REVIEW ARTICLE

Outcome of Conservative Versus Surgical Management of Pott's Spine

Charde P[1],Chandrakar A, Vijan K[1] , Jadhav M[1] ,Baheti S[1], Kumbhare V[1], Kawde P[2]

1 – Junior Resident, Department of Orthopedics, JNMC, Sawangi, Wardha, M.S., India.
2 - SeniorResident, DepartmentofOrthopedics, JNMC, Sawangi, Wardha, M.S., India.

Abstract

Tuberculosis of the bones and joints stays uncommon, accounting for simplest about 1 to a few% of all cases of tuberculosis, with comparable occurrence time tendencies.Antituberculous chemotherapy is the mainstay of spinal TB remedy. Radical debridement mixed with fusion and instrumentation is utilized in patients with Neurological deficit, caseous abscesses, sequestered bone formation, instability or a kyphotic angle of more than 30°.But, an issue stays concerning the surgical approach and modality of instrumentation. Pott's disorder of the backbone commonly involves the mid thoracic spine. Tubercle bacilli attain the spine either hematogenously or thru lymphatic channels from the paravertebral lymph nodes or pleural area. Pott's ailment of the backbone affect active length of existence, it is an ailment of younger person and formative years. In the current study conventional medical therapy was reviewed in comparison to that of surgical therapy for Pott's spine.

***Keywords**: Pott's spine, conventional, surgical*

Address for correspondence: Dr. Pratik Kawde, Junior Resident, Department of Orthopedics, JNMC, Sawangi, Wardha, M.S., India. dranurag0009@gmail.com

Introduction

Tuberculosis of the bones and joints stays uncommon, accounting for simplest about 1 to a few% of all cases of tuberculosis, with comparable occurrence time tendencies.[1,2,3,4] The present day document from the sector health agency (WHO) on tuberculosis manage indicates that tuberculosis instances have commenced to say no international for the primary time.[5] Further, the WHO Tuberculosis Surveillance and tracking document issued in 2012 shows a decrease within the occurrence of tuberculosis in latest years.[6,7,8,9,10] Pain is the maximum commonplace supplying manifestation. Antituberculous chemotherapy is the mainstay of spinal TB remedy.[11] Radical debridement mixed with fusion and instrumentation is utilized in patients with Neurological deficit, caseous abscesses, sequestered bone formation, instability or a kyphotic angle of more than 30°.[12] But, an issue stays concerning the surgical approach and modality of instrumentation. Pott's disorder of the backbone commonly involves the mid thoracic spine. Tubercle bacilli attain the spine either hematogenously or thru lymphatic channels from the paravertebral lymph nodes or pleural area.[13] Pott's ailment of the backbone affect active length of existence, it is an ailment of younger person and formative years.[7,13] Weight bearing joints (spine 40%, hips 13%, and knee 10%) are most usually affected.[14,15]

Impediments of Pott's spine

1. Paraplegia: most dreaded problem. It can occur because of mechanical stress on spinal twine via abscess, granulation tissue, tubercular debris, caseous tissue, or mechanical instability via pathological subluxation/dislocation.
2. Edema of spinal cord, myelomalacia or direct involvement of meninges and spinal wire with the aid of tubercular infection/inflammation may additionally lead to neural loss.
3. Infective thrombosis/endarteritis of spinal vessels.
4. Kyphosis.
5. Hemiplegia.
6. Monoplegia.[16,17,18,19]

Medical management of Pott's spine

Pharmacological therapy usually consists of triple-drug antituberculous chemotherapy (p-amino salicylic acid, streptomycin, and isoniazid) and plays a main role in TB treatment, if the lesion is without complications and limited to the vertebrae.[20] Some studies have reported the worsening of existing symptoms or the appearance of new lesions in patients who initially responded well to antituberculous therapy.[21,22] However, with the appropriate indications, surgery is considered superior for preventing neurological deterioration, maintaining stability, and early recovery.[11,23,24,25,26,27,28,29,30,31,32]

Specific Drugs

Streptomycin

This is one of the aminoglycosides, it is bactericidal, it's far almost entirely reserved for remedy of tuberculosis in aggregate with different capsules. It's given intramuscularly in a well-known dose of one gram in line with day, reduced to 500- 700 mg in patient underneath 50 kg body weight. It is excreted through the kidneys and must be used cautiously in patient with impaired renal feature. Adverse effects are ototoxicity and to a lesser extent nephrotoxicity. It is contraindicated in patients with myasthenia Graves as it can impair neuromuscular transmission.

