Tuberculosis of lumbar and lumbosacral spine

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Abstract

Introduction: Lumbar spine tuberculosis constitutes an aspect of spinal tuberculosis and remains a major healthcare problem.

Aim of Surgery: Early surgery can provide early ambulation along with relief of pain and stability.

Surgical Options: Posterior approach particularly with transpedicular stabilization provides access to anterior elements and is satisfactory in majority of the patients.

Imaging: MRI is the investigation of choice but many times X-ray is required to access the extent of bony destruction.

Instrumentation: It provides immediate rigid fixation of the involved spine. It promotes early healing and prevents progression of the deformity.

Results: Surgery, along with effective medical treatment, can provide satisfactory answer to the much dreaded tuberculous infection of the spine.

Conclusion: Early treatment of tuberculosis of the spine with medical and surgical combined gives good prognosis.

Key Words

- Spine
- Lumbar spine
- Tuberculosis
- Pott's disease

Introduction

Tuberculosis remains a major healthcare problem worldwide, since times immemorial, and the AIDS pandemic is held responsible for the recent resurgence in the incidence of tuberculosis. Immunocompromised, immune deficiency, poor nutrition, life in overcrowded ghettos constitute other important risk groups, and it is estimated that more than two million people worldwide have spinal tuberculosis.[1,2] Immigration from countries with a high prevalence of tuberculosis is another factor in apparent resurgence in the developed countries.[3] Spinal tuberculosis is the commonest form of tuberculosis, and often has been discussed as being "typical" and "atypical" lesion. A "typical" lesion is one with adjacent vertebral (usually dorsolumbar) destruction with involvement of the intervening disc, together with a paravertebral cold abscess. An atypical lesion is any lesion that does not fit the above description. With availability of newer imaging techniques, the distinction between "typical" and "atypical" has progressively blurred, as a varied spectrum of radiographic images of tuberculous spine has been recognized and documented. The clinical profile is changing, with early detection in the vulnerable groups, due to widespread use of MRI in the imaging of spinal pathologies. Spinal tuberculosis encompasses a vast spectrum of pathologies ranging from a small granuloma to frank suppuration and osseous destruction. Classically, the lesion is described as pathology involving a spinal motion segment, i.e., two adjacent vertebrae and the intervening intervertebral disc space. The evolution of the lesion into a fusiform paraspinal abscess (Figure 1) with gibbus deformity and consequent myelopathy is also well known. Further, tracking of the pus can occur into well defined spaces like posterior triangle in the neck, along the ribs, along the psoas and into the inguinal region or the gluteal region.

Received: 17-01-12; Revised: 04-04-12; Accepted: 10-05-12
Disclosures: This article has not received any funding and has no vested commercial interest
Acknowledgements: None

Figure 1
Cold abscess seen in the lumbar triangle

Tubercular involvement of lumbar and lumbosacral segments of spine occurs less often than that of cervical and thoracic regions. Backache as the initial symptom may be present for weeks, and consultation is sought only when the pain becomes severe and unrelenting. Given the capacious lumbar spinal canal containing nerve roots (that behave like peripheral nerves and can withstand certain degree of angulation and deformation), paucity of neurological features is not surprising. The lordotic curve preempts the formation of gibbus, and a deformity occurs only when the vertebra is destroyed.[4]

Mode of infection

Spine is the commonest site for skeletal tuberculosis. Generally, lumbar spine tuberculosis, as in any other site for extra-pulmonary or skeletal tuberculosis occurs due to reactivation of a dormant focus; the initial exposure usually occurs during childhood. Infection may, however, occur following surgery, as for lumbar disc.[5]

Traditionally, tuberculous infection is thought to be due to retrograde flow in the Batson's vertebral venous plexus, as that occurs during sudden increase in intra-abdominal pressure and lodgement of mycobacteria in the vertebral bodies.[6]

Wiley and Trueta[7], however, showed that a rich arterial plexus supplies the vertebral bodies under physiologic pressures, and the blood flow through the Batson's venous plexus is not enough to enter the vertebral bodies. Moreover, the richly vascular metaphyseal bone near the anterior longitudinal ligament corresponds to the most common site of infections, thus implicating an arterial route for hematogenous osteomyelitis.[8] Tuberculous spondylodiscitis has been reported to occur after lumbar discectomy.[4]

