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# Socio-Demographic Features and Long-term Outcomes of Patients with Spinal Tuberculosis Treated Operatively and Non-Operatively in Neurosurgery and Rheumatology Departments: Experience from Côte d'Ivoire

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## ABSTRACT

***Introduction:*** *Tuberculosis (TB) is a chronic pulmonary infectious disease which is caused in humans primarily by Mycobacterium tuberculosis and, more rarely, by M. bovis [1]. Numerous studies have found favourable safety and efficacy profiles in early outcome of both surgery and non-operative (NO) management for spinal TB, but reported studies that focus on long-term outcome in our healthcare system are rare. Our study aimed to highlight the sociodemographic features and long-term clinical and radiological outcome of patients with spinal TB treated operatively (O) and NO.*

***Materials and Methods:*** *Two groups of patients diagnosed with spinal TB treated either (O) or (NO) were followed up retrospectively for 10 years from January 2009 to December 2018. Forty-three patients treated NO were included from the Rheumatology department, while 44 surgical patients from neurosurgery department. Patients of all ages diagnosed with spinal TB were included based on clinical findings and imaging. American Spinal injury Association (ASIA) scoring was used for assessing overall muscle strength and sensory functions. Vertebral bone injury, cold abscesses and spinal deformity were assessed in both groups. Followed-up (FU) occurred in 3 periods, the first period from 1 to 3 months followed by 3 months to 5 years and 5 to 10 years.*

***Results:*** *The mean age was 42 ± 0.15 and 44 ± 0.70, respectively in conservative groups (CG) and surgical group (SG). Sex ratios consisted of 1.04 and 1.58, respectively in CG and SG. Motor functions improvement was more pronounced in SG, thus 17 patients (39.5%) showed improvement compared to 13 patients (31%) in CG, statistically significant (P=0.436).*

***Conclusion:*** *Demographics trended likewise the literature. At final FU, both groups showed improvement in neurological status, but surgery patients were more likely to demonstrate greater correction of spinal kyphosis deformity than the CG (P=2.43).*



## Keywords

Demographic, Spinal tuberculosis, Follow-up, Neurology, Outcome.


## Introduction

Tuberculosis (TB) is a chronic pulmonary infectious disease which is caused in humans primarily by Mycobacterium tuberculosis and, more rarely, by Mycobacterium bovis [1]. M. tuberculosis is transmitted predominantly from human to human via droplet respiratory infections when an individual infected coughs or sneezes. The oldest example of spinal tuberculosis, in the form of fossil bones, dates back to about 8000 Before Christ (BC). Findings in Egyptian mummies clearly indicated that spinal caries existed around 2400 BC [2]. Hippocrates first observed tubercles “Phymata”, in the tissue of cattle, sheep, and pigs [2]. The incidence of tuberculosis has had a mark resurgence in the past 2 decades. Approximately 30 million patients suffer from tuberculosis every year, and 8 million cases are added annually [3]. Worldwide, an estimated 2 billion people are infected with tuberculosis. Only 5% to 15% will become symptomatic [4]. An estimated 10 million patients developed tuberculosis disease in 2019, and there were an estimated 1.2 million deaths among Human Immune-deficiency Virus negative (HIV-negative) people and an additional 208.000 death among people living with HIV. The World Health Organization (WHO) region of Africa accounted 25 % of TB infection [5]. Bone and joint TB count about 3 to 5 % of all extrapulmonary infections. Spine TB location constitutes 50% of bone and joint TB [3]. The natural history and presentation are notable for cold abscesses causing mass effect, early or late neurologic deficit. The disease can be diagnosed with laboratory work-up and image findings, but tissue diagnosis with culture, histology, and polymerase chain reaction is the gold standard [4]. Kyphosis deformity of the spine caused by anterior vertebral body destruction occurred in 3 to 5 % of TB cases with or without proper management. Late treatment or neglect of spinal tuberculosis can result in severe spinal kyphosis deformity because of bony destruction and vertebral collapse. Kyphosis can lead to back pain, increased instability, vertebral translation, and neurological injury [3]. Medical management is pursued by surgery when a neurologic compromise occurs, a voluminous cold abscess, important anterior vertebral destruction leading to a kyphosis deformity, failure of medication and instability [6]. Numerous studies have found favourable safety and efficacy profiles in early outcomes of both surgery and non-operative treatment for spinal tuberculosis, but reported studies that focus on long-term outcomes in our healthcare system are rare. Our study aimed to highlight the socio-demographic features and long-term clinical and radiological outcomes of patients with spinal tuberculosis treated operatively and non-operatively from our own experience.

## Patients and Methods

Two groups of patients diagnosed with spinal tuberculosis treated either operatively or non-operatively have been followed up retrospectively for 10 years from January 2009 to December 2018. The study was conducted in two different departments. Forty-three patients treated non-operatively were included from the Rheumatology department at University Hospital Centre (UHC) of Cocody, while 44 patients who underwent surgery were included from the neurosurgery department at UHC of Yopougon in the Côte d’Ivoire Republic (CIR). Inclusion criteria encompassed patients of all ages diagnosed with spinal tuberculosis based on clinical findings and imaging during our study period.

