

Surgical treatment of tuberculous spondylodiscitis

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Abstract. – Background: Most patients affected by spinal tuberculosis can be successfully treated conservatively with chemotherapy, external bracing and prolonged rest. Nevertheless, kyphotic deformity, spinal instability and neurological deficit remain a common complication associated with conservative approach.

Aim: To illustrate different indications and treatment modalities for tuberculous spondylodiscitis, focusing on the role of surgery as an adjuvant of effective chemotherapy in the management of selected patients.

Materials and Methods: Various early and late surgical procedures are recommended to treat spinal tuberculosis. The Authors analyzed surgical indications, approaches, complications and outcomes comparing their experience with available Literature.

Results: Conservative management is preferable in patients without vertebral instability and deformity; in presence of abscesses, invasive radiological techniques in combination with abscess drainage and chemotherapy are recommended. In patients with vertebral collapse, kyphotic deformity or abscess formation, vertebral instability or neurological deficits, anterior radical debridement, anterior strut grafting and anterior instrumentation is an optimal standardized procedure. In patients with involvement of more than two vertebral levels or lumbosacral junction and in those whose sagittal alignment is markedly deformed with segmental kyphosis, and in patients who have difficulty in undergoing anterior instrumentation, posterior instrumentation is recommended in combination with anterior radical debridement and anterior strut grafting in one or two staged procedures.

Conclusions: Since surgery for spinal tuberculosis is demanding, it should be performed only after taking into account the risks and benefits in operable patients. Various surgical procedures are recommended to treat spinal tuberculosis but the common goals are to eradicate the infection and to prevent or to treat neurologic deficits or spinal deformity.

Key words:

Spinal tuberculosis, Chemotherapy, Kyphosis, Bony fusion.

Introduction

The development of effective antituberculosis drugs has revolutionized the treatment of patients with spinal tuberculosis since most patients do not have extensive bony destruction and sequestration can now be successfully treated conservatively with chemotherapy, external bracing, and prolonged rest^{1,7,8}. CT and MRI imaging allow detection of tuberculous infection of the spine at a very early stage (pre-destructive or early destructive) possibly before the development of severe deformity and neurological deficits. In these cases antituberculous chemotherapy alone is effective in eradicating the infection with the only aid of external bracing^{1,2}. However, conservative treatment may fail because of unresponsiveness or noncompliance to antituberculous chemotherapy⁷. Moreover, since the anterior column of the spine is primarily affected, bony destruction and vertebral collapse often result in significant pathologic kyphosis and neurological deficits^{7,9-11}.

When chemotherapy is given without any external bracing of the affected vertebral segment, an extensive collapse of the anterior vertebral column may result, leading to instability and progressive kyphosis, thus prolonging recovery time and affecting the long-term outcome^{2,10}.

Kyphotic deformity remains a common complication associated with conservative approach^{2,3,12}; high incidence of progressive kyphosis (38%) and low rate of fusion (46% to 85%) are reported after chemotherapy alone⁴. Moreover, the prevalence of neurologic involvement represents 10% to 47% of those with spinal tuberculosis⁷.

Surgery in tuberculous spondylitis is traditionally considered to be an adjuvant of effective chemotherapy⁴. However, considering that regular antibiotic therapy and spinal stability maintenance are the prime strategy for treatment of any spinal infection, aggressive surgical treatment

plays an important role in the management of selected patients^{2,10,13}. CT-guided or open biopsy remains extremely useful, as direct examination and cultures are positive in only one-third to one-half of patients¹⁴. Diagnosis is often confirmed by biopsies obtained during surgery.

Surgical indications

Indications for surgery in the active stage of the disease are: failure of conservative therapy in terms of expanding paravertebral abscess or progressive bone destruction with significant angulation or vertebral collapse greater than 50% after a chemotherapeutic regime and rest for 6 to 8 weeks; epidural abscess causing compression of dural sac or large paravertebral abscess; progressive complete or partial neurological dysfunction at any time during medical treatment; prevention of severe kyphosis in young children with extensive dorsal lesion. Surgery is performed also in cases of nondiagnostic biopsy and in case of radicular or medullary compression due to granulation tissue, cold abscess, or sequestered bone and disc fragments^{1,2,4,15}. Indications for late surgery are recrudescence of the local disease, residual spinal deformity, development of neural complication and persistent severe pain due to mechanical instability¹. Since surgery for spinal tuberculosis is demanding, it should be performed only after taking into account the risks and benefits for each patient. Various surgical procedures are recommended to treat spinal tuberculosis^{2,9}, but the common goals are to eradicate the infection and to prevent or to treat neurologic deficits or spinal deformity.