Isoniazid drugs

Dose 5mg/kg/day. It's miles cheap and enormously effective, it ought to be included in any antituberculous routine except there may be a selected contra-indication. It must take delivery of carefully in patient with impaired liver or kidneys characteristic, in affected person with epilepsy, patient with psychosis or alcoholism it's miles contra-indicated in patient with drug-prompted liver disorder. The most serious side impact of isoniazid is peripheral neuritis, which can be prevented by way of vitamin B6 l0 mg in line with day.

Rifampicin

Capsules or pills, 150 mg, 300 mg Dose: 10 mg/kg/day (maximum of 600 mg/day) as a minimum half of an hour earlier than meal. It's contra-indicated in jaundiced affected person, it need to be used cautiously in pregnancy, hepatic impairment, alcoholism, and we have to display liver characteristic. Rifampicin induces hepatic enzymes which boost up the metabolism of numerous pills which include estrogens, corticosteroids, phenytoin, sulphonylureas, and anticoagulants. The effectiveness of oral contraceptives is decreased and alternative circle of relatives planning recommendation should be presented.

The most serious side effect are hepatitis, thrombocytopenia, and the affected person must be warn that orange-pink discoloration of body secretions may additionally arise.

Thiacetazone

150 mg + 300 mg isoniazid

Dose: 150 mg/day orally.

It is indicated in treatment of tuberculosis in combination with different pills. It is contraindicated in impaired liver characteristic.

Adverse effect: Nausea, dyspepsia, hepatitis (rare) haemolysis (uncommon) and skin rush.

Pyrazinamide capsules 500mg

Dose 35mg/kg/day

It is a bactericidal drug simplest energetic towards intracellular dividing form of mycobacterium tuberculosis, it exert its impact most effective in the first two or three months. It is specifically beneficial in tuberculous meningitis due to excellent meningeal penetration.

Contra-indication in liver sickness. It ought to be carefully used in impaired renal function, diabetes, and gout.

Facet impact: hepatoxicity, jaundice, liver failure anorexia, nausea & vomiting, sideroblastic anemia, urticaria, arthralgia and gout.

Ethambutal: 140 mg

Dose 25 mg/kg/day for no extra than months in the initial segment and 15 mg/kg/day inside the continuation section.

Cautions: lessen dose in renal impairment, aged and pregnancy.

Contra-indicated: in younger youngsters beneath 6 years of age and antique patients.

Adverse impact: Optic neuritis, pink/inexperienced shade blindness, peripheral neuritis- patient ought to slop the drug and record any visual signs and symptoms. Medical treatment has proven nice impact in around 60% of uncomplicated instances of Pott's spine.[33]

Tuli et al. stated neurological recuperation in 30% to 40% of patients with neurological deficits, submitted to conservative remedy.[34,35] Within the 2010 WHO hints, ST is protected in category I of treatment and a routine in 2 stages is usually recommended for this class. In the first 2 months (intensive section) 4 first-line tablets (isoniazid, rifampicin, pyrazinamide and ethambutol or streptomycin) have to be administered, and in the following four months (continuation phase), isoniazid and rifampicin.[36,37,38] The WHO and the American Thoracic Society (ATS), attending to the difficulty of tracking the therapeutic response in ST, advocate on this unique case, the prolongation of the continuation phase for a in addition 3 months, for a total of 9 months of treatment.[38] The presence of comorbidities also does no longer justify any therapeutic change to this regimen, even though ability drug interactions, mainly with antiretroviral, have to be taken into consideration.[39]

Directly observed therapy short course (DOTS)

Direct observation of the medication intake is the high-quality approach to make sure that the patients comply with the routine, being these days facilitated by means of the intermittent drugs regimens which allow the medication consumption for two or 3 instances every week.[36,40]

Multi drug resistant tuberculosis (MDR-TB)