Demographic data and clinical features were collected, including constitutional symptoms such as TB red flags (evening fever, general condition changes, asthenia, loss of appetite, and weight loss). Back pain was assessed using the Visual Analogue Scale (VAS), and neurological status was evaluated with the American Spinal Injury Association scale (ASIA). Diagnosis was based on constitutional symptoms, clinical findings, Mantoux test, tissue culture, histology, image findings, and clinical response to anti-tuberculosis therapy. Imaging evaluated the extent of vertebral destruction, paravertebral cold abscess formation, epidural purulence, and spinal deformity. Patients' outcomes were assessed through clinical and radiologic features. The clinic included ASIA scoring to evaluate overall muscle strength and sensory deficits. Complete paraplegia was defined as motor strength below 2 out of 5, while incomplete paraplegia was defined as motor strength equal or up to 2 out of 5. Imaging assessed improvements in vertebral bone and cold abscesses, as well as spinal deformity for both groups. Laboratory follow-up included measurements of Erythrocyte Sedimentation Rate (ESR), C-reactive protein, total blood count, and radiographic assessments. Exclusion criteria comprised incomplete data, patients diagnosed with TB without spinal involvement, and those with pyogenic spondylodiscitis. All patients were followed up for a duration of 10 years. Follow-up occurred in three periods: the initial phase from the first inpatient month to the third month of treatment, the second phase from 3 months to 5 years, and the third phase from 5 years to 10 years. The purpose of this study was to conduct an observational descriptive analysis of two groups of patients who underwent conservative or surgical management, assessing the clinical features, imaging findings, and outcomes. Ethical approval was obtained from both institutions, namely the University Hospital Centre (UHC) of Yopougon and UHC of Cocody in the Côte d'Ivoire Republic, through the Medical Sciences ethical council. Patients' consent was obtained prior to enrolment, either in person or via phone call, ensuring they received all necessary information.

## Results

### Demographic features

The non-operative group included 43 patients, while the operated group consisted of 44 patients. The demographic features were similar in both groups. The mean age of the operated and conservative groups was respectively 42 ± 0.15 and 44 ± 0.70. The predominant age range was between 40 and 50 years. Men were the majority in both groups, with sex ratios consisted of 1.04 and 1.58 for the conservative and surgical groups, respectively. Urban residents predominated in both the conservative and surgical groups, with 80% and 61.4%, respectively. Data showed a higher prevalence of non-literacy in both groups, with housewives being the most affected (n=11, 25%) in the conservative group and (n=14, 31%) in the surgical group followed by manual workers.

### Clinical features

The follow-up period lasted 10 years in both groups; however, outcome data were obtained from both operated and non-operated patients. Seven patients from the conservative group switched their treatment to be included in the surgical group once surgery criteria were met, as previously mentioned. Constitutional symptoms were observed in both groups: 69% in the operated group and 39% in the non-operated group. Tuberculosis bacillus contagious presumption (TBCP) was identified in 26% of operated patients and 32% of non-operated patients. Back pain was the most common clinical presentation in both conservative and surgical groups, occurring in 92% and 95.3%, respectively. Eighty-four percent of the surgical group had neurological impairment at disease onset, compared to 44% in the non-surgical group. Paraplegia was the most common neurological disorder in the operated group. Nineteen out of 43 (45.2%) patients had complete paraplegia, while 5 out of 43 (11.4%) in the conservative group. Ten (24%) patients in the surgical group had incomplete paraplegia, compared to 8 out of 43 (18.7%) in the conservative group. Gross sensory disorders were more prevalent in the surgical group at 50%, compared to 26.4% in the conservative group. Genital and urinary tract disorders were also more common in the surgical group, at 22.7% and 9%, respectively. Spinal deformities were observed in both the conservative and surgical groups, with the latter being more affected: 43.2% versus 36%. Kyphosis was the more common deformity compared to scoliosis.

**Table 1:** Demographic features of the conservative and surgical group.

| Demography | Conservative group | Surgical group |
|---|---|---|
| Series | 43 | 44 |
| Average age | 44 ± 7 SD | 42 ± 15 SD |
| Gender ( Man Vs Woman) | 22 Vs 21 | 27 Vs 17 |
| Sex ratio | 1.04 | 1.58 |
| Marital status | Married (n=31, 70.5%) | Single (n=27, 61.36%) |
| Housewife | 11 (25%) | 14 (31%) |
| Non-literacy patients | 14 (31%) | 11 (25%) |
| Urban patients | 34 (80%) | 27 (61.4 %) |

### Image findings

A computed tomography (CT) scan was the most common exam performed in both groups. Although the surgical group was more likely to undergo a CT scan than the conservative group, with percentages of 98% and 91.6% respectively. A similar trend was observed for magnetic resonance imaging (MRI), with 48% and 23.6% respectively. More than 70% of patients in both groups had a plain X-ray showing indirect signs of TB injury however neuro-imaging was also essential for an accurate assessment of spinal TB. All patients received a CT scan within one month of consulting a physician. The lumbar spine was the most common site of TB lesions in both groups, with 34% in the surgical group and 48% in the non-surgical group. The most frequently affected spinal segment was L4-L5 in the conservative group (14.7%) (Figure 1). In contrast, the surgical group commonly showed TB injury in the thoracic and lumbar regions, with 54% and 34% respectively (Figure 2). One spinal motion segment was involved in 44% of conservative patients and 56% of surgical patients, while multiple segment involvement, indicating multifocal injury across three contiguous spinal columns, was observed in both groups (Figure 2). Paravertebral abscesses were assessed using enhanced CT scans and MRI. The non-surgical group exhibited a higher incidence of

paravertebral abscess collections than the operated group, at 68% and 36% respectively, while the abscesses in surgical patients were more voluminous. The average volume of paravertebral abscess collections was 22 ± 6 $cm^3$ in the conservative group and 34 ± 3 $cm^3$ in the surgical group. Epiduritis was most common in surgical patients, affecting 79%, often with spinal cord entrapment (Figure 2). Vertebral osteolysis was common in both groups, involving intervertebral disc destruction, vertebral body collapse (VBC), and sequestration of bone fragments (BF) (Figure 3). Vertebral body collapse was observed in 38.6% of surgical patients, compared to 31% in the conservative group. The surgical group also exhibited the most common bone fragment sequestration in 8 out of 44 patients (18.2%). At baseline, spinal deformity was slightly higher in the surgical group (38.6%) compared to the conservative group (36%). The deformity was more often kyphosis than scoliosis in both groups. At final follow-up assessment, kyphosis was more prevalent in the conservative group (60%) than in those operated on (34%) (Table 2). Scoliosis deformity was less than 4% in both groups.

