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Percutaneous Image-Guided Drainage of Spinal Tuberculous Abscess: Clinical Outcomes from a Libyan Cohort

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Abstract

Study Design: Retrospective observational study.

Objectives: To evaluate the clinical outcomes of Image-guided percutaneous drainage combined with anti-tuberculous therapy in patients with spinal tuberculous abscesses.

Setting: Tripoli University Hospital, Libya.

Patients & Methods: We retrospectively reviewed the clinical & radiological images of 10 Libyan patients with spinal tuberculous abscess, treated with image-guided percutaneous drainage, anti-tuberculous chemotherapy (ATT) and spinal bracing. They were 8 females and 2 males with a mean age of 34 years. 3 patients (30%) presented with paraparesis. They were followed up for an average of 26.4 months. Outcomes were assessed using Visual Analog Scale (VAS) for back pain, Erythrocyte Sedimentation Rate (ESR), ASIA Impairment Scale (AIS) for neurological assessment and Cobb's (deformity) angle measurements.

Results: The mean duration of symptoms before diagnosis was 5.4 months, mean abscess volume drained was 480 ml, and median duration of ATT was 18 months.

All 10 patients improved generally, ESR dropped from 108 ± 16.7 mm/hr to 15.2 ± 7.4 mm/hr ($p < 0.00001$). Pain VAS decreased from 7.8 ± 1.6 to 1.9 ± 1.4 ($p < 0.00001$). At presentation, there were three patients with paraparesis (AIS C-D); all improved to AIS E. Cobb's angle increased from 21.9° to 27.4° with no evidence of instability.

Conclusion: In conjunction with ATT, percutaneous drainage is a safe and effective intervention for spinal TB abscesses, yielding significant pain relief, neurological improvement and inflammatory control.

Introduction

Tuberculosis (TB) remains a major global health challenge, particularly in developing nations. Libya is classified as a medium-burden TB country, with an estimated incidence of 59 cases per 100,000 population in 2023, according to the World Health Organization (WHO) [1]. Spinal Tuberculosis (STB), which accounts for nearly 51% of skeletal TB and approximately 2% of all TB cases in Libya [2], is one of the most severe forms of extrapulmonary TB. Its clinical consequences can be debilitating, often including paravertebral or iliopsoas abscess formation, neurological deficits of varying severity, progressive kyphotic deformity, and persistent back pain, which is almost universally reported by affected patients.

Traditionally, management of STB has centred on surgical drainage and radical debridement, often combined with spinal instrumentation when necessary [3]. Although effective, these procedures carry significant morbidity, including intraoperative blood loss, postoperative infection, prolonged rehabilitation, and risk of neurological injury [4]. With advancements in imaging and minimally invasive techniques, CT-guided percutaneous drainage has gained prominence as a valuable alternative, particularly in settings where extensive surgery may not be feasible. This approach allows effective evacuation of abscesses with reduced procedural morbidity, especially when combined with standardized anti-tuberculous therapy (ATT).

Despite growing international evidence, data from North African populations remain limited. Within this context, the current study evaluates the clinical outcomes of CT-guided percutaneous drainage combined with anti-tuberculous therapy and bracing in a cohort of Libyan patients diagnosed with spinal tuberculous abscesses.

Patients and Methods

The records and radiological investigations of a total of 15 patients who presented to the orthopaedic outpatient clinic of Tripoli University Hospital and were diagnosed with spinal tuberculous spondylodiscitis, from 2009 to 2022, were analysed.

Five patients were excluded because they had early TB spondylitis / spondylodiscitis with small or no paravertebral abscess, they were successfully treated conservatively with ATT and spinal immobilization.

Ten patients who underwent percutaneous drainage of the abscess were included in this study.

The diagnosis was established initially clinically and radiologically with CT scans and MRI studies. Patients had tuberculous paraspinal abscess of more than 3 cm diameter or intravertebral /epidural abscess were included.