Isoniazid and rifampicin resistance is termed MDR-TB and, if similarly, there is resistance to a fluoroquinolone or at the least one 2nd-line injectable drug, it is termed substantially multi drug resistant tuberculosis (XDR-TB).[41,42] The prevalence of resistance in ST remains unknown.[39] As there are not any particular guidelines for the remedy of MDR-TB in spinal infection, the remedy of this pathology ought to be accompanied by way of the WHO or ATS guidelines for the remedy of MDR pulmonary infection, which advocates a healing routine lasting no much less than 18-24 months. Preferably treatment must be primarily based on DST.[43,44] A examine with the aid of Rajasekaran describes five factors predictive of fulfillment inside the treatment of spinal MDR-TB, which include:

i. Progressive medical development at 6 months,
ii. Radiographic development throughout treatment,
iii. Multi-resistant contamination to less than three tablets,
iv. The need to use four or fewer second-line tablets and,
v. No want to change the regimen at some stage in treatment.[41]

Treatment options for Pott's spine without neurological dearth

Conservative treatment regarding the usage of two or three antituberculous tablets with bed rest or ambulant chemotherapy, the novel clearance of a lesion and the Hong Kong method of anterior debridement and fusion or anterior debridement alone, gave comparable lengthy-time period outcomes without a late relapse or past due-onset paraplegia.[45] The most effective benefit of the novel operation changed into much less overdue deformity compared with debridement.[45] Tuberculosis of the spine is a medical disease and ought to be treated with antituberculous capsules, relaxation and mobilization with an appropriate orthosis.[46,47]

Therapeutic options for treatment of neurologically complicated Pott's spine

Surgical remedy is practiced international even for a minimal grade of neurological deficit. Tuli found neurological recovery in 30% to forty% of sufferers having drug remedy and rest for four to 6 weeks whilst watching for surgical treatment or being made match for it.[34]

Correction of kyphosis in active disease

This is indicated while the affected person gives with a severe kyphosis of $\geq 60°$, or if the kyphosis is possibly to heal with this amount of deformity. This could arise if 3 or extra vertebrae are worried with a loss of 1.5 or more vertebral bodies in the dorsal or dorso-lumbar backbone.[48,49] Youngsters more youthful than seven years of age, with three or more affected vertebral bodies in the dorsal or dorso-lumbar backbone and two or more 'at-hazard symptoms', are likely to have progression of the kyphosis with boom and have to go through correction.[50,51] During the procedure the spinal cord have to be saved under vision in case it have to become elongated. Correction of the kyphosis may be executed by way of:

a) A one-stage transpedicular method; [52]

b) 1 stage anterior decompression and bone grafting followed by way of correction of the kyphosis and posterior instrumentation [53] or
c) A single-level correction by means of an extra pleural anterolateral approach.[49,54]

Louw achieved transthoracic anterior decompression and vascularized rib grafting in the course of the identical process, or weeks later, through shortening of the posterior column with a multilevel posterior osteotomy, instrumentation and fusion. The imply pre-operative kyphosis of 56° turned into corrected to 27°, which healed at 30°.[55]

Surgical Treatment of Pott's Paraplegia

Undoubtedly neurological complications related to tuberculous spondylitis do recover in a few instances after scientific treatment alone. The surgical technique objectives on the debridement of tissues, decompression of neurological structures and stabilization of the backbone. Those aims may be completed by:
1. Debridement and/or decompression and anterior fusion.
2. Debridement and/or decompression and posterior fusion.
3. Debridement and/or decompression and anterior fusion observed with the aid of instrumented simultaneous or sequential posterior arthrodesis.
4. Instrumented posterior arthrodesis followed with the aid of debridement and/or decompression and anterior fusion.[56]
According to distinct reviews, considering the subsequent elements might be useful with a view to pick the approach.[1,57]
1-affected person's age
2-Presence of scientific co-morbidities
3- Region of bony destruction (anterior, posterior or each)
4- Location of the compressive lesion with admire to the dura (anterior, posterior or each)
5- Density of the compressive lesion (pus or strong extradural lesion)
6- Patient's bone inventory
7- Variety of segments involved
8- Degree of kyphotic deformity
9- Vicinity of involvement (craniovertebral junction, cervical, cervicothoracic junction, thoracic, thoracolumbar junction, upper lumbar, cauda equina).

Table 1: showing indications of surgery in patients with Pott's spine.