Surgical options

Surgical options are decompression and/or debridement, both with or without fusion. Laminectomy has no place in spinal tuberculosis except for extradural granuloma/tuberculoma or in the setting of secondary stenosis due to an old healed disease, without much deformity¹.

The surgical procedure traditionally considered the gold standard for spinal tuberculosis is the radical debridement of the lesion through anterior approach and solid anterior interbody fusion with strut grafts^{3,7,10,12,15-17}.

Combined one-stage anterior radical debridement, arthrodesis with interbody autografting and instrumentation allow direct exposure of the pathological site and permits effective resection of damaged vertebrae, sequestra of disc and bone and tuberculous granuloma^{1,2,7,10}. Resection of pathological structures releases the spinal cord at the involved level and allows revascularization; it leads to reduction of general toxemia, decreasing the quantity of chemotherapeutic agents needed and the duration of the therapy^{1,10}. The outcomes of anterior debridement associated to bony fusion in the treatment of spinal tuberculosis have been compared with non-operative treatment and anterior curettage without fusion⁶: the percentage of fusion with a bone graft is 97% at 10 years, compared with 90% with debridement alone, and arthrodesis results in a much higher rate of fusion and lesser rate of late deformity than the debridement and the chemotherapy alone. Various anterior grafting techniques have been described in order to obtain partial or complete correction of kyphosis in the exudative stage of spinal tuberculosis, including autogenous iliac crest graft or rib autograft and femoral or fibular allograft^{7,10}. Use of cages with iliac/rib graft provides better correction as well as maintenance of correction in comparison to the isolated iliac crest or rib graft¹. Finally, anterior instrumentation simplifies postoperative nursing and avoids the burden of long-standing external thoracolumbosacral orthosis in most cases^{7,10} (Figure 1).

However, these procedures are not always successful in correcting the kyphotic deformity and maintaining the alignment of the spine, especially in cases in which the grafts span more than two disc spaces¹⁸. A high incidence (59%) of graft related problems are reported¹⁸; if the grafts fail, slip, or get absorbed, correction can be lost and progressive kyphosis develops aggravating neurologic symptoms and chronic back pain^{18,19}. Moreover, in cases of epidural suppuration the access to the neural elements is limited when an anterior approach is used. Anterior instrumentation alone is possible only if the posterior elements are intact¹⁰.

To prevent or correct postoperative kyphotic deformity and accelerate early ambulation, some Authors have recommended adjunctive simultaneous or staged posterior instrumentation and arthrodesis to improve the possibility of anterior interbody fusion^{2-4,7,15}. Supplementary posterior instrumentation may be preferable if there are more than two vertebrae involved, in children affected from advanced tuberculosis at risk of progression