Diagnostic Tests:

- All patients had a BCG scar.
- Tuberculin skin test was positive All tested patients
- TB-PCR (Tuberculosis-Polymerase Chain Reaction) testing was performed in two patients
- Samples for AFB staining and cultures were sent to the National Centre for Disease Control (CDC) Tuberculosis Control Centre. Cultures were positive in 4 patients (40%).

Data collected included: the duration of symptoms before diagnosis; VAS of back pain; associated symptoms; AIS (ASIA Impairment Scale); ESR; X-rays; CT scans and MRI images (initial and last follow-up); level(s) involved; Cobb's angle (initial and follow-up); and the volume of abscess drained.

Radiological Features

All patients underwent both contrast-enhanced CT and MRI at baseline, which demonstrated characteristic imaging findings consistent with tuberculous spondylodiscitis.

Radiological evaluation played a central role in the diagnosis, procedural planning, and follow-up assessment of patients with spinal tuberculous abscesses in this study.

Magnetic Resonance Imaging (MRI) revealed vertebral body involvement with hypointense signal on T1-weighted images and hyperintense signal on T2-weighted and STIR sequences, reflecting marrow oedema and inflammatory infiltration, with most patients showing contiguous vertebral involvement with intervertebral disc space narrowing, endplate destruction, and varying degrees of paraspinal soft tissue extension. Epidural extension was observed in selected cases, resulting in thecal sac compression and correlating with neurological deficits in three patients.

Paravertebral and iliopsoas abscesses appeared as well-defined collections demonstrating central fluid signal intensity (low on T1, high on T2) with peripheral rim enhancement following gadolinium administration, consistent with caseous necrosis. Bilateral iliopsoas abscesses were more common than unilateral collections in this cohort. In some patients, multiloculated abscess cavities were identified, which influenced catheter placement strategy.

Computed Tomography (CT) provided superior delineation of cortical bone destruction, vertebral collapse, and calcific debris within abscess cavities. CT imaging was essential for procedural planning, which allowed accurate needle trajectory selection while avoiding neurovascular structures. CT guidance allowed precise catheter placement into the largest abscess pocket, ensuring effective evacuation.

Management Protocol:

All patients were admitted to the orthopaedic ward. Clinical and radiological diagnosis was established, and AIS for those with neurological deficits was recorded.

Anti-tuberculous combination treatment (ATT) was initially started empirically (Rifampicin, Ethambutol hydrochloride, Isoniazid (INH), Pyrazinamide), one day after the procedure and continued for 2 months then reduced to INH and Rifampicin for the remaining time, according to the guidelines of the National Tuberculosis Control Program (NTP). This was continued for an average of 15 months (median of 18 months).

The minimally invasive abscess drainage procedure was explained in detail to the patients, and written consent was obtained.

Procedure:

In the CT suite, initial images were obtained, and the point of entry was marked by the radiologist. Under full aseptic technique, local anaesthetic (Lignocaine 2%) was injected around the entry point. Under CT control, a wide-bore cannulated needle and guide wire were introduced into the abscess cavity. This was followed by dilation of the entry point and introduction of the drainage catheter (silicone F12 Foley’s catheter in 6 cases and a small chest tube in 2 cases). The drainage catheter was then connected to a closed system drainage bag, which was kept on free drainage until the amount drained was less than 10 cc in 24 hours. The catheter was then removed.

Two patients with paravertebral and intravertebral abscess with epidural extension and paraparesis, were subjected to abscess aspiration in an operating room under C-Arm fluoroscopy. Aspiration was preferred for smaller or anatomically constrained abscesses.

Patients were subsequently discharged at the appropriate time (depending on the clinical condition) and followed up jointly at the Centre of Disease Control (CDC), where ATT was monitored and supplied, and our follow-up clinic. MRI scans were performed at the 3-, 12-, and 18-month follow up.

Thoracolumbar jacket bracing was continued for at least 12 weeks.