Rapid onset paraplegia
Worsening paraplegia despite conventional therapy
Paraplegia despite continuation of conventional therapy
Recurrent paraplegia
Paraplegia due to disease of posterior neural canal
Spinal tumor syndrome when diagnosis is doubtful
Cases where conservative management is not possible.

Indications of surgical treatment of Pott's spine is depicted in table 1. In patients without evidence of neurological compromise, the remedy is composed in anti-tuberculosis capsules and bracing, supplied the sagittal alignment of the spine is preserved.[58] Garg et al.[59] and Kumar et al.[60] advocated the usage of the posterior method by myself to carry out spinal canal decompression and abscess drainage at some stage in the equal degree as internal fixation and fusion. In sum, the surgical control of regular spinal tuberculosis rests on two standards:

1. debridement with spinal twine decompression and,
2. Stabilization of the spine.

Those principles are also accompanied in some developing nations, in which surgical remedy can prevent the long-time period improvement of severe kyphosis.[61] Spinal TB is traditionally handled surgically by way of anterior instrumented fusion,[62] combined anterior-posterior method,[63] extra pleural anterolateral technique or posterior manner most effective.[64] The probably motive for this might be that pedicle screws cross the vertebral body pedicle, the most powerful a part of the vertebral body, presenting 3-dimensional correction and strengthening the spinal three-column balance, which is a whole lot stronger than anterior instrumentation.[65] Excessive pulmonary difficulty quotes had been stated in previous anterior thoracic tuberculosis surgical procedures.[66] The risk of harm to the

pulmonary parenchyma, along with lung laceration, atelectasis, pneumonia or empyema is significant issues.[67,68]

Anterior approach

Inside the amazing majority of cases, the posterior elements of the spine aren't affected on this contamination. Granulation tissue specifically reasons the compression of neurological systems, caseous material and abscesses with anterior origin. It's far inside this idea's help that the anterior method turned into popularized by way of Kandwal et al.[69] The authors described 93% of fusion rate in the mechanically use of debridement via anterior method.[70,71] For the same approach, several authors described a good neurological recuperation, absence of recurrence of the infection at lengthy-time period observe-up, and corrections of the kyphotic attitude between 18° and 20°.[72,73] The achievement of anterior debridement observed through fusion has been proven to be inversely associated with the length of the reconstruction.[74,75]

Posterior approach

Its exceptional advantages are the familiarity of the method and the decrease morbidity, making sure top-quality exposure for circumferential decompression both by way of transforaminal and by transpedicular path. It additionally allows the extension of the instrumentation to more than one ranges and provides a greater protection for the anterior reconstruction, keeping off the complications inherent to the opening of the thoracic and abdominal cavities.[41,76]

Combined approaches

Numerous research describe precise to wonderful consequences with anterior decompression accompanied by using anterior or posterior instrumentation.[74] Posterior instrumentation after anterior decompression and reconstruction, in a simultaneous or sequential manner, is indicated to prevent complications related to the anterior graft, in patients with long segments affected (> 4 segments), in cases of pan vertebral ailment or while good sized kyphosis correction is important.[41]

Osteotomies and vertebral resection

Remedy of established kyphotic deformities may be hard and requires osteotomies for good enough correction, which may be executed via anterior-best, posterior-handiest or mixed techniques.[74]Rajasekaran describes a final-beginning wedge osteotomy that is powerful for the correction of extreme put up tubercular kyphosis permitting deformity correction with minimal complications.[78] Osteotomies are technically worrying and feature a hardship charge that is as high as 40%, together with dural tears, temporary or everlasting neurological deficits, pulmonary headaches, and blood loss. For that reason, this manner is best advocated in the case of extreme kyphosis, each inside the active and restoration ailment.[69]

Minimal invasive spine surgery

Minimally invasive strategies are automatically utilized in degenerative pathology and have been more and more utilized in ST.[78] Video assisted thoracoscopy is accomplished to decrease the headaches associated with thoracotomy, with similar outcomes to the open techniques in scoliosis. This minimal invasive approach is likewise being utilized in surgical control of spinal tuberculosis however few studies have addressed its function.[69,79]

Complications of surgery

1. Superficial wound infection.
2. Transient intercostal neuralgia.
3. Laceration of lung parenchyma.
4. Pulmonary atelectasis.
5. Pleural effusion.
6. Empyema.
7. Pneumothorax.[80]