Pathology

Tuberculous infection may affect the vertebral body, intervertebral disc, neural arch, or the posterior elements, but exhibit preference for anterior and middle columns. Infection occurs by hematogenous route, through visceral dissemination from an active or quiescent focus located in the lung, lymphatic system, abdominal viscera, etc. Typical involvement consists of a lesion of two adjacent vertebrae and the intervening disc, supporting the arterial spread theory.[8] The cold abscess so formed spreads subperiosteally and under the anterior and posterior longitudinal ligaments across several segments, stripping the vascularity and destruction of several vertebrae. Vertebral ischemia reduces its strength leading to collapse due to compressive stress. The intervertebral disc being avascular is not involved primarily. However, due to compromise of nutritional supply from paradiscal regions of the vertebrae, the disc is invaded. Apophyseal joints' involvement too has been reported.[9] Neurological compromise occurs due to mechanical compression of the spinal cord or the nerve roots by the cold abscess, angulation due to vertebral collapse, sequestrum, or thick granulations. Endarteritis causing myelomalacia too can contribute to myelopathy, and in such an event prospect of recovery is limited.

Burden of disease

Tuberculosis of lumbar and lumbosacral spine imposes crippling restrictions on the lifestyle, with neurological deficits ranging from nil to complete Cauda equina syndrome. About 40% of the patients will have fever and weight loss.[10] Backache is a universal symptom, and often the most prominent symptom, restricting the patient to bed. There is often a tendency to try various options that promise relief or cure, viz., massages, use of lumbar belts, yoga, physiotherapy, etc.

With passage of time and progression of disease, there is formation of psoas abscess, which may point in the lumbar triangle of petit, right iliac fossa or below the inguinal ligament. Patient may complain of pain over the anterior aspect of thigh due to compression of lateral cutaneous nerve of thigh. Muscle wasting is seen in the calf, quadriceps or anterior tibial group of muscles with foot drop. A characteristic finding may be wasting of small muscles of the foot leading to hollowing of the plantar aspect and the dorsum of the foot. Lower limb involvement may be unilateral or bilateral, and there may be formation of non-healing ulcers on the heels or over the sacrum. Pus discharge may be followed by formation of chronically discharging sinuses in the groin or hip region. Lumbar spine instability is a real and potential risk that needs

immediate evaluation and surgical planning. Granulations causing Cauda equina compression present with features of lumbar canal stenosis.

Laboratory evaluation

Tuberculous spondylodiscitis is often associated with nutritional anemia, raised erythrocytic sedimentation rate (ESR), elevation of serum C-reactive proteins. A complete evaluation of the patient's biochemical status that is liver functions and renal functions is essential, since these parameters will be monitored during the period of medical therapy with anti-tubercular drugs. Associated morbidity like diabetes mellitus requires effective management to provide optimal environment for elimination of tubercular infection.

Imaging

Imaging is the mainstay of diagnosis and treatment planning of a patient with suspected spinal tuberculosis. While the typical appearances in spinal tuberculosis are well known, an atypical form may mimic malignancy, necessitating complete oncology workup.[11]

Plain X-Rays: Typically, there is narrowing or involvement of the disc space with lytic lesion of the adjacent vertebrae (Figure 2), and formation of a paraspinal abscess, that may track into the psoas major. A central type of involvement may result in 'concertina' collapse.[12]

Anterior involvement will result in stripping of the anterior longitudinal ligament (Figure 3), loss of osseous vascularity and anterior scalloping of the vertebrae. Wedge collapse results in angulation and kyphotic deformity. Anteroposterior views may show pedicular destruction.