Statistical tests: Statistical analysis was performed using Microsoft Excel (Microsoft Corp., Redmond, WA, USA). Continuous variables were summarized as mean ± standard deviation (SD) or median with interquartile range (IQR).

Changes between baseline and last follow-up were assessed using the paired Student's t-test. The Wilcoxon signed-rank test was used as a non-parametric confirmatory test. A two-tailed *p* value < 0.05 was considered statistically significant.

Results

Ten patients (8 females, 2 males) with spinal tuberculous abscesses underwent percutaneous intervention. Ages ranged from 7.5 to 79 years (mean: 34.6 years).

Seven patients had lumbar spine involvement between L1 and L5, three patients had thoracic level involvement between T10 and T12; three patients had a two non-contiguous level disease. **(Table 1**)

The average duration of symptoms before diagnosis was 5.4 months ranging from 2 to 9 months. The main symptom for all patients was back pain, while 3 patients presented with lower limb weakness (paraparesis). Other symptoms included loss of weight and night sweats which were noted in all patients.

Four patients had Unilateral Iliopsoas spinal abscess, one of these with epidural extension; six patients had bilateral abscesses, two of which with epidural extension.

Procedure Details

- Seven patients had their abscess drained, while three had aspiration with no catheter continuous drainage.
- Abscess volumes drained ranged from 30 mL to 1900 mL, with a mean volume of 480 ± 614.6 mL. The Median drained volume was 250 mL (IQR 78–542 mL).
- The largest abscess (1900 mL) was drained from a 19-year-old female with T10–T11 involvement
- The average catheter drainage time was 55 ± 16.6 hours (Range= 48 to 72 hours)
- No procedure or catheter complications were noted

Clinical Outcomes

Neurological Status

At presentation, 3 patients (30%) had neurological deficits. AIS grades at baseline were AIS E in 7 patients (70%), AIS D in 2 patients (20%), and AIS C in 1 patient (10%). Neurological status improved in all patients with baseline deficits. All patients achieved AIS E status at last follow-up. **(Figure 1**)

Back Pain Relief

All patients reported substantial improvement in back pain following percutaneous drainage or aspiration. (**Table 2**)

Mean VAS score dropped from 7.8 ± 1.6 to 1.9 ± 1.4, a statistically significant reduction (Mean difference: 5.9 points; 95% CI: 5.27–6.53. $p < 0.00001$), indicating marked symptomatic relief.

Inflammatory Marker Response

Erythrocyte Sedimentation Rate (ESR) showed a dramatic decline post-procedure: the mean ESR decreased from 108.4 ± 16.7 mm/hr to 15.2 ± 7.4 mm/hr (Mean difference: 93.2 mm/hr; 95% CI: 83.6–102.8. $p < 0.00001$) at the 3-month follow up, reflecting resolution of active infection and inflammation.

Radiological changes and Kyphotic Deformity

Follow-up MRI at 3, 12, and 18 months demonstrated progressive resolution of abscess cavities, reduction in paraspinal soft tissue mass, and gradual normalization of marrow signal intensity. No progressive epidural compression was observed after intervention. Decrease in post-contrast enhancement and reduction in abscess size correlated strongly with clinical improvement and normalization of inflammatory markers. **(Figure 2)**

Despite clinical and laboratory improvement, there was a significant progression in spinal deformity. Mean Cobb's angle increased from 21.5 ± 5.6 degrees at presentation to 27.4 ± 8.3 degrees at last follow-up. (mean increase = 5.9 degrees; 95% CI: 3.60–8.20), which was statistically significant ($p < 0.001$). (**Table 2**)

One 26-year old female with primary L2-3 level involvement had an additional level T6, the kyphotic angle T6 initially was 25° and at the last follow up was 33°. With no symptoms of instability or cosmetically unacceptable. (**Figure 3**)

Up to the last follow up, none of the patients required surgical correction for kyphotic deformity.

