



SPINAL TUBERCULOSIS

SPİNAL TÜBERKÜLOZ

Murat KÖKEN¹,
Selçuk ÖZDOĞAN²,
Bekir Can KENDIRLIOĞLU³,
Burakhan KOCAMAN⁴

¹Surgeon of the Orthopaedics and Traumatology, Department of Orthopaedics and Traumatology, Gazi State Hospital, Samsun.

²Surgeon of Neurosurgery, Department of Neurosurgery, Dr.Lütfi Kırdar Kartal Training and Research Hospital, İstanbul

³Resident of Neurosurgery, Department of Neurosurgery, Dr.Lütfi Kırdar Kartal Training and Research Hospital, İstanbul

⁴Resident of Neurosurgery, Department of Neurosurgery, Ankara Numune Training and Research Hospital, Ankara

SUMMARY:

Spinal tuberculosis is involved 1-3 % of all cases of tuberculosis. Spinal tuberculosis is the most dangerous type of skeletal tuberculosis. When spinal column is involved, it can result with neurological deficit, kyphosis and spinal deformity. Although the development of more accurate imaging modalities helps the early diagnoses, we can still see late diagnosed tuberculosis patients. There is not a standard surgical procedure for these patients. Surgical planning must be made carefully, complication rates must be decreased and patients living conditions must be cared.

Key Words: Spinal tuberculosis, Pott disease, Tuberculosis

Level of evidence: Review article, Level V

ÖZET:

Spinal tüberküloz tüm tüberküloz vakalarının %1-3 ünü oluşturmaktadır. Spinal tüberküloz, iskelet sistemini tutan tüberkülozun en tehlikeli tipidir. Spinal tutulum sonrası nörolojik defisit, kifoz ve deformite oluşabilmektedir. Görüntüleme tekniklerinin giderek gelişmesi sayesinde erken teşhis konulabilmesine rağmen geç tanı almış spinal tüberküloz vakalarına halen rastlanmaktadır. Bu vakalara uygulanacak standart bir cerrahi prosedür bulunmamaktadır. Vertebra tutulumlarında cerrahi yaklaşım çok iyi planlanmalı, komplikasyon oranları en aza indirgenmeli ve hastanın yaşam kalitesine önem verilmelidir.

Anahtar Kelimeler: Spinal tüberküloz, Pott hastalığı, Tüberküloz,

Kanıt Düzeyi: Derleme, Düzey V

Address: Dr. Selçuk Özdoğan,
Dr.Lütfi Kırdar Eğitim ve Araştırma
Hastanesi, E-5 yolu üzeri, Cevizli,
Kartal, İstanbul.

Gsm: +90 506 763 71 73

E-mail: drselcukozdogan@hotmail.com

Received: 24th August, 2014.

Accepted: 18th November, 2014

INTRODUCTION:

Tuberculosis is an old disease as human history that reported to be seen at B.C.8000². When Robert Koch had proved tuberculosis bacillus at 1882, diagnosis and treatment of this disease had been developed. Spinal tuberculosis was first described by British surgeon Percival Pott at 1779¹⁵.

Spinal tuberculosis is the most seen type of extrapulmonary tuberculosis. It consist 1-3% of all type of tuberculosis⁹. Spinal tuberculosis could be diagnosed on multilevels at undeveloped countries, late diagnosed patients or medical therapy resistant cases. Kyphosis, instability and neurological deficit could be seen with vertebral injuries.

Spinal tuberculosis surgery has variations because there is not a standard protocol for the surgical treatment. Surgical approaches could be chosen as anterior, posterior or combined due to the spinal region, surgeons experience or medical centers protocol selection. Surgical treatment must be supported with medical therapy¹.

HISTORY:

Tuberculosis, which is as old as humanity itself, is reported to have first seen at 8000 BC when humans started living in groups and cattle were domesticated. Acid resistant bacilli were found on human skeletons which lived in Germany during this era. Similarly a girl who lived in a town called Dra' Abu el-Naga near river Nile around 3000 BC was treated using magic because her sputum contained blood. Investigation of her mummy revealed tuberculosis. Code of Hammurabi which was written around 2250 BC accepts tuberculosis as a divine punishment².