**Table 2:** Clinical features of patients treated conservatively and those operated on.

| Clinical features | | Conservative group | Surgical group |
|---|---|---|---|
| Series (number of patients) | | 43 | 44 |
| Comorbidities | Diabetes mellitus | 3 (6.8%) | 1 (2.27%) |
| | HIV | 8 (18.2%) | 3 (6%) |
| | Hypertension | unknown | Unknown |
| | Nutritional status | Malnutrition 5 (11.4) | None malnourishment |
| Constitutional symptoms | | 17 (39 %) | 30 (69%) |
| TB contagious presumption | | 14 (32%) | 11 (26%) |
| Previous TB infection | | 2 (4.6%) | 5 (11.4%) |
| Evening fever | | 11 (26.2%) | 18 (42%) |
| Asthenia | | 38 (81%) | 39 (88%) |
| Weight loss (More than 10% of whole body mass) | | 14 (32 %) | 21 (47 %) |
| Back pain | | 40 (92%) | 42 (95.3 %) |
| Neurologic disorders | | 19 (44%) | 36 (84%) |
| Paraplegia | complete | 5 (11.4%) | 19 (45%) |
| | Incomplete | 8 (26.4%) | 10 (24%) |
| Gross sensory disorders | | 11 (26.4%) | 22 (50%) |
| Bowel and bladder disorders | | 4 (9%) | 10 (22.7%) |
| Spinal column gibbous | | 15 (36%) | 19(43%) |
| Follow-up duration | | 10 years | 10 years |

## Diagnosis

As in most low-income countries, the diagnosis of spinal tuberculosis considers evidence of tuberculosis infection (ETI), the type of disease onset, followed by characteristic findings on neuro-imaging work-up. The disease onset was insidious in both groups. The delay in diagnosis exceeded 3 months in both the conservative and surgical groups. The main diagnostic approach in our study included the following criteria: ETI, Mantoux test, neuro-imaging features, and CT-guided biopsy (CT-B). The specimen obtained via CT-GB underwent bacteriological and histo-pathological analysis. Additionally, for patients operated on, a direct intraoperative sample was obtained and subjected to testing for direct TB bacillus isolation or culture. Complete blood count (CBC), Erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP) were performed to assess treatment outcomes in both groups. Among our patients, some were co-infected with Human Immunodeficiency Virus (HIV). Eight out of 44 patients (18.2%) in the conservative group were diagnosed with HIV positive compared to 3 patients (6%) in the surgical group (see Table 2).

As depicted above, our series reported the ETI in 39% and 69% respectively in conservative and surgical group. ETI in our study included respectively previous TB infection 4.6% and 11.4%; TB contagious presumption 32% and 26%; Weight loss more than 10% of global body mass 32% and 47%; Evening fever 26.2% and 42% as well as asthenia 81% and 88% respectively in conservative and surgical group (Table 2). The Mantoux test was achieved in less than 30 % in both group and was positive in conservative and surgery group, respectively in 18.2% and 6.2%. In addition to ETI and Mantoux test that are less specific in the literature, the cornerstone of TB diagnosis in our series was based in image findings. The image typical features showed TB injury pattern in both group. CT-scan was carried out in more than 90% in both group. In our literature review, the neuroimaging like CT-scan work-up had a sensibility and a specificity in 97.7 % and 50% respectively. Magnetic Resonance Imaging (MRI) was achieved in operated patients than conservative ones, 23.6% and 54.5% respectively. Its sensibility and specificity ranged from 91% to 100%. CT-scan guided biopsy was carried out in 8 surgery group patient while none conservative patients didn't undergo CT-san guided biopsy. Seven out of 8 specimens were positive highlighting Tuberculosis bacillus either in direct analysis and culture (Table 3).

**Table 3:** Image features of the conservative and surgical group.

| Imaging findings/ Patients | | Conservative/ 43 | Surgical group/ 44 |
|---|---|---|---|
| Spinal column plane X-ray | | 33 (77%) | 37 (85%) |
| Spine CT-scan | | 39 (91.6%) | 43 (98%) |
| Spine MRI | | 10 (23.6%) | 21 (48%) |
| Spine TB injury location | Cervical | 0 | 1 (2.3%) |
| | Thoracic | 15 (35%) | 24 (54.5%) |
| | Lumbar | 21 (48%) | 15(34%) |
| | Thoraco-lumbar junction | 5 (11.7%) | 5 (11.6%) |
| | Sacrum | 3 (6%) | 1(2.3%) |
| Single spinal motion injury | | 19 (44%) | 25(56%) |
| Para vertebrae abscess collection | | 29 (68%) | 16 (36%) |
| Epiduritis | | 8 (18%) | 35 (79%) |
| Spondylitis | | None | 1 (2.3%) |
| VBC | | 13 (31%) | 17 (38%) |
| BF sequestration | | None | 8 (18.2%) |
| Early spinal column deformity | | 16 (36 %) | 17 (38.6) |
| Kyphosis at Final FU | | 26 (60%) | 15(34%) |
| CT-guided biopsy | | None | 8 (18.6%) |

Therefore, CT-scan guided biopsy sensibility and specificity have been assessed to 100 % and 50 % respectively. In addition, all the

sample obtained during open surgery 36 (84%) has been positive Tuberculosis bacillus either through direct analysis, specimen culture or histo-pathology.