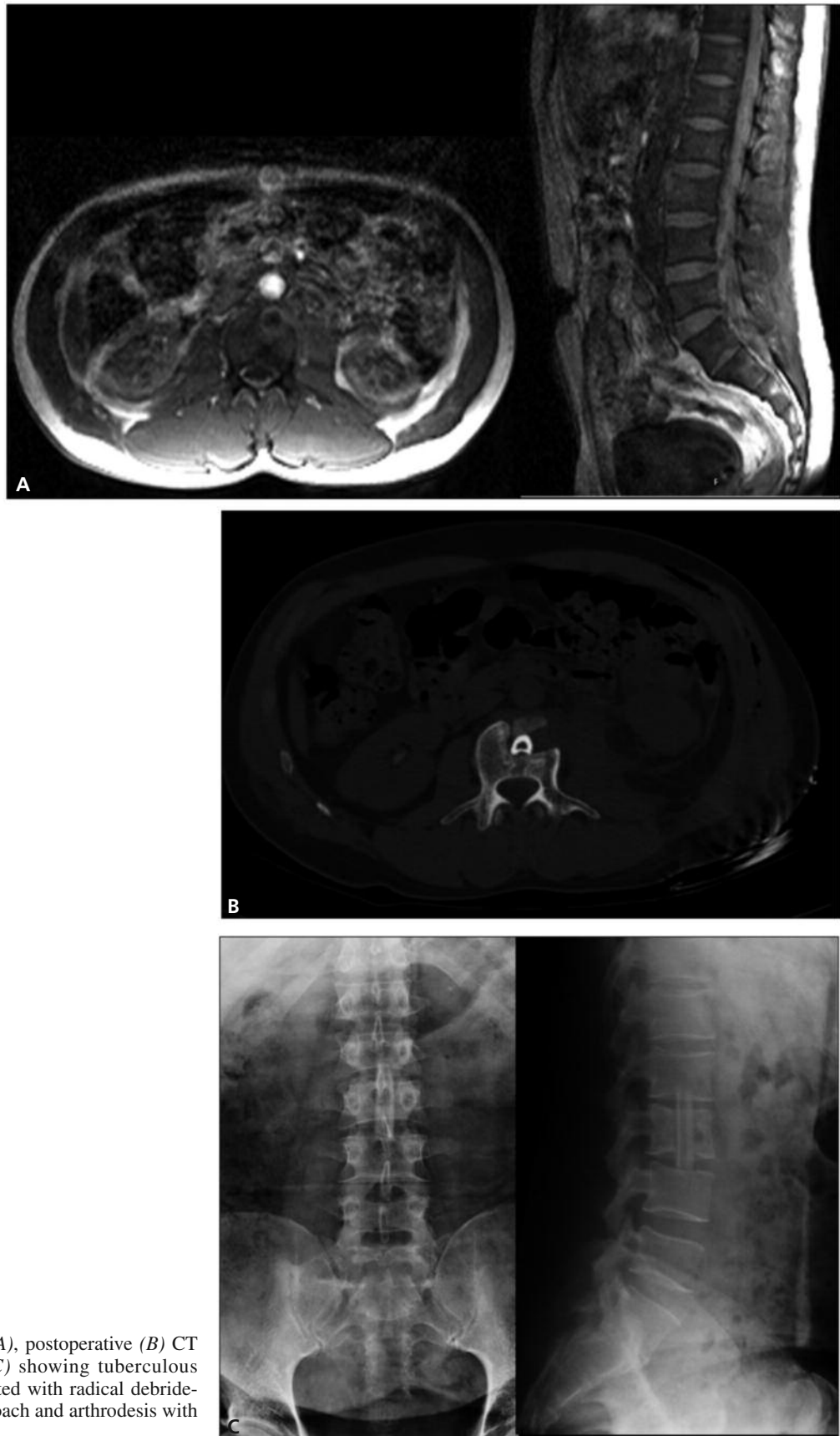


Fig. 1. Preoperative (A), postoperative (B) CT and X-ray images (C) showing tuberculous spondylitis of L2 treated with radical debridement by anterior approach and arthrodesis with autogenous rib graft.

of kyphosis and if the lumbosacral junction is involved^{7,10,15}. After combined anterior radical debridement and fusion and posterior instrumented fusion, the incidence of graft-related problems and the progression of kyphosis are significantly lower than with anterior surgery alone⁴. However, the combined procedure may be associated with prolonged operating time, greater blood loss, longer hospital stay and increased perioperative complications and mortality^{7,20}.

Due to availability of modern imaging modalities allowing for early diagnosis and more effective antituberculosis chemotherapy, more conservative surgical options than anterior radical approach became more popular²¹.

Posterior surgical approach alone combining fusion with rigid instrumentation has been shown to be less technically demanding and to avoid the potential intra- and post-operative complications associated with the anterior approach²². Posterior debridement, fixation with transpedicular screws or laminar/pedicular hooks/rods, with or without the placement of posterior or posterolateral interbody grafts can be safely performed in patients whose vertebral bone involvement is not extensive with no multilevel vertebral involvement and no high-grade kyphosis². In the thoracic spine, posterior arthrodesis can be easily extended without sacrifice of spine mobility. On the contrary, in the lumbar spine, extension of posterior fusion levels reduces lumbar motion. Therefore, in patients with lumbar tuberculosis, short instrumented posterior stabilization followed by anterior curettage and interbody arthrodesis effectively achieves immediate stability, long-term lumbar lordosis, a high fusion rate, and a satisfactory clinical outcome³ (Figure 2). Transpedicular screws can be placed in the affected vertebrae if the upper part of the vertebra is not destroyed by infection^{23,24}. In cases in which posterior instrumentation with pedicle screws is less appealing, lamina hooks can be used without sacrificing additional motion segment hence surgical exposure and the extent of spinal fixation is reduced to a minimum³. The limitation of lamina hooks is that they cannot be used in lesions extended to the sacral spine.