Symptoms of tuberculosis were first described by Hippocrates around 460-375 BC. Hippocrates used the word "Phitisie" which roughly meant decrepit. He described the clinical course of the disease, stated that it was more frequent between 18-35 years and listed food which could be used for treatment. Galenus of Pergammon who lived between 129-200 BC used the same word to describe the disease and stated that it was dangerous to be in the same room with these patients for they could transmit the disease. Avicenna who lived between 980-1038 AD in his book "El-kanun fi't-Tıbb", which was completed in 1025, states that this disease has human to human spread, mothers who breastfeed their children should be treated and rose essence and rose syrup could be use for treatment²¹.

Definition, causes and first steps in treatment of tuberculosis were realized by Dr. Rene Laennec's studies. Laennec, who also discovered the stethoscope, described the clinical course and pathology of a total of 393 pulmonary diseases including tuberculosis. A new era was opened in 1882 when Robert Koch showed the tuberculosis bacillus in the sputum. Robert

Koch later obtained a pure culture, created an experimental model in animals and reproduced the bacteria in infected animals. Robert Koch was given the Nobel prize in 1905². The bacteria, which was then known as bacterium tuberculosis, was named as M. Tuberculosis by Lehmann and Neuman in 1886 due to its fungal properties such as colony morphology and slow reproduction rate⁷.

Spinal tuberculosis was first described by English surgeon Percival Pott as a painful kyphotic deformity with paraplegia. Percival Pott described a patient as having "a sharp pain and numbness accompanied by a motor deficit in the back. Afterwards, the patient describes an unusual coldness and loss of sensation in the thigh. Following that, involuntary twitching is observed during the night. Urinary and fecal incontinence and erectile impotence develops. In the end the patient is rendered immobile¹³.

In 1908, two French scientists named Calmette and Guerin from the Pasteur Institute located in the city of Lille, successfully cultured the bacillus in a growth medium consisting of glycerined calf meat obtained from a cow with mastitis caused by Mycobacterium Bovis, bile and potato. In the following 13 years a total of 230 generations were created in order to weaken the bacteria and a vaccine against tuberculosis was made available in 1921. Scientific circles called this immunity-causing bacteria as Bacille Calmette-Guerin (BCG)¹⁸. Since that day the easily applied intradermal vaccine has become a reliable and cheap way of stopping this disease².

Antibiotherapy in tuberculosis starts with Walksman's discovery of streptomycin in 1944. However, the bacteria rapidly developed resistance to single antibiotherapy. In 1946 the effect of aminosalicylic acid was shown to be effective on the bacteria and in 1952 Robizek and Selikof discovered isoniazid and thus three-antibiotherapy which lasted for 18-24 months was made available. With the discovery of pyrazinamide in 1954, ethambutol in 1962 and rifampicin in 1966, total duration of treatment was reduced to six months²¹.

EPIDEMIOLOGY:

According to the data from Turkish Antituberculosis dispensary, total number of tuberculosis cases in 2015 were 20.535 and number of cases in 100.00 population were 28,5 in Turkey. Number of new cases were 18.753 and the ratio in 100.0 population was 26,0. Total number of cases in 2010 was reduced to 16.551 and its ratio in 100.0 population decreased to 22,5. Number of new cases was 15.183 and the ratio in 100.0 population was decreased to 20,6. In 238 (3,7%) of the cases there was vertebral involvement. 109 patients (45,8%) were male while 129 patients (54,2%) were females. There were no patients aged between 0-4. 3 patients were between 5-14, 20 patients were between 15-24, 35 patients were between 25-34, 20 patients were between 35-44, 40 patients were between

45-54, 51 patients were between 55-64 and 69 patients were older than 65²⁰.

