

Early Surgical Management Outcomes in Cervical Spine Tuberculosis: A Case Series from Sabah, Malaysia

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Abstract: *Cervical spine tuberculosis (CSTB), accounting for 3-5% of all spinal tuberculosis cases, is rare but can lead to catastrophic consequences owing to its specific anatomy, making it prone to instability and neurological compromise. Despite its rarity, there is ongoing debate over the early surgical management of cervical tuberculosis. This study evaluates the outcomes of early surgical management in six patients with CSTB treated in Kota Kinabalu, Sabah, Malaysia, from 2017 to 2020. The patients, comprising four males and two females with a median age of 51, exhibited pre-operative neck pain and neurological deficits. Surgical approaches varied based on disease severity and anatomical considerations. Despite one post-operative death and one implant failure, most patients showed significant improvement in symptoms and neurological function. Our findings underscore the importance of combining medical and surgical treatments in the early stages of CSTB to prevent severe outcomes.*

Keywords: cervical spine tuberculosis, early surgical management, cervical instability, neurological outcomes, Sabah tuberculosis cases

1. Introduction

Tuberculosis (TB) is endemic in Sabah, Malaysia. In this region, fifteen percent of TB cases involve extrapulmonary sites, with the spine being the most commonly affected area [1]. Of all the spinal TB, cervical tuberculosis (CSTB), encompassing both atlantoaxial and subaxial forms, is rare. These cases represent approximately 3-5%, of all tuberculosis spine cases in Sabah [2]. CSTB is characterized by its potential to cause spinal instability, leading to progressive malalignment and neurological compromise due to the unique anatomy and biomechanics of the cervical region [3]. Spinal TB can be either uncomplicated, in which one is diagnosed without the presence of spinal instability, deformity, or neurological deficit; and complicated spinal TB as evidenced by the presence of all the mentioned complications [4].

CSTB management poses a challenge to clinicians because its occurrence is infrequent and the optimal treatment strategy is not clearly defined. Medical treatment with anti-tubercular drugs (ATT) remains the primary treatment for uncomplicated CSTB [5]. The goal of medical therapy is to eliminate the tubercular infection and promote healing of the affected spine. However, owing to its specific anatomy, CSTB is prone to developing instability, subsequently causing cord compression and causing neurological deficit. In cases of complicated CSTB with severe neurological deficits or spinal instability, surgical intervention is considered to decompress the neural structures, restore spinal alignment, and achieve spinal fusion [3].

The standard approach of CSTB should involve a combination of anti-tubercular drug therapy and early surgical intervention [6]. However, the decision for the surgical approaches must be made carefully, considering factors such

as the levels of involvement, side of compression, the extent of neurological deficits, the severity of spinal deformity or pre-existing developmental stenosis, and the response to medical treatment, if the diagnosis is in doubt, whether the need for open biopsy.

The outcome of CSTB management depends on several factors, including the stage of the disease at presentation, the presence of neurological deficits, the effectiveness of the chosen treatment modality, and the organism's sensitivity to ATT. Studies have reported variable outcomes, ranging from successful recovery with restoration of neurological function and spinal stability to persistent neurological deficits and complications post-surgery [7], [8]

Given the rarity of CSTB, literature on this subject is limited, and clinical guidelines may not be well-established. Therefore, this review aims to explore the available literature on CSTB, focusing on early surgical management and treatment outcomes. By analyzing relevant studies and case series, we strive to gain insights into the challenges faced by clinicians in diagnosing and managing CSTB, as well as the effectiveness of different treatment approaches. Ultimately, this comprehensive review will contribute to a better understanding of CSTB management and its impact on patient outcomes, enabling clinicians to make informed decisions for optimal patient care. This study provides critical insights into the management of CSTB, a rare but severe form of spinal tuberculosis, highlighting the benefits of early surgical intervention in improving patient outcomes

2. Materials and Methods

This was a retrospective analysis of six CSTB patients treated surgically at a single center namely Queen Elizabeth Hospital,

a tertiary referral spine center in Kota Kinabalu, Sabah, Malaysia, from year 2017 to 2020. The purpose of this study is to examine the outcome of the early surgical management of CSTB, in terms of resolution of symptoms in patients with uncomplicated CSTB and improvement in neurological function in patients with complicated CSTB based on the America Spinal Injury Association (ASIA) Impairment Scale. The regions involved ranged from C1 to C7, subdivided into upper cervical (C1-C3) and lower cervical (C4-C7). The diagnosis was based on clinical and radiological findings, hematologic and pathological examination. Patient demographic data, including age, sex, co-morbidities, and clinical symptoms such as neck pain and neurological status using ASIA chart, radiological investigations such as plain radiography and magnetic resonance imaging (MRI) of the affected regions, laboratory results such as erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) and histopathology examination were collected. The indications for surgery include patients with neurological deficits, spinal instability due to severe vertebral erosion or destruction, and severe progressive kyphosis. The surgical management strategy and relevant post-operative outcomes and complications were also reviewed and compared. All patients were treated with conventional four antituberculosis drugs (isoniazid, rifampicin, ethambutol, and pyrazinamide) for a 2-month induction phase and subsequently two antituberculosis drugs (isoniazid and rifampicin) for the 10-month maintenance phase. Informed consent was acquired from all patients involved in the study.