### Treatment

Overall, patients in our study received medical treatment. The medication involved anti-tuberculosis drugs following a standard protocol. The treatment strategy adhered to the national guidelines for TB management. Anti-tuberculosis chemotherapy lasted six months for the surgical group and nine months for the conservative group. The first two months included Isoniazid (H) 5-6 mg/kg/day, Rifampicin (R) 10 mg/kg/day, Pyrazinamide (Z) 30-35 mg/kg/day, and Ethambutol (E) 15-25 mg/day. The remaining four months for the surgery group and eight months for the conservative group consisted of Rifampicin (R) and Isoniazid (H). Treatment was initiated once spinal tuberculosis was strongly suspected based on ETI, clinical features, and imaging findings. Corticosteroids were administered to patients presenting with neurological impairment. The duration of corticosteroid therapy varied longer in the conservative group, from 15 days to two months, compared to seven to twenty-one days in the operated group. Corticosteroid treatment was reduced in a sub-acute manner post-operatively.

Bracing was performed in 38 (89.7%) patients in the conservative group, whereas 13 (30%) patients in the surgery group had been braced before surgery. Therefore, the overall patient in the surgical group had their brace removed within one week postoperatively, while the conservative group patients continued wearing braces throughout their treatment duration. During the initial phase of conservative management, 7 (15.9%) patients switched to the surgical group after meeting the surgery criteria, bringing the total number of patients in the surgical group to 44.

Thus, overall, forty-four patients underwent surgery. Fifty percent of surgical patients were operated on within one month from the disease onset, with intervals ranging from 8 days to one month. Different surgeons with more than 5 years experience in TB surgery performed the procedures. Forty-two patients (95.5%) underwent a posterior approach, while two (4.5%) patients had a combined anterior and posterior approach. Surgeries included decompression through laminectomy in four patients (9.5%), debridement and cold abscess removal in seventeen patients (39.5%), deformity correction in nine patients (21%), and laminectomy, stabilization, and fixation in thirty-seven patients (86%).

### Outcome

Follow-up (FU) data included the duration of TB treatment, either by medication or surgery, which was determined according to the following hierarchy of sources: medical data, regional TB data registration, department of clinic consultation visit, and by phone call.

Long-term FU information was lacking due to a high percentage of missing data, which represented one of the major limitations of our study. Although the remaining variables scrutinised for early FU assessment showed functional clinical improvements involving neurological and back pain in both groups, our study reported outcomes at medium-term follow-up. The follow-up duration was 10 years for each group. At the final FU, seventeen operated patients (39.5%) showed improvement, while 13 (31%) in the conservative group were improved. Thirteen (30%) patients in the surgical group remained stable, compared to 20% in the conservative group. Eleven (25%) patients in the conservative group did not improve and experienced deterioration in their neurological status. Among those who deteriorated, four (10%) had complete paraplegia, six (13%) had incomplete paraplegia, and one suffered from disabling chronic neuropathy. One patient from the surgical group deteriorated postoperatively and was the only death in our series. Sensory and pain outcomes followed similar trends such as motor function. The remaining patients were lost to follow-up (LTFU), including more surgical patients 12 (27.9%) than conservative patients 6 (24%) (Table 4).

## Discussion

### Demographics

Our study included 43 patients treated conservatively and 44 patients who underwent surgery. Demographics followed similar trends to those reported in the literature. The average age was comparable in both groups: 44 ±7 and 42 ±15, respectively, in the conservative and surgical groups (Table 1). Ifthekar and al. reported an average age of 36.9 ± 17.63 in a series of 286 patients, with 46.5% of patients aged between 21 and 40 years [7]. Male patients were predominant in both groups, with a higher sex ratio in the surgical group compared to the conservative ones. Ramos and al. in an American series of 2789 patients reported a median age of 51 years, with 61% being male. These data showed a

**Table 4:** Outcome features in follow-up of surgical and conservative group patients.

| Group/ FU | | Conservative (n=43) | | | Surgical patient (n=44) | | |
|---|---|---|---|---|---|---|---|
| | | Initial | Medium term | Long term | initial | Medium term | Long term |
| Improvement | Motor | 4(9.3%) | 6 (13.6%) | 13(31%) | 6 (13.6%) | 11 (25%) | 17 (39.5%) |
| | Sensory and pain | 6 (13.6%) | 7 (16%) | 13(31%) | 9 (21%) | 26(60 %) | 36 (81.4%) |
| Stationary | Motor | 15(34 %) | 13(29.5%) | 9(20%) | 13 (30%) | 5 (11.6%) | 2 (4.6%) |
| | Sensory and pain | 18(41.8) | 14(31.81%) | 14(33%) | 4 (9.3%) | 3 (7%) | 3(7%) |
| Deterioration | Complete paraplegia | 6 (13.6%) | 4 (9.3%) | 4(10%) | None | None | None |
| | Incomplete paraplegia | 8(41%) | 7 (16%) | 6(13%) | 2 (4.6%) | None | None |
| | Sensory and pain | None | 2 (4.5%) | None | None | 2 (4.6%) | 1(2.3%) |
| Bone fusion | Imaging | 0 | 13 (30%) | 31 (73%) | 0 | 28 (64%) | 31 (72 %) |
| Loss to FU | | | | 6 (24%) | | | 12 (24%) |