PATHOGENESIS:

In tuberculous osteomyelitis, microorganisms are usually blood-borne and originate from an active visceral focus which is in the initial stage of the primary infection (Figure-1).



Figure-1. *Mycobacterium tuberculosis*
(From Prof. İ. Teoman Benli's archive).

Direct inoculation (to the ribs or vertebra near the tracheobronchial nodes from the pulmonary focus) or lymphatic spread is also possible. Osteal infection is usually solitary, it can be the only manifestation of the disease in some cases and may go unnoticed for years. Multifocal osteal involvement is seen in patients with acquired immune deficiency^{4,16}.

Tuberculous osteomyelitis is more destructive and harder to control compared to suppurative osteomyelitis. Histopathologic findings are the same as other sites in the body. Big macrophages with pale pink and irregular granulated cytoplasm are observed in specimens painted with hematoxyline eosine (Figure-2).

The nodule, which is formed by epithelioid histiocytes is surrounded by lymphocytes which produce the cytokines activating the macrophages. Older granulomas are surrounded by fibroblasts and connective tissue. Multinuclear giant cells are frequently found in these granulomas. These cells are formed by the fusion of 20 or more macrophages and have wide cytoplasm and multiple nuclei. In the granulomas caused by the tuberculosis bacillus or other infectious microorganisms, a central necrosis is observed due to hypoxia and free oxygen radicals. Macroscopically, these granulomas appear like cheese and thus named caseous necrosis (Figure-3)¹⁶.

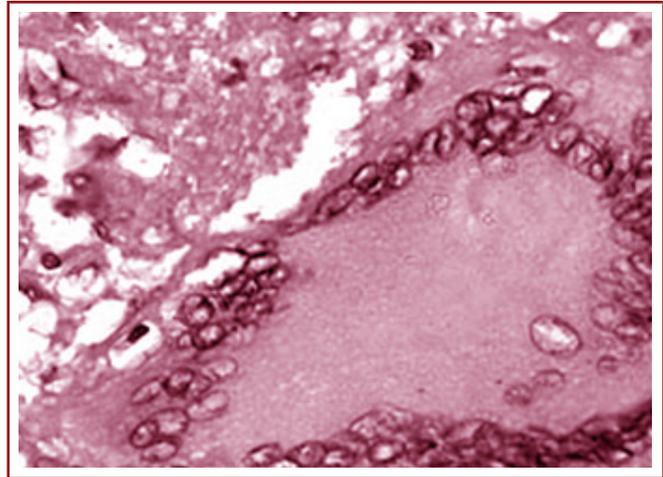


Figure-2. Histopathologic appearance of the tuberculosis
(From Prof. İ. Teoman Benli's archive).

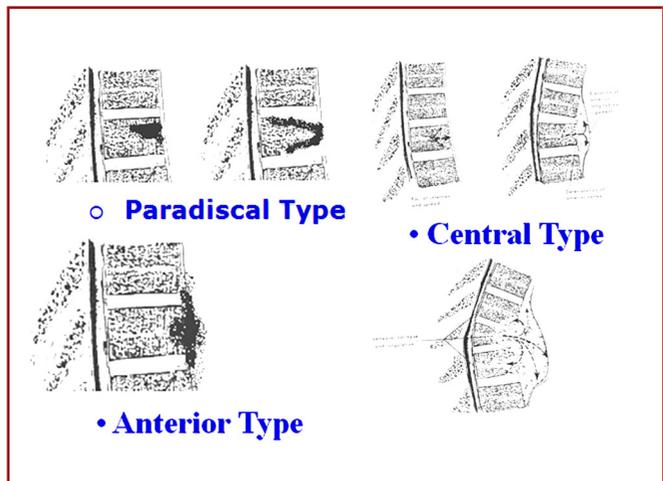


Figure-3. Spinal tuberculosis: types of affection
(From Prof. İ. Teoman Benli's archive).