Figure 2
Lumbar spine radiograph showing reduction of disc space L1/L2

Figure 3
Lumbar spine radiograph showing anterior scalloping of L3 vertebral body without involvement of adjacent disc spaces

Computed Tomography: CT is useful to assess degree of bony destruction and for treatment planning, when

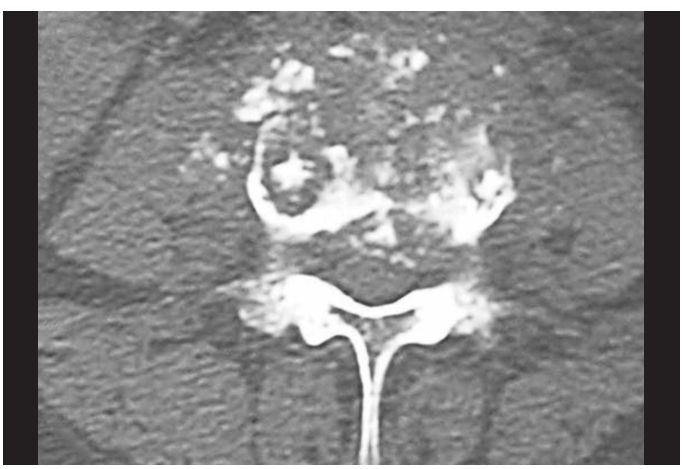

Figure 4
CT showing destruction of L3 vertebra

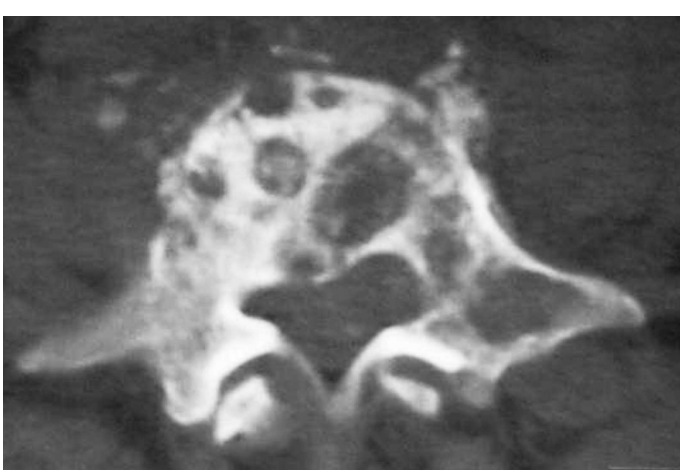

Figure 5
NCCT showing extensive tuberculous involvement of the body and posterior elements

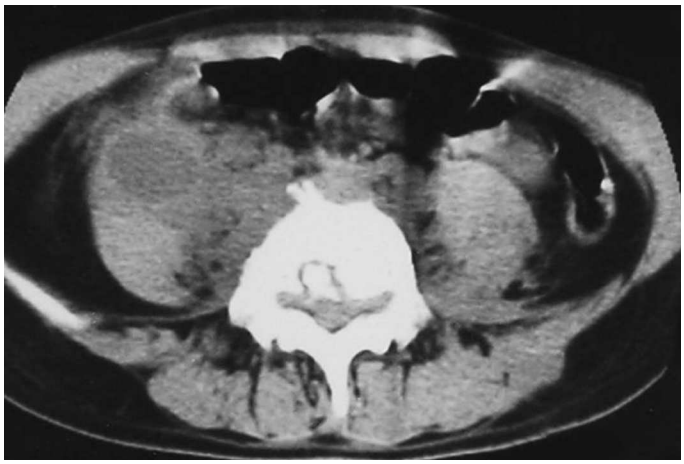

Figure 6
CT image showing calcification, bone destruction and paraspinal collection

stabilization is contemplated (Figures 4 and 5). The involvement has been classified as fragmentary, osteolytic, periosteal, and sclerotic.[13] Calcification (representing bone sequestra) with paraspinal collections and bone destruction is pathognomic of tuberculosis (Figures 6).[14]

Magnetic resonance imaging: MRI is a sensitive imaging modality that shows vertebral and intradural disease, and paravertebral abscess (Figure 7). T2-weighted and Short T1 inversion recovery (STIR) sequences show the extent of the disease. The extent of neural compression is well delineated, along with the deformity, extent of subligamentous spread, findings that determine the approach. MRI also reveals skip lesions and appendicular lesions. Contrast enhanced MRI is useful to define the epidural abscess.[15]