3. Results

Our study sample of six patients comprises of four males and two females, with a median age of 51. All patients had positive tuberculosis contact and lived in an endemic region. The mean duration of presenting symptoms was 1.9 ± 1.0 months. Two patients were associated with significant co-morbidities during presentation. Four patients were confirmed with extra-spinal tuberculosis. Five patients complained of neck pain, three patients with lower cervical tuberculosis suffered significant neurological deficits (ASIA B and C) while the other three patients with upper cervical tuberculosis were noted with preserved neurological function (ASIA E) at the time of presentation. Two patients had atlantoaxial (C1-C2) involvement while the remaining 4 patients involved the subaxial cervical vertebrae (C3-C7). The mean erythrocyte sedimentation rate (ESR) was 60.33 ± 28.58 mm/Hr and the mean C-reactive protein (CRP) was 67.18 ± 67.61 mg/L. Paravertebral abscesses were found in all patients (100%), epidural abscesses were found in three patients (50%) and a retropharyngeal abscess was found in one patient. Patients with epidural abscesses were associated with the worst neurological deficit. Surgery was performed in all six patients under general anesthesia. Two patients with atlantoaxial (AA) lesions were managed with posterior decompression, debridement, instrumentation, and fusion. One patient with severe kyphosis C2/3 was treated with single-stage anterior decompression, instrumentation, and fusion. Two patients with multilevel adjacent segments and extensive paravertebral abscesses were treated with combined anterior and posterior decompression, instrumentation, and fusion. One patient with developmental stenosis without index-level segmental kyphosis was treated with posterior-only decompression,

instrumentation, and fusion. The mean surgery time was 231 ± 86 minutes, the combined anterior and posterior approach took the longest surgery time among all three approaches, followed by posterior only approach and then anterior only approach. Post-operatively, neck pain was significantly reduced in all patients. In two out of three patients who had pre-operative weakness, neurological function was reported to have improved, and one patient with multiple comorbidities and pre-operative weakness died from multiple organ failure despite having no surgical complications. One patient with an AA lesion and basilar invagination was reported to have implant failure. No surgical site infections were reported.

Table 1: Patient demographic data. Pt- Patient number; M- male; F – female; RTA – renal tubular acidosis; CKD – chronic kidney disease; Sx – symptoms; ASIA – America Spinal Injury Association; *Sx duration in months.

Pt/ Index Level	Age/ Sex	Co-morbid	Other TB sites	Sx	*Sx Duration	ASIA
1/ C6/7	60/M	None	Lung	Neck pain, limbs weak-ness	1	C
2/ C1/2	44/F	RTA, CKD	Lung	Neck pain	3	E
3/ C6/7	51/M	None	No	Neck pain, limbs weak-ness	2	C
4/ C2/3	38/F	None	Ingui-nal	Neck pain	2	E
5/ C6/7	61/M	Par-kinson, stroke	No	Neck pain, limbs weak-ness	0.5	B
6/ C1/2	24/M	None	Nasal	Neck pain	3	E

Table 2: Investigation results and surgery details. ESR – erythrocyte sedimentation rate on admission in mm/Hr; CRP – C-reactive protein on admission in mg/L.

Pt/ Index level	ESR	CRP	Radiographic features	Abscesses
1/ C6/7	66	33	Single segment anterior vertebrae bodies erosion with underlying developmental stenosis	Paravertebral, epidural
2/ C1/2	15	12.1	Erosion of right anterior arch of C1 and odontoid process with basilar invagination	Paravertebral
3/ C6/7	101	76	Multi-level anterior vertebrae bodies erosion	Extensive paravertebral, epidural
4/ C2/3	46	1.1	Erosion of C2 and C3 vertebral bodies with cervical kyphosis	Paravertebral
5/ C6/7	72	99	Multi-level anterior vertebrae bodies erosion	Extensive paravertebral, epidural
6/ C1/2	62	182	Atlantoaxial joint erosion	Paravertebral, retropharyngeal

Table 3: Kyphotic angle measurement on the radiograph, surgical approach and operation duration. Op – operation.