Discussion

Tuberculosis is a major health problem globally. In Libya the reported incidence is about 59 per 100,000 population, 44% of the reported numbers are foreign workers, extrapulmonary tuberculosis (EPTB) constitutes about 36% of cases, which is higher than the global average of 15-25% of cases **[2]**. According to locally published data from the National TB control program (NTP) of the Libyan CDC, skeletal Tuberculosis constitutes 11% of EPTB cases.

All patients in this series experienced significant improvement in pain and inflammatory markers, with complete neurological recovery in those presenting with deficits. These findings are consistent with current concepts in spinal tuberculosis management, which emphasise antituberculous chemotherapy as the cornerstone of treatment, with intervention reserved for selected cases **[5]**.

We have shown that all patients who presented with neurological deficits improved to normal neurological status within three months. Few cohort studies have reported significant neurological improvement following CT-guided drainage, with recovery documented using Frankel or ASIA grading systems **[6,7]**.

The marked reduction in back pain observed following drainage is consistent with previous studies reporting rapid symptomatic relief after abscess evacuation. Similar benefits have been reported by Pluemvitayaporn et al. and Lai et al., who demonstrated significant pain relief and functional recovery following CT-guided drainage of spinal tuberculous abscesses **[6,7]**. Effective infection control in the present study was reflected by the pronounced decline in erythrocyte sedimentation rate following intervention, which aligns with pharmacokinetic and clinical studies indicating that reduction of abscess volume lowers bacterial load and enhances penetration and efficacy of systemic antituberculous drugs **[8,9]**.

The favourable outcomes observed also highlight the importance of conservative management in spinal tuberculosis. All patients were treated with standardized antituberculous chemotherapy and spinal bracing, which constituted the foundation of treatment, while percutaneous drainage served as an adjunct to control abscess burden and relieve compression.

This series shows that despite prolonged spinal immobilization, there was a significant kyphotic deformity progression which is, fortunately, not associated with instability or pain. This finding is consistent with previous studies indicating that while minimally invasive drainage effectively controls infection and symptoms, it does not reliably prevent deformity progression, which is largely related to vertebral destruction and delayed diagnosis **[5,10]**.

Other minimally invasive and image-guided techniques have also been shown to be effective in managing spinal and paraspinal infections. CT-guided intervertebral disc drainage, continuous drainage of psoas abscesses with local ATT, further support the role of targeted minimally invasive approaches in infection control and symptom relief **[11,12,13]**.

Randomised trials and contemporary reviews further support reserving surgical stabilisation for cases with significant instability or severe deformity **[14]**.

Conclusions

Percutaneous image-guided drainage, when combined with anti-tuberculous therapy and spinal bracing, represents a safe and effective management in selected patients with spinal tuberculous abscesses. While progression of spinal deformity remains a concern, this approach provides meaningful symptom relief, effective infection control, and favourable neurological outcomes while minimizing procedural morbidity.

Study Limitations

This study is limited by its retrospective design, small sample size, and single-centre experience, which may affect generalizability. The absence of a control group precludes direct comparison with surgical or conservative-only management.

Declarations

Data Availability Statement

Additional data are available from the corresponding author upon reasonable request.

Author Contribution Statement

1. Alageli NA: Data collection and analysis, writing and revising the article
2. Abograra AS: radiological analysis and reporting, writing the radiological features and reviewing
3. Taleb FS: reviewing and editing

Ethical Approval Statement:

Ethical approval was obtained from the local hospital ethics committee.

Patient Consent Statement:

Not applicable for the study as this was not an experimental study and no identifiable images of human subjects were included in the article.

We confirm that all methods were performed in accordance with the relevant guidelines and regulations.