Figure 7
MRI showing central destruction of L3 vertebra with discal involvement

Medical therapy

First-line therapy for spinal tuberculosis consists of multi-drug combination therapy with isoniazid, rifampicin, pyrazinamide and ethambutol. Standard four-drug therapy is given for four months, followed by eight months of rifampicin and isoniazid. Treatment is monitored with clinical improvement, ESR and radiological improvement, and therapy may have to be extended if improved is delayed. Treatment with only chemotherapeutic drugs faces plenty of challenges, including poor compliance and unreliable drug delivery, which generates greater resistance profiles. Direct observed treatment with fixed-dose multidrug combinations has result in improved compliance and results.16 Emergence of multidrug resistant strains of Mycobacterium is serious concern, and it requires aggressive and prolonged management with four to six drugs, i.e., isoniazid, rifampicin, pyrazinamide, ethambutol, streptomycin, ethionamide or cycloserine/ofloxacin.[17]

Lumbar spine tuberculosis can be managed with anti-tubercular therapy in the presence of limited disease involving only one segment with minimal destruction. Ambulatory patients are encouraged ambulation with lumbar support, but advised to avoid lifting of weights or any physical strenuous activity. Resolution of symptoms with pain relief occurs, followed by radiological improvement that may be seen and monitored by serial imaging. Worsening of pain and restriction in physical activity, however, indicates disease progression, and often prompts the surgeon to advice surgery.

Management options

Although, there are options for medical and conservative, non-operative management in many patients due to varied indications, the extent of disability and nature of burden of disease often prompts the surgeon and the patient to exercise operative surgical option. Following facts may lead to a proactive stance in favor of surgery:

1. Extirpation of the disease burden is better and easier in the early stage of the disease[18]
2. Marked and rapid improvement of patient's general condition after drainage of abscess,[18] and there is better response to ATT with faster healing
3. Immediate relief of compressive myelopathy
4. The disease may progress inspite of adequate chemotherapy
5. Deformities may occur or worsen inspite of chemotherapy
6. Stabilisation procedures, instrumentation can be carried out once the abscess has been drained and

debridement carried out
7. Rapid ambulation after surgery and stabilization procedures
8. Provision of adequate tissue sampling in patients with uncertain diagnosis

Aims of surgical management are:

1. Pain relief
2. Dural and neural decompression to prevent, stabilize or reverse a neurological deficit
3. Stabilisation the spinal column
4. To provide early ambulation, and thus prevent the complications of prolonged recumbency
5. Drainage of cold abscess

Unlike the cervical or thoracic segments, the tubercular pathology-afflicted lumbar spine is amenable to surgical procedures by posterior approach. There is no need to transgress the abdominal cavity. The retroperitoneal approach too may provide adequate access to the lumbar spine. The various types of tubercular involvement and approach thereof can be considered as follows (Figures 8, 9, 10, 11, 12, 13, 14).

1. Spondylodiscitis with formation of cold abscess and minimal vertebral destruction: An approach to evacuate pus by posterior (interlaminar or translaminar access) approach, combined with pedicle screw stabilization provides immediate pain relief and stability, resulting in early ambulation
2. Spondylodiscitis with significant vertebral destruction and neurological deficit: Here, the destroyed vertebra can be excised, granulations curetted and anterior column support given by

Figure 8
Immediate postoperative management showing pedicular screw stabilisation

Figure 9
MRI showing destruction of L4 with involvement of adjacent disc space

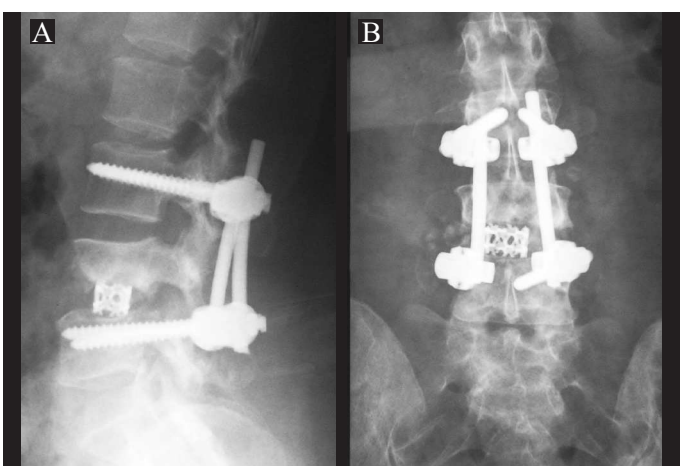

Figure 10 A&B
Postoperative spine radiograph showing titanium intervertebral cage and pedicular screws