Pt/Index level	Kyphotic angle (Degree)	Surgical approach	Op Duration (mins)
1/ C6/7	-5.6	Posterior	280
2/ C1/2	NA	Posterior	195
3/ C6/7	6.4	Combined	308
4/ C2/3	39.66	Anterior	120
5/ C6/7	4.64	Combined	330
6/ C1/2	NA	Posterior	155

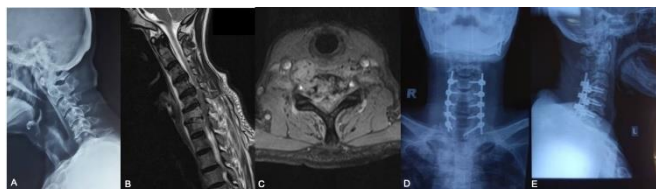


Figure 1: A 60-year-old man was diagnosed to have lower cervical tuberculous spondylitis after a 1-month history of neck pain with limbs weakness. Plain radiograph and MRI showed destruction of C6-C7 vertebral bodies with multilevel developmental stenosis (A-C), posterior approach was done and final follow-up radiographs showed good fixation and fusion (D-E).

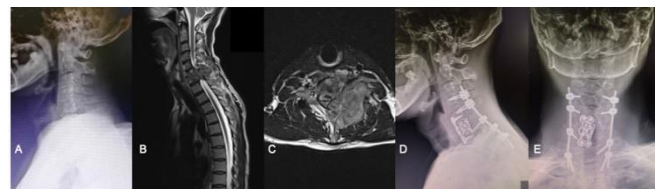


Figure 2: A 51-year-old man was diagnosed with lower cervical tuberculous spondylitis after a 2-month history of neck pain with limbs weakness. Plain radiograph and MRI showed destruction of C6-C7 vertebral bodies with extensive paravertebral and epidural abscesses (A-C), combine anterior and posterior approach was done and final follow-up radiographs showed good fixation and fusion (D-E).

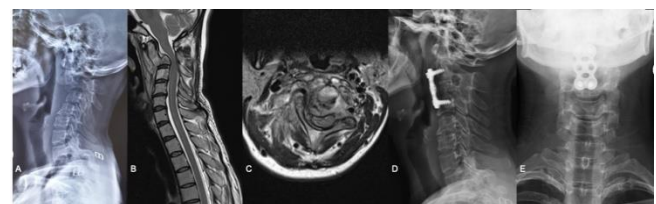


Figure 3: A 38-year-old lady was diagnosed with upper cervical tuberculous spondylitis after a 2-month history of neck pain. Plain radiograph and MRI showed destruction of C2-C3 vertebral bodies with severe local kyphosis, kyphotic angle 39.66 degrees (A-C), anterior-only approach was done and final follow-up radiographs showed good fixation and fusion (D-E).

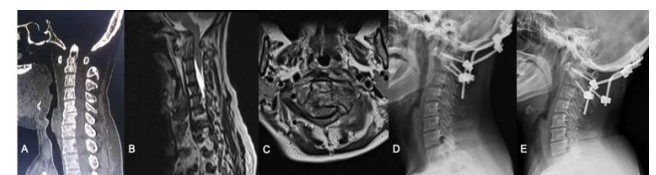


Figure 3: A 44-year-old lady was diagnosed with upper cervical tuberculous spondylitis after a 3-month history of neck pain. Computed tomography and MRI showed erosion of the right anterior arch of C1 and odontoid process with

basilar invagination (A-C), posterior-only approach was done. The initial post-op radiograph showed good fixation (D) but the final follow-up radiograph showed implant failure (E)

4. Discussion

Cervical tuberculosis (TB) is a rare and challenging form of extrapulmonary TB that affects the cervical spine. It accounts for approximately 3-5% of all TB spine cases [9]. In this case series study, we presented the clinical outcomes and early surgical management strategies of six patients diagnosed with cervical TB at our center in Kota Kinabalu, Sabah, Malaysia, from 2017 to 2020. Cervical TB is characterized by its specific anatomical considerations, potential for instability, and risk of causing neurological compromise, making its management complex and demanding.

In our study, we observed a relatively equal distribution of cervical TB cases between males and females, with a median age of 51. Most patients presented with pre-operative neck pain, a common symptom in cervical TB cases with a mean duration of presenting symptoms of 1.9 ± 1.0 months which was early compared to around 10.8 months as described by Wang et. al [6], [10]. Three patients (50%) with subaxial cervical TB suffered from significant neurological deficits, while the other three patients (50%) with upper cervical TB (C1-C3) had preserved neurological function at the time of presentation. These findings are consistent with previous literature, which highlights that cervical TB can lead to severe neurological deficits due to compression of the spinal cord or nerve roots [11], [12]. However, in upper cervical TB especially disease spanning AA lesion, the sagittal canal diameter for the spinal cord is relatively bigger compared to subaxial cervical spine, this may explain why in our series the patients had preserved neurological function at the time of presentation. Pathogenesis of neurological deficit in spinal TB cord compression occurs in combination with physiological factors by inducing a series of inflammatory changes, cord edema, localized ischemia; and mechanical factors such as structural compression from granulation tissue, bone, and subluxation or translation of the vertebrae and soft compression from abscess [6], [13]. These may explain why patients with epidural abscesses in our series had the worst pre-operative neurological function at the time of presentation.