Multiple Vertebral Disease

A couple of stage spinal TB may additionally occur as continuous involvement of to 4 contiguous vertebrae, or may also affect special levels in special parts of the backbone. The lesion in continuity usually is visible in immunodeficient sufferers and in patients with hemoglobinopathies.[73,81]

The non-operative treatment of patients with multilevel spinal TB without neurologic deficit is the same as the remedy of an affected person with a normal spinal TB. Accurate neurologic exam and MRI before scheduling surgical procedure in patients with multilevel spinal TB

is essential to determine the level of compression.[82]

Several surgical strategies were used for the management of multilevel spinal TB. Cavuşoğlu et al. said long-time period outcomes on anterior radical debridement, decompression, and fusion using anterior spinal instrumentation and tibial allograft replacement for control of multilevel spinal TB in 22 sufferers.[83]

Conclusion

Spinal tuberculosis (Pott's disease) predominantly impacts the thoracic backbone and is often identified late. The remedy is based chiefly on anti-tuberculosis capsules with the equal regimens as for pulmonary tuberculosis, although a remedy-length of 9 months is often used in everyday practice. Inside the absence of a neurological emergency, surgical procedure is indicated to prevent secondary spinal cord compression in patients with great abscess formation and/or sagittal spinal crumble. Both the anterior and the posterior processes may be used. Additional posterior fusion is needed best inpatients with marked osteolysis chargeable for severe instability.