similar trend, although their study population was significantly wide than ours. This discrepancy may be explained by differences between the two samples. Spinal TB primarily affects children and young adults in developing nations, whereas the opposite trend is observed in developed countries [8]. Studies from developing nations tend to have lower average ages of affected individuals, whereas those from developed nations show higher average ages. This variation may be due to differences in immunity, nutritional status, healthcare facilities, and general awareness of the disease in developed countries [7]. Based on the patients' lifelong occupation, non-literate patients predominated in both groups. The majority of our patients were from urban areas (Table 1), similar to the findings of Ifthekar and al., who reported a 62.4% prevalence in urban areas [7]. A study by Wang and al. also suggested a higher incidence of spinal tuberculosis in urban areas, but another study by Ibrahim and al. indicated a higher prevalence in rural populations. Since overcrowding is common in urban areas and tuberculosis is known as a disease of overcrowding spreading via droplet infection, the increased prevalence in densely populated urban regions is well explained [9]. Patients who were married predominated in the conservative group (n=31, 70.5%), whereas the operated patients were mostly single (n=27, 61.36).

## Clinical features

Pott's disease is often linked with various comorbidities that may influence both the clinical presentation and the natural course of the disease. Previous TB infections were reported in both the conservative and surgical groups, respectively (n=5, 11.4%) and (n=2, 4.54%). Our study identified spinal TB to be associated with diabetes mellitus (DM) in three patients (7%) in the conservative group, but only one patient in the surgical group was affected by DM. Co-infection with human immunodeficiency virus (HIV) was observed in eight (18.2%) conservative patients. Juan De and al. reported spinal TB to be linked with HIV in 19%, which was similar to our findings [10]. The delay in diagnosis exceeded three months in both groups, corroborating some literatures indicating delays of more than three to six months [11,12]. Our study found that constitutional symptoms were more common in the surgical group, affecting 69% (n=30), compared to 39% (n=17) in non-surgical patients. Ifthekar and al. reported constitutional symptoms ranging from 30% to 40%. This difference may be related to variations between our study samples. Persistent back pain is the most common functional sign of early spinal tuberculosis. Back pain was reported in 40 (92%) conservative group patients and 42 (95.3%) operated patients at disease onset, as shown in Table 2. Su and al. identified back pain as the most common functional symptom [11]. Neurological deficits and kyphosis are two severe complications of untreated spinal tuberculosis. Studies have shown that the prediction of neurological deficits depends on the affected spinal segment and radiological features. In our study, 19 (44%) patients in the conservative group experienced neurological disorders, while 36 (84%) surgical patients displayed neurological issues. Five patients (11.4%) in the conservative group had complete paraplegia, whereas 19 (45%) in the surgical group suffered from complete paraplegia. Incomplete paraplegia was observed in 8 (26.4%) conservative patients compared to 10 (24%) in surgical patients. Gross sensory loss was reported in 10 (26.4%) conservative patients and 22 (50%) in the surgical group. Spinal TB can also cause bowel and bladder dysfunction as evolving complications. Our study recorded four (2%) cases of urinary tract disorders in the conservative group and 19 (43%) in the surgical group. Su and al. in a sample of 48 patients, reported 37 (77.1%) neurological deficits, with 13 (62.5%) experiencing limb weakness, 27 (56.3%) limb numbness, and 19 (39.6%) urinary tract disorders [11,12]. These data are consistent with those reported in our study. The slight differences between our findings and those of Su and al probably relate to the different composition of our samples, as our study included both conservatively and surgically treated patients.

## Diagnosis

In our study, the diagnosis criteria included typical clinic and neuroimaging features, ETI with or without bacteriological or histological confirmation. Three quarter of patients in our series underwent plan X-ray for diagnosis at disease onset, which was reported in 33 (77%) and 37 (85%) respectively in the conservative and surgical groups. CT scan was performed in over 90% of patients in both groups. The sensitivity and specificity of CT scan diagnosis were 97.7% and 50%, respectively [12]. CT-guided biopsy was mainly performed in surgical patients' group, with 8 (18.6%) of 44 receiving the procedure, whereas no conservative patients underwent CT-guided biopsy. Magnetic Resonance Imaging (MRI) was performed more frequently in operated patients than in conservative ones, 54.5% and 23.6% respectively, and its sensitivity and specificity ranged from 91% to 100% [13]. Abdelmoula L and al. reported typical diagnosis features based on CT scan and MRI, ranging from 87.2% to 92.5%, respectively [14]. Rajasekaran S and al. reported the sensitivity of plan X-ray to be lower in 15%, while CT scan sensitivity was 100%, with no data available on specificity. In addition to CT-scan and X-ray, MRI sensitivity was 100%, with a specificity being more than 80% [13]. Single spinal segment joint (SSJ) involvement was seen in 19 (44%) conservative patients, whereas 16 (36%) of surgical patients had SSJ involvement. Abdelmoula L and al. reported single spinal segment involvement in 67.3%, with multifocal injuries in 32.7% [14]. Ifthekar and al. reported that, among 286 patients, 63.28% had single spinal segment involvement [7]. This difference may be related to the disparity in sample sizes between our two studies. The remaining patients in our study presented with either multifocal contiguous or non-contiguous spinal TB injury (Figure 3). Ifthekar and al. reported that 25.79% of patients had multifocal contiguous spinal TB, and 11.3% had multifocal non-contiguous spinal TB [7]. The incidence of non-contiguous spinal TB in the literature ranges from 1.1% to 16.3%. Iftekar and al. concluded that single segment disease is more common than multi-focal spinal TB, but overall, multifocal contiguous TB was the most frequent form, followed by lumbar and thoraco-lumbar TB [7]. Paravertebral cold abscesses were reported in 29 (68%) conservative group patients and in 16 (36%) surgical group patients. Epiduritis was reported in 8 (18%) of conservative group patients and 35 (79%) of surgical group patients (Table 3). The most common location of spinal TB was the lumbar spine in 21 (48%) of conservative group patients, while the thoracic spine was involved in 24 (54.5%) of