All patients in our study had a positive TB contact history and lived in an endemic region, emphasizing the importance of considering TB as a differential diagnosis in patients from regions with a high TB burden. Early diagnosis is crucial to initiate timely and appropriate treatment, as delayed diagnosis can lead to severe complications and neurological sequelae. Surgical management is often required for cases of cervical TB with severe instability, neurological deficits, or significant deformity [14]. ESR and CRP were raised in five out of six patients (83%), these were two easily available biomarkers for systemic inflammation or infection, not for diagnosis but frequently employed for disease progression monitoring. Despite their limited specificity, they can supplement clinical response and imaging findings to evaluate recovery.

We performed early surgery on all patient regardless of their neurological status. We utilized single-stage posterior surgery for two patients with atlantoaxial (AA) lesions and one patient with developmental stenosis without index level segmental kyphosis; single-stage anterior surgery for one patient with severe kyphosis C2/3 and combined anterior and posterior surgery in two patient with multilevel adjacent segments and extensive paravertebral abscess. The posterior-only approach is appropriate for upper cervical TB with no extensive abscesses and has demonstrated successful outcomes in atlantoaxial TB [14], [15], however, the risk of infection is higher in the posterior approach with limited access to the anterior column for direct decompression in the subaxial cervical spine. Anterior only approach has direct access to the pathology, especially in the severe kyphotic cervical spine, not only can direct decompression of the spinal cord, but it can get better correction of the deformity since CSTB lesions predominantly anterior column. Multiple outcomes studies demonstrated good outcomes with no deterioration in neurological deficit, good fusion rate with less bleeding, and less infection with the anterior-only approach to CSTB [14], [16], [17], however, it is difficult to access to craniocervical and cervicothoracic junction from the anterior. In cases of CSTB involving multiple levels of vertebral destruction with extensive abscesses, anterior debridement is essential. When more than two consecutive vertebrae are severely affected, particularly in patients with pronounced kyphosis, a combined anterior and posterior approach becomes necessary. In these instances, posterior instrumentation is crucial for partially correcting kyphosis and preventing the loosening or breakage of screws. These techniques not only restore the physiological curvature and intervertebral height of the cervical spine but also achieve spinal decompression [14]. However, the disadvantages of the combined anterior and posterior approach are longer operating time and increased bleeding. Despite surgical intervention, one patient with multiple comorbid with extensive epidural abscesses causing significant neurological deficit who underwent combined anterior and posterior surgery in the study succumbed from multiple organ failure despite no surgical complications indicating the severity and potential complications associated with cervical TB. Careful patient selection and optimization, preoperative evaluation, and surgical techniques are essential to minimize the risk of complications. In this patient, a staged procedure might be a better option, a reduced initial operative times might lower the morbidity.

The post-operative outcomes in our study demonstrated improved neck pain in all five patients, and neurological recovery to functional neurology in two patients with pre-operative neurological deficits. There were no surgical site infections reported in this study. Since tuberculosis was not known to form biofilms, it is relatively safe for implantation. However, one patient with an AA lesion underwent posterior occipitocervical fusion and experienced implant failure. This might be due to biomechanical stress at the highly mobile C0-C2 region or non-union. However, the patient was asymptomatic and refused further revision surgery. Duration of anti-TB was still debatable, six months of anti-TB for spinal TB was associated with high relapsed or recurrences but none with nine months or longer. Eighteen months of anti-TB was associated with poor compliance and drug-related toxicity. With the introduction of a multidrug combination,

the recommended duration for spinal TB is 9 months to 12 months [18]. All five patients were treated with 12 months of anti-TB.

4. Other Recommendations

This case series study has some limitations, including its retrospective nature, small sample size, and the absence of a control group. Future prospective studies with larger cohorts and longer follow-up periods are needed to further validate our findings and optimize the management of cervical TB.

5. Conclusion

Cervical spine tuberculosis, though rare, poses significant challenges due to its potential for instability and neurological compromise. Early surgical intervention, combined with medical treatment, is crucial for improving patient outcomes and preventing severe complications. This study highlights the importance of a multidisciplinary approach in managing CSTB effectively.

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Author Profile



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