Conflict of Interest: *None declared*
Source of Support: *Nil*

References

1. Tuli SM. Tuberculosis of the spine: a historical review. ClinOrthopRel Res. 2007; 460:29–38.
2. Tuli SM. Historical aspects of Pott's disease (spinal tuberculosis) management. Eur Spine J 2013;22(4):529–38.
3. Abuaku B, et al: A comparative analysis of tuberculosis treatment success between Hunan Province of China and Eastern Ghana. Med PrincPract 2010; 19: 451–456.
4. Nagashima H, Yamane K, Nishi T, et al: Recent trends in spinal infections: retrospective analysis of patients treated during the past 50 years. IntOrthop 2010; 34: 395–399.
5. Global tuberculosis control: WHO Report 2011. Available at http://www.euro.who.int (accessed on 15/08/2012).
6. European Centre for Disease Prevention and Control/WHO Regional Office for Europe. Tuberculosis surveillance and monitoring in Europe, Report 2012.Available at http://www.euro.who.int (accessed on 15/08/2012).
7. World Health Organization. Tuberculosis in the present time. A global overview of tuberculous situation TUB/WHO. Retrieved from http://apps.who.int/iris/bitstream/10665/60551/1/WHO_TB_91.158.pdf.
8. Thomas MD. Mycobacterial diseases. In Harrison's Principles of lnternal Medicine. Eds Wilson J. D., Braunwald E, Isselbacher K.J., Petcrsdrof R.G., Martin J.B., Fauci AS., Root R.K., By Me Graw. Mill, Inc. 12th. edn. Vol I, 1991: 637 - 45.
9. Ferrer M, Torres L, Ramirez O, et al. Tuberculosis of the spine. A systematic review of case series. IntOrthop 2012; 36:221–31.
10. Jin D, Qu D, Chen J, et al: One-stage anterior interbody autografting and instrumentation in primary surgical management of thoracolumbar spinal tuberculosis. Eur Spine J 2004; 13: 114–121.
11. Jain A. Tuberculosis of the spine: a fresh look at an old disease. J Bone Joint Surg Br. 2010; 92: 905–913.
12. Swanson A, Pappou I, Cammisa F et al: Chronic infections of the spine: surgical indications and treatments. ClinOrthopRelat Res 2006; 444: 100–106.
13. Henry L.J. Tuberculosis and Sarcoidosis of bones and joints. In Metabolic, Degenerative and inflammatory disease of bones and joints, Eds. Henry L.D., Lea and Febiger. Philadelphia 1972. 953 – 1005.
14. Watts H, Lifeso R. Current Concepts Review - Tuberculosis of Bones and Joints. J Bone Joint Surg Am 1996; 78(2): 288-99.
15. Pertuiset E, Beaudreuil J, Liote F et al. Spinal tuberculosis in adults. A study of 103 cases in a developed country, 1980– 1994. Medicine (Baltimore) 1999; 78: 309-20.
16. Dhammi I, Singh S, Jain A. Hemiplegic/monoplegic presentation of cervical spine (C1-C2) tuberculosis. Eur Spine J 2001; 10:540-4.
17. Jain A. Treatment of tuberculosis of the spine with neurologic complications. ClinOrthop2002; 398:75-84.
18. Guven O. Severe kyphotic deformity in tuberculosis of the spine. IntOrthop1996; 20:271.
19. Rajasekaran S, Shanmugasundaram T. Prediction of the angle of gibbus deformity in tuberculosis of the spine. J Bone Joint Surg [Am] 1987; 69-A: 503-9.
20. Al Muhlim F, Ibrahim E, Hassan EL. Magnetic resonance imaging of tuberculous spondylitis. Spine. 1995; 20:2287–2292.
21. Cheng V, Ho P, Lee R et al. Clinical spectrum of paradoxical deterioration during antituberculosis therapy in non-HIV-infected patients. Eur J ClinMicrobiol Infect Dis. 2002; 21:803–809.
22. Park J, Kim Y, Kwon C et al. Paralysis developing as a paradoxical response during the treatment for tuberculous spondylitis: a case report. Ann Rehabil Med. 2014; 38(3):405–409.
23. Rezai A, Lee M, Cooper P. Modern management of spinal tuberculosis. Neurosurgery. 1995; 36:87–97.
24. Ghadouane M, Elmansari O, Bousalmame N et al. Role of surgery in the treatment of Pott's disease in adults: Apropos of 29 cases. Rev ChirOrthopReparatriceAppar Mot. 1996; 82:620–628.
25. Zou M, Li J, Lv G et al. Treatment of thoracic or lumbar spinal tuberculosis complicated by resultant listhesis at the involved segment. ClinNeurolNeurosurg. 2014; 125:1–8.
26. Friedman B. Chemotherapy of tuberculosis of the spine. J Bone Joint Surg Am. 1966; 48:451–474.
27. Kaplan C. Conservative therapy in skeletal tuberculosis: an appraisal based on experience in South Africa. Tubercle. 1959; 40: 335–368.
28. Tuli S, Srivastava T, Verma B et al. Tuberculosis of spine. ActaOrthop Scand. 1967; 38:445–458.
29. Guerado E, Cerván AM. Surgical treatment of spondylodiscitis. An update. IntOrthop. 2012; 36(2):413-20.
30. Luk K. Tuberculosis of the spine in the new millenium. Eur Spine J. 1999; 8(5):338-45.
31. Bhojraj S, Nene A. Lumbar and lumbosacral tuberculous spondylodiscitis in adults. Redefining the indications for surgery. J Bone Joint Surg Br 2002; 84:530-4.
32. Gao Z, Wang M, Zhu W et al. Tuberculosis of ultralong segmental thoracic and lumbar vertebrae treated by posterior fixation and cleaning of the infection center through a cross-window. Spine J. 2015; 15(1):71–78.
33. Ekinci S, Totar O, Akpancar S et al. Spinal Tuberculosis. Journal of Experimental Neuroscience 2015:9 89–90.
34. Tuli S. Treatment of neurological complications in tuberculosis of the spine. J Bone Joint Surg [Am] 1969; 51-A:680-92.
35. Jain A, Kumar J. Tuberculosis of spine: neurological deficit. Eur Spine J2013;22(4):624–33.
36. Garg R, Somvanshi D. Spinal tuberculosis: A review. J Spinal Cord Med. 2011; 34: 440-454.
37. Bass J, Farer L, Hopewell P et al. Treatment of tuberculosis and tuberculosis infection in adults and children. American Thoracic Society and The Centers for Disease Control and Prevention. Am J RespirCrit Care Med 1994; 149: 1359-1374.
38. WHO (2010) Treatment of tuberculosis Guidelines (4th edn), World Health Organization. Retrieved from http://apps.who.int/iris/bitstream/10665/44165/1/9789241547833_eng.pdf?ua=1.

