

Spinal Tuberculosis Recent Trends of Surgical Management in Modern Era

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Abstract

Tubercle bacilli has been known to live in symbiosis with mankind since centuries. Tubercle bacilli mainly causes pulmonary disease but extra pulmonary manifestations are fairly common with spine being the most common site

Keywords: spinal tuberculosis; modern era; percutaneous pedicle screw

Introduction

Tubercle bacilli has been known to live in symbiosis with mankind since centuries. Tubercle bacilli mainly causes pulmonary disease but extra pulmonary manifestations are fairly common with spine being the most common site [1]. Amongst the bone and joint tuberculosis, spinal tuberculosis requires special attention because it not only affects the biology and mechanics but also the neurology. Treatment principles of spinal tuberculosis have changed rapidly over the years with the improvement in socioeconomic status, development of BCG vaccine and effective anti-tubercular drugs, hand in hand numerous controversies have also emerged over the treatment protocol. The whole idea of surgical management of spinal tuberculosis is changing today with the advent of minimally invasive spine surgery (MISS), tubular/endoscopic decompression and percutaneous pedicle screw (PPS) fixation.

Discussion

Tuberculosis is epidemic in many parts of the world and with spinal tuberculosis being the most important and most common extrapulmonary tuberculosis site. It is always necessary for a shrewd spine surgeon to be well versed with the latest principles and trends in the management of one of the most unintelligible disease known to mankind. The 2 most important milestones in the history that had a great impact on the treatment of spinal tuberculosis is the development of ATT and results of MRC trials. Before the advent of ATT, treatment was mainly a watchful observation and emphasis for good sanitation and nutrition. The ultimate goal was to achieve ankylosis in least disabling position by the application plaster cast immobilization for 2-3 years [1-6]. Because of the unpredictable and unsatisfactory results of this orthodox treatment surgeons opted to surgically excise the diseased bones and joints by targeting the pathological area [7, 8]. This led to increased morbidity and mortality. But with the advent of ATT and its remarkable results [14] led to the development of the middle path regime which changed the

principles of radical surgical debridement to optimal surgical debridement mainly focusing on prevention of neurology and deformity. The MRC trials concluded that drug treatment group, debridement group and debridement with anterior spinal fusion group has similar outcomes over 15 years [16] except that the fusion group had quicker pain relief and decreased tendency for deformity progression. The landmark results of Oga et al. [17] showed that tubercle bacilli do not adhere to metal and neither form biofilms, thus releasing the anxiety to use instrumentation for immediate stability amongst spine surgeons. Thus the modern principles of fusion and bone to bone contact for effective results were laid down. Modern day indications and principles of surgical treatment of spinal tuberculosis is well defined. Indications include severe and rapidly progressive neurological deficit, significant destruction causing mechanical instability and deformity, large abscess causing pressure symptoms and lack of response to ATT. Similarly surgical principles include optimum debridement and decompression, adequate bone to bone contact for fusion, providing immediate stability for early mobilization with an approach which causes least morbidity coupled with effective ATT. Radical debridement is not recommended nowadays and decompression and debridement is restricted to removal of sequestered disc, loose pieces of bone with drainage of pus to allow spinal canal decompression. In children, injury to the growth plates must be avoided by limited debridement [18]. Anterior column reconstruction is obtained by anterior or posterior approaches using strut grafts (autograft/allograft) or titanium mesh cages. Immediate stability is provided with adequate instrumentation. Graft related complications and loss of correction of kyphosis [20, 21] has been described after isolated arthrodesis. Upadhyay et al. reported dislodgment of graft after anterior fusion in 10 out of 104 patients and increase in kyphosis by 20 degrees in one year [22]. Primary stabilization provides immediate pain relief, promotes healing and neurological recovery, enhances fusion rates and allows early mobilization. These principles can be achieved with anterior alone,

posterior alone or combined approaches. Tuberculosis is always a medical disease, so without effective ATT any surgery performed by above principles in mind can fail. Apart from the traditionally used anterior, posterior, combined anterior posterior approach, recently minimal invasive spine surgery (MISS) is playing a significant role in surgical management of tuberculosis. MISS has proven its might with regards to better patient outcomes less postoperative stay, less blood loss, less postoperative pain, smaller incisions and early return to work in degenerative spine pathologies [44, 45]. But in the management of spinal tuberculosis its use is restricted to procure specimens for culture, drainage of epidural abscess, percutaneous debridement of early discitis, anterior transforaminal debridement and reconstructions followed by percutaneous screw fixation.

Applications of MISS are a boon in immunocompromised and elderly morbid patients. Ashizwa et al [46] performed percutaneous transpedicular biopsies and found 92% accuracy without significant complications. Paraspinal and epidural abscesses tend to resolve with chemotherapy. However, if pressure symptoms appear or there is failure of resolution, percutaneous drainage & debridement aided by transforaminal or posterior full-endoscopic techniques help in immediate symptom resolution as well as getting a representative sample for laboratory studies and change in MDT [47](Case 3). Expandable retractor systems (Quadrant retractor system- Medtronic Inc, Syn Frame, XLIF – NuvasiveInc) have been also utilised in the surgical management of TB spine with notable success. Direct lateral Interbody fusion (DLIF) & Oblique lateral interbody fusion (OLIF) offer thorough anterior debridement and fusion for up to 2 levels of involvement followed by percutaneous MIS Screw fixation [48]. These approaches have been rendered much more useful with the advent of expandable cages with variable footplates which help in placement through the narrow corridors yet achieve excellent kyphosis correction and restoring the loss of height due to the disease process. Minimally invasive surgery techniques using video assisted thoracoscopic (VATS) decompression of the anterior tuberculous lesions have also been reported. Such techniques minimize surgical morbidity however indications are primarily for debridement, as these techniques only allow for minimal correction of sagittal parameters [49, 50, and 51]. The advantages of these MIS Anterior techniques are that the lead to significantly less morbidity, minimal epidural fibrosis and excellent anterior release which aids in good deformity correction with the posterior fixation technique.

Recent trend is for an all posterior global reconstruction whereas Anterior Cervical Decompression & Fixation (ACDF) remains the gold standard in subaxial/ Cervico-thoracic region TB (Case 4). Hu et al [52] in a series of 18 patients have demonstrated the role of image processing and planning software like SURGIMAP (NemarisInc) in determining preoperatively the level and type of osteotomy so as to achieve the best surgical correction. Percutaneous pedicle screw placement have been used extensively in MISS stabilization procedures. These however have disadvantages like increased radiation exposure, guide wire related complications and superior facet joint violations (). Intraoperative 3D Navigation is also a very useful tool for guided screw placement and intraoperative osteotomy planning and has been extensively put to use for complex post-tubercular deformities. Intraoperative Neuro-Monitoring (IONM) is a useful adjunct for such scenarios where the spinal cord is stretched over the internal gibbus and the surgical team can get a reasonable correction without endangering the spinal cord and resultant postoperative neurological worsening as INOM give real-time feedback regarding the functioning across the operated segment via the multimodal monitoring.

Conclusion

Tuberculosis has been known to coexist with human species since ages. Principles of treatment has changed drastically over the years, with advances in medical management with ATT use and gradually increasing

use of MISS surgical techniques there is always a wide scope for treatment of spinal tuberculosis to achieve more better outcomes in coming times.

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