CLINICAL COURSE:

Osteoarticular tuberculosis is caused by hematogenous, lymphatic or direct spread to the skeletal system from a pulmonary or non-pulmonary focus. It forms 1-2% of all tuberculosis cases. Although its incidence increases in the fourth decade, it is the same between male and female and HIV (+) and (-) patients.

Vertebra is the most common site of tuberculosis in the musculoskeletal system and frequently causes pain, deformities and neurological deficits. In the adults, tuberculous spondylitis most frequently involves lower thoracic and upper lumbar vertebrae. There is 56% thoracic, 28% lumbar, 22% thoracolumbar and 1% cervical involvement. The most affected vertebrae are the 9th thoracic and 1st lumbar vertebra. Thoracic involvement causes neurological complications in

5-25% of cases. The disease usually affects two vertebral bodies and the disc capsule between them. Progress is long and slow. The disease often attacks the anterior part of the vertebral body and reaches the neighboring vertebra via the anterior ligament. This manner of progress is usually attributed to rich arteriovenous blood supply of the region and the high oxygen need of the bacillus. Intramedullary granulomas and paraplegia can be seen in the advanced phases. Anterior narrowing of vertebrae may accompany segmental collapse or gibbus formations. Sinus formation opening to the skin may cause perispinal abscess. Paraspinal abscesses may spread to other parts of the body. As an example, psoas abscess formation with spread to the thigh and groin may result from the involvement of psoas muscle. Psoas abscess is seen in 5% of tuberculous spondylitis. The patient may complain of back pain, muscle weakness and paralysis^{6,16}.

In the early stages of the disease; sharp, stabbing or drilling somatic pain is more pronounced. Daily activities increase the pain while rest alleviates it. In the advanced stages of the disease, neuropathic pain is also observed due to infiltration of the nervous tissue and compression. Neuropathic pain is characterized as burning or electrifying. It is usually worse in the night and the patient can not carry out basic tasks due to debilitating pain.

DIAGNOSIS:

Direct graphy, computerized tomography and magnetic resonance imaging can be used. Magnetic resonance imaging is the most important diagnostic tool for early stage vertebral infections. Radiologically, the lesion is first seen as an infection on the anterior part of the vertebra corpus adjacent to the subchondral bone plate and causes a subchondral destruction. It turns into a discovertebral lesion and progresses through under the anterior and posterior longitudinal ligament or by destructing the subchondral bone. This causes a decrease in the distance between two discs in direct graphy^{5,6,10,23}.

Radiology of tuberculosis is characteristic for one or more segments to be affected, big and calcified paravertebral masses, sclerosis, loss of new bone formation and late onset disc destruction (Figure-4).

Calcification in the abscess in histopathology is pathognomonic for tuberculosis¹⁹. Pyogenic vertebral osteomyelitis should be considered first for differential diagnosis. Tuberculosis of the vertebra must be distinguished from brucellosis and similar infections, histiocytosis X, sarcoidosis, hemangiomas, benign or malignant tumors such as osteosarcomas, Ewing's sarcoma, multiple myeloma and metastases (Figure-5).

TREATMENT:

Overall condition of the patient, spinal instability criteria and the experience of the surgeon are important when planning surgery²². Advantages and disadvantages of a given surgical approach must be individualized for all cases. Possibility of kyphosis and neurologic deficit must be kept in mind before and after surgery. Mehta et al used four groups for classification while Oguz et al used three^{9,12}.



Figure-4. MR images of the patients with spinal tuberculosis in the multiple vertebrae in the thoracic region (From Prof. İ. Teoman Benli's archive).

Direct approach to the mass, instrumentation and graft fusion are the advantages of an anterior-only approach. Benli et al have reported good outcomes using this approach³. Shorter duration of surgery results in less blood loss.

However, this approach may not produce satisfactory results when three or more segments are affected. Complication rates of instrumentations for more levels can be high. Li et al report successful outcomes for cases with involvement of

two or less levels⁸. Posterior approach is the most frequently used technique. It is also the best choice for the patients with a poor clinical status. Pu et al have reported very good results in patients with abscesses with limited spread, limited compression of the spinal canal and poor clinical status¹⁴.