surgical group patients. Abdelmoula L and al. reported the lumbar location in 67.3%, followed by 47% in the thoracic and 14.3% in the cervical spine [14]. Ifthekar and al. found the most common location to be the thoracolumbar segment (28.72%), followed by the thoracic segment (25.96%) [7]. These findings are consistent with our results. Spinal deformity was a common complication of spinal TB. The disease destroys the vertebral bodies and often results in kyphosis, more frequently than scoliosis, potentially compromising spinal cord function [15]. From disease onset, our study reported 16 (36%) and 17 (38.6%) patients with spinal deformity in the conservative and surgical groups, respectively. At final follow-up, kyphosis was observed in 26 patients (60%) in the conservative group and 15 patients (34%) in the surgical group.

## Management

Chemotherapy is the main treatment for TB infection. With the development of targeted anti-TB chemotherapy, the clinical course of TB has changed so that patients now rarely die from the disease. The period of infectivity has also been greatly shortened, relapses are less frequent, and chronicity has decreased. There are five first-line anti-tuberculosis drugs: Isoniazid, Rifampicin, Pyrazinamide, Ethambutol, and streptomycin. Various treatment regimens have been described, and typically 6-12 months of chemotherapy are needed [16]. In our study, all patients in both groups received appropriate anti-TB chemotherapy for at least 6-12 months.

## Outcome

Spinal TB is an insidious, progressive disease that is often diagnosed late, sometimes years after its onset, with or without early proper management [15]. Our study monitored both groups over a follow-up period of 10 years. All patients in our series received appropriate medical treatment in accordance with national anti-TB drug protocols. Initial follow-up data indicated improvement in both groups, but the surgical group showed better neurological outcomes and experienced greater pain relief than the conservative group, although this difference was not statistically significant (P=6.5). One-year follow-up showed a similar trend, with minor functional gains in the conservative group compared to the surgical group (P=0.2). At final follow-up, motor function improvement was more pronounced in the surgical group, with 17 patients (39.5%) showing improvement compared to 13 patients (31%) in the conservative group, a difference that was statistically significant (P=0.436). Sensory functions followed a similar pattern: 36 patients (81.4%) in the surgical group and 13 patients (31%) in the conservative group exhibited improvement. Neurological status remained unchanged in 14 patients (33%) in the conservative group and 3 patients (7%) in the surgical group. The study reported adverse outcomes, such as complete paraplegia in 4 patients (10%) and incomplete paraplegia in 6 patients (13%), both in the conservative group. No neurological deterioration was observed in the surgical group. Despite initiating TB treatment, deformity may continue to progress until the spinal lesion heals completely [16]. Our study identified spinal gibbous at the onset of the disease in 16 patients (36%) in the conservative group and 17 patients (38.6%) in the surgical group. At final follow-up, kyphosis decreased slightly in the surgical group from 17 patients (38.6%) to 15 patients (34%), whereas the conservative group showed worsening from 15 patients (36%) to 26 patients (60%). These results are consistent with those reported in the literature. Rajasekaran and al. recommended that when surgical criteria are met, combining surgery with appropriate anti-tuberculosis chemotherapy achieved better outcomes in spinal correction than medication alone [13]. Park D and al. reported that surgery combined with short-course or long-course anti-TB therapy produced superior results compared to chemotherapy alone [17]. Tang Y and al. in their retrospective cohort study of 132 patients with thoraco-lumbar tuberculosis undergoing three types of surgical management, found that: the first group underwent an anterior approach alone (n=22, group A), the second combined anterior and posterior approaches (n=79, group B), and the third had a posterior approach only (n=31, group C). All three groups demonstrated significant kyphosis correction at final follow-up (P1=0.002; P2=0.0016; P3=0.0015) [18]. J Bone reported a 21° kyphosis progression after chemotherapy alone within five years, increasing to 25° after fifteen years. The same study showed kyphosis progression of 8° after chemotherapy with debridement within five years and 11° after fifteen years. Conversely, patients who underwent chemotherapy, debridement, and fusion experienced a kyphosis progression of less than 3° over both five and fifteen years [19]. In our study the kyphosis deformity was most common in thoracic spine likewise the spinal TB location in both group. Jignesh J and al. reported the kyphosis deformity for being more frequent in thoracic spine cases (62%), paravertebral abscesses were observed in 63 % and multiple vertebrae involvement predominated across all spinal region, especially in thoraco-lumbar and lumbar disease [20]. At final follow-up, 6 patients (13%) in the conservative group and 12 patients (24%) in the surgical group were lost to follow-up (LTFU) (Table 4). Theresa N Mann and al. reported, in 44 paediatric patients followed for spine TB, 27 LTFU (84%). Of these 27 children, 19 (70%) were ≤ 10 years old at the time of LTFU, 20 (74%) had thoracic or thoraco-lumbar vertebrae affected and 16 (59%) had received corrective surgery [21]. These data reported by Theresa N Mann and al. were higher than those reported in our study. This trend may be related to the difference in our two samples. Thus Theresa N Mann and al. included paediatric population compared to our study which included all age.

