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Commentary

Commentary on "Selection of Optimal Lower Instrumented Vertebra for Adolescent Idiopathic Scoliosis Surgery"

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Besides being the most common form of scoliosis, adolescent idiopathic scoliosis (AIS) is a complex three-dimensional deformity, necessitating surgical intervention in cases of severe curvature progression.[1] Selecting the optimal segments to fuse, especially the most proximal and lowest instrumented vertebra (LIV) for the surgical treatment of AIS is a critical decision that requires careful consideration of several factors. The choice of LIV plays a pivotal role in achieving successful surgical outcomes, a good sagittal and coronal balance of the spine and therefore minimizes the potential risks like adding on (AO), and proximal and distal junctional kyphosis (DJK). On the other hand, the length of the stabilization should be performed as short as possible to preserve motion segments, granting for a high quality of life after surgery.[2]

Different concepts were recommended such as Harringtons' stable zone, the stable vertebra and neutral vertebra theory, disc reversal on bending radiographs, last touched vertebra (LTV) and substantial touched vertebra.[2-7] However, the selection of the correct LIV in AIS is still discussed controversially and AO as well as DJK are reported with up to 14% occurrence after surgery, dependent on the curve pattern and the lengths of the stabilization.[5,8]

Seo et al.[9] summarize the historical recommendations of the LIV selection in AIS and review the actual literature with adopted selection methods of the LIV dependent on the different curve patterns. They included 18 mainly retrospective studies from 2003–2022 in their nonsystematic review. The historical overview in the first part emphasizes the problem of the different strategies of selecting the "correct" LIV and the reason, why this problem is still unsolved. They give also a detailed overview of the actual literature and enlighten the potential benefit of preoperative LIV assessment with additional positional radiographs. Just recently, Kim et al.[10] published their retrospective clinical and radiographic outcome of 57 patients with 2.2 years follow-up comparing the LIV selection dependent on the LTV on supine and upright anteriorposterior radiographs of the whole spine. They concluded that the LTV on supine radiographs can be the optimal LIV in AIS patients. Seo et al.[9] point out, that also the type of curve to address has an essential role on the LIV selection. For example, Lenke 1A-R curves were found to be more susceptible to AO than 1A-L curves.[11] Therefore, to prevent AO in Lenke 1A-R curves, LTV+1 has been recommended as the optimal LIV in 1A-R curves. Other important factors to be taken into account are

the LIV rotation, the deviation of the LIV of less than 2 cm from the central sacral vertebral line and the necessity to consider sacral slanting when stabilizing to L3 or L4. In summary, the review of Seo et al.[9] gives a detailed overview of the actual literature and enlightens the benefit of positional radiographs in LIV selection in AIS. Positional radiographs seem to be a reliable tool to gain high quality, reproducible clinical, and radiographic surgical outcomes for AIS patients.

As surgeons, we currently determine the decision of the length of fusion in AIS according to the different curve patterns according to Lenke et al.,[5] the curves' flexibility, kyphotic segments, the rotation of the end-vertebra, the lateral deviation of the LTV, and sacral slanting. The focus in general is on anterior posterior imaging. In the future, a standardized decision should also consider more the sagittal profile, pelvic parameters, and possible transition anomalies of the thoracolumbar and lumbosacral junctions, and the individual maturity. Further 3-dimensional curve evaluation and big-data analyzes may lead to even improved patients specific decision-making with better clinical and radiographic outcomes and less postoperative complications. Until then the surgeon's experience and expertise play a pivotal role in LIV selection. Experienced surgeons are better equipped to make informed decisions regarding LIV selection based on the patient's unique anatomy and clinical presentation. Lastly, discussing the surgical plan, potential risks and expected outcomes with the patient and her or his family is crucial. Patients' goals, activities, and aspirations should be factored into the decision-making process.

- **Conflict of Interest:** The author has nothing to disclose.

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