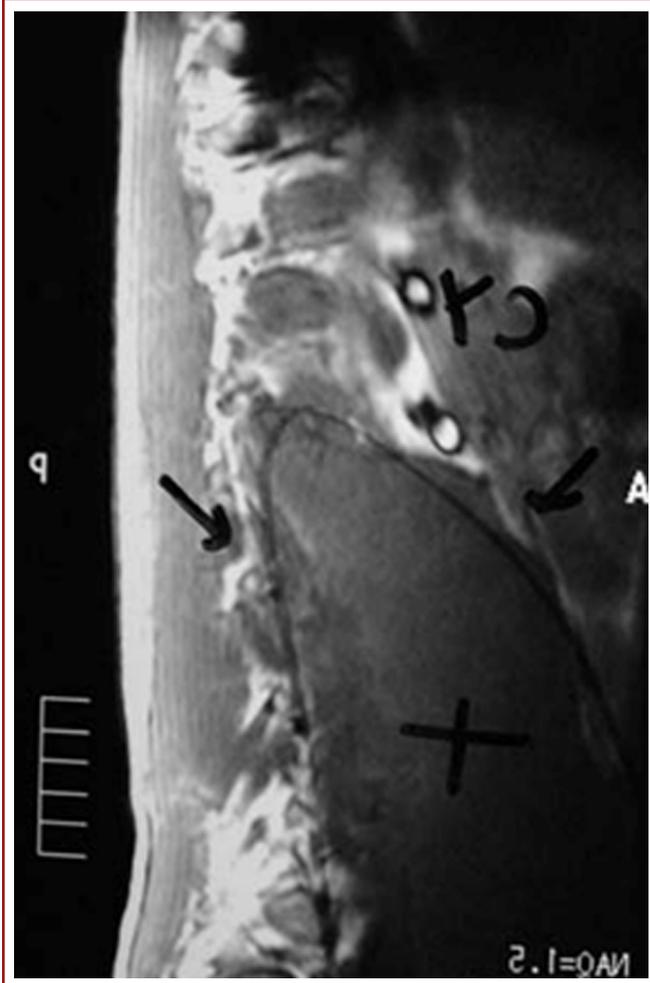


Figure-5. MR images of the patients with spinal tuberculosis and psoas abscess in lumbar vertebrae (From Prof. İ. Teoman Benli's archive).

Advantages of this approach are the possibility of debridement, decompression and instrumentation using one incision and ability to turn into a combined approach if necessary. Its main disadvantage is insufficient exposure of anteriorly spreading lesions¹¹.

The combination of anterior and posterior approach allows complete resection of the lesion and 360 degrees stabilization. This approach lets the surgeon perform the best and strongest stabilization, debridement and decompression. Longer duration of the surgery, increased blood loss, need for intraoperative change of the patient position, multiple incisions

and insuitability for patients with poor clinical condition are the disadvantages of this approach¹⁵.

Complications of surgery include failed fusion, complications of instrumentation, adjacent segment disease, insufficient decompression and stabilization¹⁷. Surgery must be planned according to the experience of the surgeon and the condition of the patient in order to minimize the risk of complications²⁴.

Surgery must always be supported with antibiotherapy. Isoniazid, rifampycine, ethambutol and pyrazinamide can be used in the first place. In addition to this therapy which lasts for 3 months, isoniazide, rifampycine and pyrazinamide treatment can be prolonged up to 9 months¹.

CONCLUSION:

Tuberculosis is a source of serious complications if it is not diagnosed and treated in early stages. Planning a treatment strategy for spinal tuberculosis which is the most common extrapulmonary form of the disease determines the quality of life for a patient. Clinical condition of the patient, existence of spinal instability, spread of the disease and the experience of the surgeon must be taken into account when planning surgery and it must always be supplemented with medical treatment.

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