## Limitations

This study was an initial attempt to record and describe the demographics, clinics, and imaging features of two patient groups within our healthcare system in which one treated conservatively and the other surgically. Thus, our study had a number of limitations. Firstly, the study was limited by its retrospective design, and some relevant data were missing, affecting the accuracy of patient outcomes. Study's investigation was limited to information routinely available in medical records and therefore was obliged to rely on hierarchy of evidence when assessing TB treatment duration. Secondly, the study had a relatively small sample size regarding both group. Finally, as two single centres experience, the long term outcome findings obtained from our study have limited generalizability to other settings. Nevertheless, the study has relevance for similar settings in that it allows awareness of the

considerations and knowledge gaps related to long term follow-up for patients with spinal TB. In addition, the study did not allow for proceeding in any comparison between the two groups because of its design as observational and its non-randomised pattern.

## Illustrations

### Case 1

A 36-year-old male who underwent medical management. He received a proper anti-TB chemotherapy during nine months. He achieved a CT-scan on 12 April 2014 after 3 months of chemotherapy.

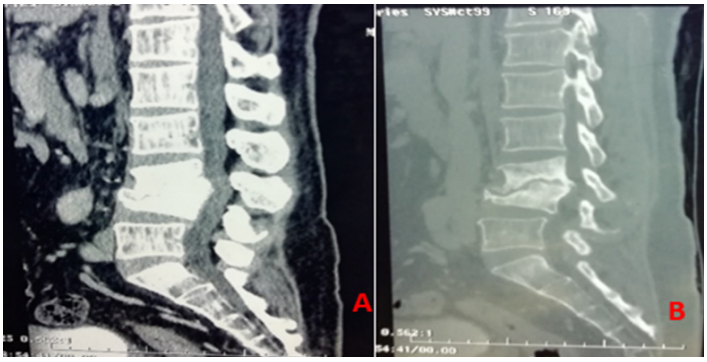


**Figure 1:** (A, B) A 36-year-old male presenting a CT-scan typical spinal TB image achieved on 12 April 2014 showing spondylodiscitis tuberculosis in the L4-L5 vertebrae, narrowing the vertebral canal at the same level. Outcomes were straightforward: the destruction of the L4-L5 vertebrae healed with anti-TB chemotherapy, and the two vertebrae fused at the end of follow-up with a good neurological outcome and pain relief.

### Case 2

A 44-year-old male spine CT-scan performed on 10 May 2016 showing spinal TB involving the T12 and L1 vertebrae. The patient underwent a surgical management. A preoperative and postoperative CT-scan were achieved during the management.

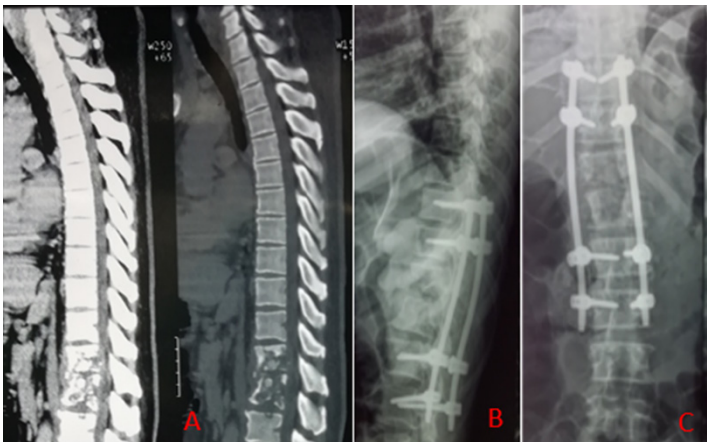


**Figure 2:** (A, B). Preoperative and postoperative CT-scan of a patient treated for thoracic spine TB; (A) Soft tissue image with sagittal reconstruction showing multifocal T12-L1 spondylodiscitis tuberculosis associated with an epidural purulence compressing the spinal cord. (B, C) Post-operative lateral and antero-posterior X-ray views respectively demonstrating the instrumentation from T10-T11 to L2-L3 stabilising the thoraco-lumbar spine.

### Case 3

A 48-year-old male's spine CT-scan obtained on 7th November 2013 showing a typical multifocal contiguous TB image. The patient was treated with medical anti-tuberculosis therapy and bracing. Surgery was suggested but the patient did not undergo surgery due to financial issues. Consequently, the patient was lost to follow-up.

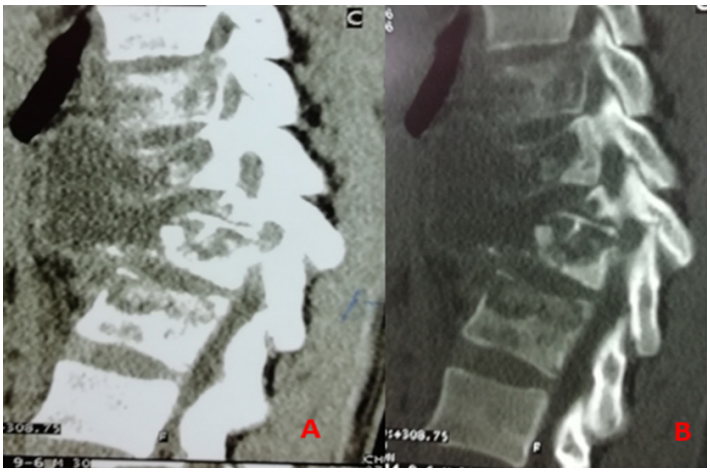


**Figure 3:** (A, B) CT-scan sagittal reconstruction of a multiple spine vertebrae involvement. (A) Soft tissue image displaying contiguous thoracolumbar vertebrae involvement from T12 to L3. (B) Bone tissue image illustrating vertebral body destruction from T12 to L3 with progressive kyphosis.