39. Sulis G, Centis R, Sotgiu G et al. Recent developments in the diagnosis and management of tuberculosis. NPJ Prim Care Respir Med 2016; 26:160-78.
40. Rajasekaran S, Khandelwal G. Drug therapy in spinal tuberculosis. Eur Spine J. 2013, 22(4): 587-593.
41. Rajasekaran S, Kanna R, Shetty A. Pathophysiology and treatment of spinal tuberculosis. JBJS Rev 2014;2(9):1-4.
42. Jutte P, Castelein R. Complications of pedicle screws in lumbar and lumbosacral fusions in 105 consecutive primary operations. Eur Spine J 2002; 11: 594-598.
43. Kizilbash Q, Seaworth B. Multidrug resistant tuberculous spondylitis: A review of the literature. Ann Thorac Med. 2016; 11: 233-236.
44. Agrawal V, Patgaonkar P, Nagariya S. Tuberculosis of spine. J Craniovertebr Junction Spine 2010; 1: 74-85.
45. Darbyshire J. A 15-year assessment of controlled trials of the management of tuberculosis of the spine in Korea and Hong Kong: thirteenth report of the Medical Research Council Working Party on Tuberculosis of the Spine. J Bone Joint Surg [Br] 1998; 80-B: 456-62.
46. Tuli S. Results of treatment of spinal tuberculosis by "middle-path" regime. J Bone Joint Surg [Br] 1975; 57-B: 13-23.
47. Kotil K, Alan M, Bilge T. Medical management of Pott disease in the thoracic and lumbar spine: a prospective clinical study. J Neurosurg Spine 2007; 6:222-8.
48. Danchaivijitr N, Temram S, Thepmongkhol K et al. Diagnostic accuracy of MR imaging in tuberculous spondylitis. J Med Assoc Thai 2007; 90:1581-9.
49. Jain A, Maheshwari A, Jena S. Kyphus correction in spinal tuberculosis. ClinOrthop2007; 460:117-23.
50. Rajasekaran S. Buckling collapse of the spine in childhood spinal tuberculosis. ClinOrthop2007; 460:86-92.
51. Rajasekaran S. The natural history of post-tubercular kyphosis in children: radiological signs which predict late increase in deformity. J Bone Joint Surg [Br] 2001; 83-B: 954-62.
52. Bezer M, Kucukdurmaz F, Guven O. Transpediculardecancellation osteotomy in the treatment of posttuberculous kyphosis. J Spinal Disord Tech 2007; 20:209-15.
53. Moon M, Woo Y, Lee K et al. Posterior instrumentation and anterior interbody fusion for tuberculous kyphosis of dorsal and lumbar spines. Spine 1995; 20:1910-16.
54. Jain A, Dhammi I, Jain S et al. Kyphosis in spinal tuberculosis: prevention and correction. Indian J Orthop2010; 44:127-36.
55. Louw J. Spinal tuberculosis with neurological deficit: treatment with anterior vascularized rib grafts, posterior osteotomies and fusion. J Bone Joint Surg [Br] 1990; 72-B: 686-93.
56. Esteves S, Catarino I, Lopes D et al. Spinal Tuberculosis: Rethinking an Old Disease. J Spine 2017; 6(1):1-12.
57. Ito H, Suchiya J, Asami G. A new radical operation for Pott's disease: report of ten cases. J Bone Joint Surg Am 1934; 16:499-515.
58. Di Martino A, Papapietro N, Lanotte A et al. Spondylodiscitis: standards of current treatment. Curr Med Res Opin 2012; 28:689–99.
59. Garg B, Kandwal P, Nagaraja UB, et al. Anterior versus posterior procedure for surgical treatment of thoracolumbar tuberculosis: a retrospective analysis. Indian J Orthop 2012; 46:165–70.
60. Kumar M, Joseph B, Manur R. Isolated posterior instrumentation for selected cases of thoraco-lumbar spinal tuberculosis without anterior instrumentation and without anterior or posterior bone grafting. Eur Spine J 2013; 22:624–32.
61. Djientcheu V, Mouafo Tambo F, Ndougsa I et al. The role of surgery in the management of Pott's disease in Yaoundé. A review of 43 cases. OrthopTraumatolSurg Res 2013; 99:419–23.
62. Benli I, Acaroglu E, Akalin S et al. Anterior radical debridement and anterior instrumentation in tuberculosis spondylitis. Eur Spine J 2003; 12: 224–234.