Posterior approach offers the advantage of an easy access to the spinal canal for neural decompression, prevents loss of correction of spinal alignment in the long term, and, thanks to the stability provided by transpedicular fixation, facilitates early mobilization of the patients².

Several surgical options have been described

to correct severe, rigid kyphosis with fixed trunk translation or kyphotic deformity beyond 90° of sagittal angulation, particularly in childhood, including placement of halopelvic or halofemoral distraction posteriorly, anterior spinal osteotomy and decompression of the spinal cord, gradual spinal distraction, posterior osteotomy and fusion, single posterior vertebral column resection, panvertebral stabilization^{1,9,25}.

Instrumentations does not increase the risk of persistence and recurrence of infection when combined with radical debridement and intensive antituberculous chemotherapy^{4,7,26}. A titanium fixation system is preferable because it allows the patient to undergo magnetic resonance imaging (MRI)¹⁰.

Conclusions

In patients with no vertebral instability and deformity, conservative management is preferable; in those who have abscess formation, invasive radiological techniques in combination with abscess drainage and chemotherapy are recommended. In patients with vertebral destruction and collapse, moderate to severe kyphotic deformity and large abscess formation, vertebral instability and neurological deficits, anterior radical debridement, anterior strut grafting and anterior instrumentation is an optimal standardized procedure. In patients with involvement of more than two vertebral levels or lumbosacral junction and in those whose sagittal alignment is markedly deformed with segmental kyphosis, and in patients who have difficulty in undergoing anterior instrumentation, posterior instrumentation may be preferred, in combination with anterior radical debridement and anterior strut grafting at the same or a subsequent session.

Some special considerations should be done for tuberculosis localized at the cervical spine or at the craniovertebral junction. Antituberculous drug therapy and immobilization with external orthosis or traction are the initial part of the treatment²⁷. Chemotherapy alone is suitable for cases that are in the early stages of the disease, without myelopathy, and without demonstrable radiological instability or significant compression of the spinal cord. A strict clinic-radiographic follow-up is recommended since abnormal mobility may cause delayed instability and potential medullar compression.



Fig. 2. Preoperative MR images (A) showing a devastating tubercular infection of the L4-L5 disc space with severe destruction of adjacent vertebral bodies and epidural and paravertebral abscess. Control sagittal MR image obtained at 8 months (B) and postoperative X-ray images (C) show no loss of correction and solid bony fusion achieved with anterior curettage posterior instrumentation L3-S1 12 months after surgery.

Even if secondary kyphosis is seldom severe, because the articular processes are usually spared, the incidence of neurological complications is high in cervical spine tuberculosis, especially in adults²⁸. After conservative treatment of

the thoracolumbar spine, severe junctional kyphotic deterioration occurs in about 20% of cases and can lead to paraplegia. Skull traction is recommended for cases with marked bone destruction and kyphosis to assist in gradual correc-

tion²⁸. The best surgical option for cervical tuberculosis is an anterior approach that combines decompression, strut grafts and internal fixation with plates or titanium mesh cages. The use of posterior instrumentation for cervical tuberculosis is reported in small series^{11,19}, although the main disadvantage is the double approach and increasing morbidity. Tuberculosis at craniovertebral junction deserves special mention because it can lead to quadriplegia and respiratory depression. Management depends from neurological status, extent of bony destruction and compression of spinal cord, associated atlantoaxial dislocation, and clinical response to antituberculous drug therapy²⁹. A transcervical retropharyngeal or transoral surgical approach can be used for either diagnostic or therapeutic purposes^{29,30}. In patients with mild bone destruction and no atlantoaxial dislocation, transoral decompression alone is performed by means of drainage of the abscess or removal of extradural granulation tissue. In tuberculous spondylitis and for any patient with atlantoaxial dislocation, the extension of bone removal depends on degree of neural compression and is followed by posterior occipitocervical fusion.

In any case, the indication and extent of surgery is dependent upon the presence of instability and spinal cord compression and should be individualized.

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