

Sp34 - In posterior only approach, what are the indications for only spinal stabilization; spinal stabilization with spinal column shortening; and spinal stabilization with anterior reconstruction?

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Recommendation: The choice between spinal stabilization only, spinal column shortening, or spinal stabilization with anterior reconstruction in a posterior-only approach is primarily determined by the severity of vertebral destruction, the degree of deformity, and the need for anterior structural support. Spinal stabilization alone is indicated in patients with severe pain and instability but with minimal destruction of vertebral bodies and when there is sufficient bone-on-bone contact. Spinal column shortening is appropriate when there is moderate vertebral body loss, and bone to bone contact can be achieved after debridement and posterior column shortening. However, in cases of substantial vertebral body loss (VBL > 0.5) or deformity > 30° that compromise bone-on-bone contact after posterior column shortening, anterior column reconstruction will be required.

Studies have demonstrated that metallic cages provide a more stable pivot for better deformity correction compared to autologous bone grafts, offering enhanced structural support.

Strength of recommendation: Moderate

Delegate Vote:

Rationale:

The advancements in imaging enabled early diagnosis and multi drug chemotherapy led to excellent healing responses, making the spinal tuberculosis (STB) a primarily medically manageable disease. However, surgery remains necessary in specific situations such as incapacitating pain from instability, neurological deterioration, or progressive deformity.

Historically, radical anterior debridement was the mainstay of surgical treatment. However, it has largely been replaced by posterior approaches utilizing pedicle screw instrumentation. (1-4) This transition is attributed to the posterior approach's surgical familiarity, reduced morbidity, and avoidance of complications associated with anterior access. (5-8) Studies have shown that microbiological yield and debridement effectiveness via posterior approaches are comparable to anterior ones. Additionally, posterior pedicle screw instrumentation provides three-column control, enhancing construct stability and improving deformity correction. (2,4)

The goals of surgery include debridement, neural decompression, deformity correction, and spinal stabilization can be effectively achieved through single-stage posterior approaches. (8,9) However, whether anterior reconstruction is necessary in active STB remains debated. (10)

Evidence supports the posterior-only approach as a safe and efficient alternative, particularly in early-stage disease with limited vertebral body destruction. Sahoo et al. reported favorable

outcomes in 18 patients with thoracolumbar STB and neurological deficits treated with posterior decompression and transpedicular screw fixation. All patients had single-level disease, <50% vertebral destruction, and mild kyphosis (8° – 27°). At 24–46 months follow-up, kyphosis improved from 17.7° to 11.6° , neurological recovery was seen in 94.4%, and 55.5% achieved bony fusion, with significant pain relief. (6)

Although single-stage posterior surgery is increasingly accepted, the ideal surgical strategy, especially regarding graft choice and anterior reconstruction, continues to be debated. Du et al. compared structural and non-structural bone grafts in single-segment thoracic spinal tuberculosis treated via one-stage posterior surgery. Both approaches led to similar improvements in pain, inflammation, and neurological status. Structural grafts offered better initial kyphosis correction but had higher correction loss. Non-structural grafts resulted in shorter surgery, less blood loss, and faster fusion, making them a less invasive yet effective option. (11)

Huang et al. proposed evaluated the use of spinal instability neoplastic score (SINS) to guide graft selection in thoracolumbar spinal tuberculosis. Patients were allocated to structural or non-structural bone graft groups based on SINS (≥ 13 for structural, 7–12 for non-structural). Both groups showed comparable clinical and radiological outcomes, but non-structural grafting was associated with shorter operative time, less blood loss, and faster fusion. The study supports SINS-based graft selection to optimize surgical outcomes.(12)

Ramakrishnan et al. conducted a prospective randomized study comparing posterior-only stabilization and global reconstruction (via all-posterior approach) in patients with thoracic and thoracolumbar spinal tuberculosis presenting with borderline vertebral body loss (VBL: 0.5–1). Both groups showed comparable neurological, functional, and radiological outcomes at final follow-up. Posterior-only stabilization had a shorter operative time and better ODI scores, while global reconstruction demonstrated marginally better kyphosis correction and maintenance. Fusion times were similar across groups. (10)

Xu et al. (13) demonstrated favorable clinical and radiological outcomes using single-stage posterior debridement and compact bone grafting with posterior column shortening in mono-segmental lumbar STB. Meanwhile, Subbiah et al. (14) proposed a therapeutic algorithm for posterior-only approaches: in cases with endplate and vertebral body involvement, anterior reconstruction was deemed necessary to restore spinal alignment and stability. Conversely, when involvement was limited to the disc space, posterior stabilization alone was considered sufficient.

Guna et al. conducted a prospective study comparing three all-posterior surgical techniques for thoracolumbar spinal tuberculosis: (i) posterior instrumentation with anterior cage reconstruction, (ii) posterior instrumentation with anterior autologous bone grafting, and (iii) posterior column shortening without anterior reconstruction. Patients requiring anterior reconstruction typically had an average vertebral body loss (ABL) > 0.5 and a deformity angle $> 30^{\circ}$. At 2-year follow-up, there was no significant difference in loss of correction among the three groups (3.4° , 3.2° , and 3.1° respectively; $p = 0.755$), and the final deformity angles were comparable. (3)

Anterior reconstruction using autografts via the posterior approach did not offer additional benefits. However, when titanium cages were used as a pivot, significantly better initial deformity

correction was achieved compared to posterior-only techniques. Despite similar outcomes in terms of complication rates, neurological recovery, and functional results across all three groups, reconstruction with metallic cages was associated with increased operative time, blood loss, and hospital stay. (3)

The author also noted intraoperatively that when deformity exceeded 30°, posterior column shortening alone resulted in poor bone-to-bone contact and, in some cases, cord kinking. In such cases, anterior reconstruction with titanium cages improved deformity correction and spinal alignment by acting as a stable pivot. (3)

Conclusion:

The choice between posterior-only spinal stabilization, column shortening, or anterior reconstruction hinges on the extent of vertebral body loss and kyphotic deformity. Stabilization alone is sufficient in cases with minimal vertebral destruction and preserved bone-on-bone contact. Posterior column shortening is suitable for moderate destruction where contact can be restored. In contrast, anterior reconstruction becomes essential when vertebral body loss exceeds 50% or deformity surpasses 30°, as these compromise stability and alignment. Metallic cages, when used in reconstruction, offer superior deformity correction by providing a stable pivot, although at the cost of increased operative time and morbidity.

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