebral rotation >1.2, and 3. Apical vertebral translation > 1.2) were observed, all spines were compensated following selective thoracic fusion. Correction was obtained using a variable hook-rod construct and the “de-compensation” maneuver. van Rhijn et al. found little correlation between the correction of the instrumented thoracic curve and the correction of the unfused lumbar segments.

In Dobbs et al. study, when the thoracic curve was corrected to the degree of correction obtained with the push-pull supine radiograph, there was the greatest likelihood of a well compensated trunk following selective thoracic fusion. Fusion of both curves can result in initially improved trunk balance at 24 months, but long term complications of adjacent segment degeneration were not considered.

COMMENTS

Both the King-Moe and Lenke classifications for idiopathic scoliosis address the issue of whether a selective thoracic fusion can be done when there are curve patterns with both thoracic and lumbar scoliosis. In the King-Moe classification, a selective thoracic fusion can be done when both thoracic and lumbar curves cross the midline, there is a minimal lumbar prominence on forward bending, and the lumbar curve is significantly more mobile than the thoracic curve. If the lumbar curve is mobile as the thoracic curve and if there is a significant lumbar prominence, both curves should be fused.

The Lenke classification is a more comprehensive method of characterizing idiopathic scoliosis. Although there is an implication that double curves with the C modifier, i.e. the apical vertebra of the lumbar curve falls outside of the center sacral line, should be included in the fusion, this is not an absolute indication for lumbar fusion. Many experienced surgeons still do not fuse the lumbar spine in this situation. The risks of not fusing the lumbar spine include post-operative trunk decompensation. If this persists, a second surgery to extend the fusion distally may be indicated. The consequence of fusing down to L4 or L5 is premature degeneration of the distal motion segments. This necessitates further surgery at a later time with either a fusion to the pelvis, a formidable task or a disc arthroplasty, an unproven option at present. Thus, there is a balance between the risk of early revision surgery with a selective thoracic fusion or late revision surgery with a long fusion.

Among the surgeon members of the Lenke study group formulating the classification, 92% would not include lumbar B-modifiers in the fusion and 68% would not always fuse lumbar C-modifiers in Lenke Type I curves. This emphasizes the role of surgeon judgment in the decision making process, but also fails to make the decision making process as well defined.

Many variables determine the clinical success of selective thoracic fusion including structural characteristics of the lumbar curve, individual surgeon capabilities and the type of instrumentation used during surgery. An important component of the King-Moe classification, not included in the Lenke classification system, is the clinical appearance of the patient’s deformity. When there is a significant (greater than 2.5cm) rise in the contour of the trunk on forward bending, the curve is structural and should be included in the fusion. Thus, the King-Moe criteria for selective thoracic fusion are still applicable. The Lenke classification is a more comprehensive classification scheme for idiopathic scoliosis, but does not give additional information for the absolute indications to include the lumbar curve when fusing scoliosis with a double curve pattern.

While it is generally accepted that patients tolerate up to 2cm of decomposition in the sagittal or coronal plane, several questions remain to be answered. What magnitude of lumbar scoliosis can be tolerated distal to a thoracic fusion? What is the maximum permissible tilt in the end vertebra of a fusion that will not lead to premature adjacent segment degeneration? The comprehensive nature of the Lenke classification system allows global characterization of lumbar and thoracic curves that may lead to answers through longitudinal follow-up in patients with selective thoracic fusions.

REFERENCES

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