Figure 11
Lumbar spine involvement showing involvement of L4 & L5 bodies

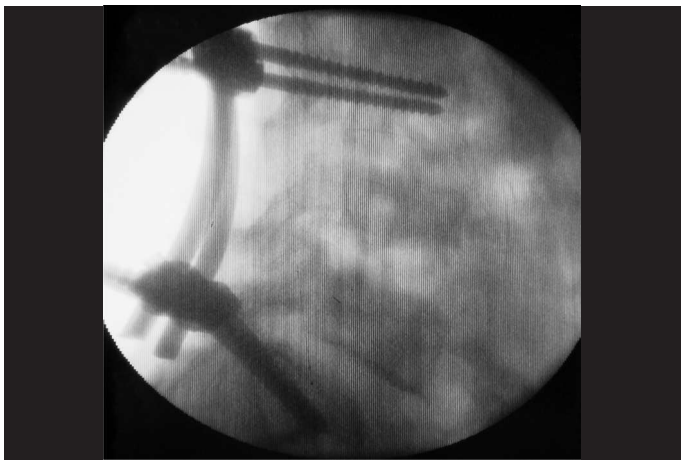

Figure 12
Immediate postoperative appearance after L3-S1 fixation

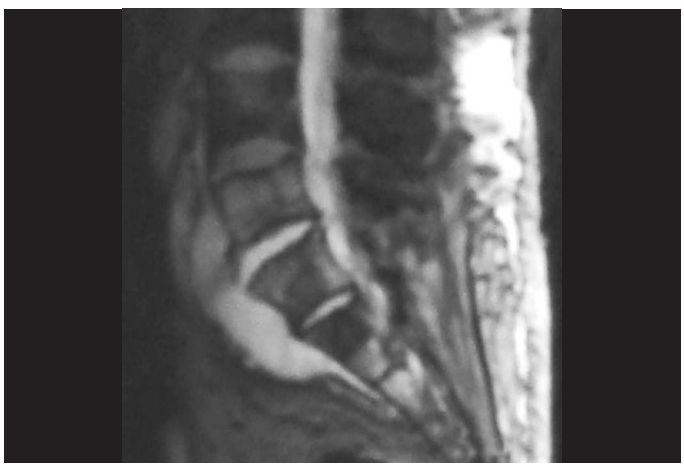

Figure 13
Lumbar spine MRI showing L5 and S1 involvement

Figure 14
Postoperative radiograph showing L4-S1 fixation

PEEK/titanium spacer, combined with pedicle screw fixation
3. Atypical involvement in the form of extradural granulomas causing vertebral scalloping without discal involvement: Here, laminectomy, neural decompression and insertion of bone graft with pedicle screw stabilization is carried out
4. Extensive sacral involvement will require spinopelvic fixation (Galvaston technique)
5. Extradural granulomas (non-osseous spinal canal involvement) causing lumbar canal stenosis requires decompressive laminectomy (Figure 15)

Figure 15
Extradural granuloma causing compression of theca requiring decompression

Instrumentation provides immediate, rigid fixation of the involved spine which allows healing, and prevents progression of deformity. Mycobacteria are less adherent of the inert hardware, and instrumentation can safely be carried out in the presence of active infection, after curettage of the diseased segment.[19,20] Lee et al. reported good bony fusion in 15 out of sixteen patients after one year of surgery that included debridement and instrumentation.[21] Instrumentation can be carried out by percutaneous minimally invasive technique.[22] In situations with extensive involvement of sacrum, stabilization can be achieved by Galveston technique of ilio-lumbar fixation. Skip lesions will require patient-specific treatment planning, encompassing the segments in a single or more than one construct.

Abscess drainage

Drainage of psoas abscess can be carried out posterolaterally through the Petit's triangle, or medial to the anterior superior iliac spine. Drainage is extraperitoneal. In rare cases when the cold abscess points

below the inguinal ligament, the incision is made over the abscess. A paravertebral abscess can be drained posteriorly at the time of decompression and spinal fixation.

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