63. Sundarajan G, Behera S, Ravi V et al. The role of posterior stabilization in the management of tuberculosis of the dorsal and lumbar spine. J Bone Joint Surg Br 2003; 85: 100–106.
64. Bezer M, Kucukdurmaz F. Transpediculardecancellation osteotomy in the treatment of posttuberculous kyphosis. J Spinal Disord Tech 2007; 20: 209–215.
65. Cui X, Zheng Y, Chen X et al. Outcomes of different surgical procedures in the treatment of spinal tuberculosis in adults. Med PrincPract. 2013; 22:346-50.
66. Kim S, Sohn M, Ryoo J et al. Clinical analysis of video-assisted thoracoscopic spinal surgery in the thoracic or thoracolumbar spinal pathologies. Journal of Korean Neurosurgical Society 2007; 42: 293–299.
67. Jayaswal A, Upendra B, Ahmed A. Video-assisted thoracoscopic anterior surgery for tuberculous spondylitis. Clinical Orthopaedics and Related Research 2007; 460: 100–107.
68. Huang T, Hsu R, Chen S et al. Video-assisted thoracoscopic surgery in managing tuberculous spondylitis. Clinical Orthopaedics and Related Research 2000; 379: 143–153.
69. Kandwal P, Vijayraghavan G, Jayaswal A. Management of tuberculous infection of the spine. Asian Spine J 2016; 10: 792-800.
70. Varatharajah S, Charles Y, Buy X et al. Update on the surgical management of Pott's disease. OrthopTraumatolSurg Res 2014; 100: 229-235.
71. Hodgson A, Stock F, Fang H et al. Anterior spinal fusion. The operative approach and pathological findings in 412 patients with Pott's disease of the spine. Br J Surg 1960; 48: 172-178.
72. Benli I, Kaya A, Acaroalu E. Anterior instrumentation in tuberculous spondylitis: Is it effective and safe? ClinOrthopRelat Res 2007; 460: 108-116.
73. Rajasekaran S, Soundarapandian S. Progression of kyphosis in tuberculosis of the spine treated by anterior arthrodesis. J Bone Joint Surg Am 1989; 71: 1314-1323.
74. Issack P, BoachieAdjei O. Surgical correction of kyphotic deformity in spinal tuberculosis. IntOrthop 2012; 36: 353-357.
75. Upadhyay S, Saji M, Sell P et al. Longitudinal changes in spinal deformity after anterior spinal surgery for tuberculosis of the spine in adults. A comparative analysis between radical and debridement surgery. Spine 1994; 19: 542-549.
76. Zhang H, Li J, Zhao S et al. Surgical management for thoracic spinal tuberculosis in the elderly: posterior only versus combined posterior and anterior approaches. Arch Orthop Trauma Surg 2012; 132: 1717-1723.
77. Rajasekaran S, Vijay K, Shetty A. Single stage closing opening wedge osteotomy of spine to correct severe post-tubercular kyphotic deformities of the spine: A 3year follow up of 17 patients. Eur Spine J 2010; 19: 583-592.
78. Kandwal P, Garg B, Upendra B et al. Outcome of minimally invasive surgery in the management of tuberculous spondylitis. Indian J Orthop 2012; 46: 159-164.
79. Pande K, Babhulkar S. Atypical spinal tuberculosis. ClinOrthopRelat Res 2002; 1: 67-74.
80. Zhong W, Xiong G, Wang B et al. Surgical Management for Thoracic Spinal Tuberculosis Posterior Only versus Anterior Video-Assisted Thoracoscopic Surgery. PLoS ONE 2015; 10(3): e0119759.
81. Rahimi-Movaghar V. Unusual Pott's disease with involvement of two separate levels of spine and delayed progressive kyphosis: a case report. Acta Med Iran 2001; 39:54-7.
82. Pandit H, Sonsale P, Shikare S et al. Bone scintigraphy in tuberculous spondylodiscitis. Eur Spine J 1999; 8:205-9.
83. Cavuşoğlu H, Kaya R, Türkmenoğlu O et al. A long-term follow-up study of anterior tibialallografting and instrumentation in the management of thoracolumbar tuberculous spondylitis. J Neurosurg Spine 2008; 8:30-8.