### Case 4

39-year-old female's spine CT scan obtained on 18th January 2013 showing typical features of L5-S1 TB injury. The patient underwent conservative management and improved by the end of follow-up.


**Figure 4:** (A, B), Lumbar CT-scan sagittal reconstruction soft tissue and bone depicting spinal TB injury; (A) Soft tissue sagittal computed tomography reconstruction displaying L5 vertebral body osteolysis, L5-S1 intervertebral disc involvement, and an epidural and cold abscess

collection. (B) Bone tissue sagittal computed tomography reconstruction showing L5-S1 vertebral osteolysis with an intact lumbar spine canal.

## Conclusion

This observational study represents our first experience for providing results from long-term follow-up of patients treated conservatively and those who underwent surgery. Patient demographics and clinical features were similar to those reported in the literature. The surgery group showed early clinical improvement in neurological functions compared to the conservative group, which was statistically significant (P=0.436). At final follow-up, both groups exhibited similar improvements in neurological status, but surgery patients were more likely to demonstrate greater correction of spinal kyphosis deformity than the conservative group (P=2.43). Further Randomized control studies are needed for carrying out proper clinical, radiological and outcome analysis related to patients managed only by medication and those who are subjected to surgery that should allow to get guide-line for managing those patients suffering of spinal TB disease.

## References


1. Taylor GM, Murphy E, Hopkins R, et al. First report of Mycobacterium bovis DNA in human remains from the Iron Age. Microbiology (Reading). 2007; 153: 1243-1249.
2. Herzog H. History of tuberculosis. Respiration. 1998; 65: 5-15.
3. Liu C, Lin L, Wang W, et al. Long-term outcomes of vertebral column resection for kyphosis in patients with cured spinal tuberculosis: average 8-year follow-up. J Neurosurg Spine. 2016; 24: 777-785.
4. Khanna K, Sabharwal S. Spinal tuberculosis: a comprehensive review for the modern spine surgeon. Spine J. 2019; 19: 1858-1870.
5. Chakaya J, Khan M, Ntoumi F, et al. Global Tuberculosis Report 2020 Reflections on the global TB burden treatment and prevention efforts. Int J Infect Dis. 2021; 113: S7-S12.
6. Varatharajah S, Charles YP, Buy X, et al. Traitement chirurgical actuel du mal de Pott. Revue de Chirurgie Orthopédique et Traumatologique. 2014; 100: 187-193.
7. Ifthekar S, Ahuja K, Yadav G, et al. Sociodemographic patterns of spinal tuberculosis patients from a tertiary care teaching hospital: A 5-year cross-sectional study. J West Afr Coll Surg. 2024; 14: 339-344.
8. De la Garza Ramos R, De la Garza Ramos R, Goodwin CR, et al. The epidemiology of spinal tuberculosis in the United States: an analysis of 2002-2011 data. J Neurosurg. 2017; 26: 507-512.
9. Wang H, Li C, Wang J, et al. Characteristics of patients with spinal tuberculosis: Seven-year experience of a teaching hospital in Southwest China. Int Orthop. 2012; 36: 1429-1434.
10. Colmenero JD, Ruiz-Mesa JD, Sanjuan-Jimenez R, et al. Establishing the diagnosis of tuberculous vertebral osteomyelitis. Eur Spine J. 2013; 22: 579-586.
11. Shou-Hsin Su, Wen-Cheng Tsai, Chun-Yu Lin, et al. Clinical Features and Outcomes of Spinal Tuberculosis in Southern Taiwan. J Microbiol Immunol Infect. 2010; 43: 291-300.
12. Parthasarathy R, Sriram K, Santha T, et al. Short-course chemotherapy for tuberculosis of the spine. A comparison between ambulant treatment and radical surgery ten-year report. J Bone Joint Surg Br. 1999; 81: 464-471.
13. Rajasekaran S, Soundararajan DCR, Shetty AP, et al. Spinal Tuberculosis: Current Concepts Global Spine J. 2018; 8: 96S-108S.
14. Tekaya R. Spinal tuberculosis: 12 years experience at a Tunisian center. Revue Malienne d'Infectiologie et de Microbiologie. 2017; 9: 927.
15. Yu B, Zhu K, Zhao D, et al. Treatment of Extreme Tuberculous Kyphosis Using Spinal Osteotomy and Halo-Pelvic Traction: A Case Report. Spine (Phila Pa 1976). 2016; 41: E237-E241.
16. Cheung WY, Luk KD. Clinical and radiological outcomes after conservative treatment of TB spondylitis: is the 15 years' follow-up in the MRC study long enough? Eur Spine J. 2013; 22: 594-602.
17. Park DW, Sohn WJ, Kim EH, et al. Outcome and Management of Spinal Tuberculosis According to the Severity of Disease: A Retrospective Study of 137 Adult Patients at Korean Teaching Hospitals. Spine. 2007; 32: E130-E135.
18. Tang Y, Wu WJ, Yang S, et al. Surgical treatment of thoracolumbar spinal tuberculosis—a multicentre, retrospective, case-control study. J Orthop Surg Res. 2019; 14: 233.
19. 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: 456-462.
20. Joshi J, Srikant B, Balasubramaniam S, et al. Determinants of surgical outcome in spinal tuberculosis: A retrospective analysis of 84 patients. J Craniovertebr Junction Spine. 2026; 17: 63-70.
21. Mann TN, Miseer S, Schaaf HS, et al. Loss to long-term follow-up in children with spinal tuberculosis: a retrospective cohort study at a tertiary hospital in the Western Cape South Africa. Pan Afr Med J. 2022; 41: 241.