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Author Note

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Tables

Table 1: Patient Characteristics

Characteristic	Value
Gender, n (%)	Female: 8 (80%); Male: 2 (20%)
Age (years)	Mean ± SD: 34.1 ± 20.3; Median (range): 26.2 (7.5–79.1)
Spinal level involved, n (%)	Lumbar: 7 (70%); Thoracic: 3 (30%); Two levels (non-contiguous): 3 (30%)
Abscess volume (mL)	Mean ± SD: 480 ± 615, Median (IQR): 250 (78–542)
Catheter duration (hours)	Mean ± SD: 55 ± 16.6, Median (IQR): 48 (6–48)
Chemotherapy duration (months)	Mean ± SD: 16.2 ± 2.9
Paralysis at presentation, n (%)	3 (30%)
Neurological deficit at presentation (AIS), n (%)	AIS E: 7 (70%); AIS C: 1 (10%); AIS D: 2 (20%);
Follow-up duration (months)	Mean ± SD: 26.3 ± 8.5; Median (IQR): 25.0 (23.0–27.6)

Table 2: Difference in back pain, ESR and deformity angle initially and at follow-up

Outcome	n	Baseline (mean ± SD)	Last (mean ± SD)	Mean change	95% CI	Paired t-test p	Wilcoxon p
ESR (mm/hr)	10	108.4 ± 16.7	15.2 ± 7.3	−93.2	[−102.76, −83.64]	<0.0001	0.002
Back pain (VAS)	10	7.8 ± 1.5	1.9 ± 1.4	−5.9	[−6.53, −5.27]	<0.0001	0.002
Cobb's angle (°)	10	21.5 ± 5.6	27.4 ± 8.3	5.9	[+3.60, +8.20]	0.0003	0.0074

Figures

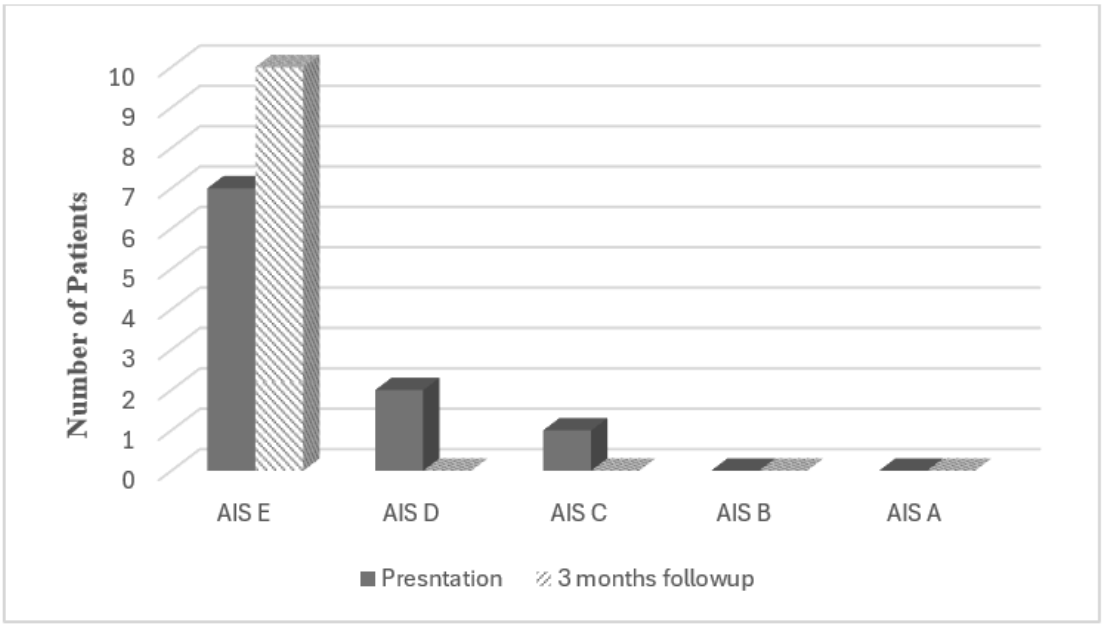
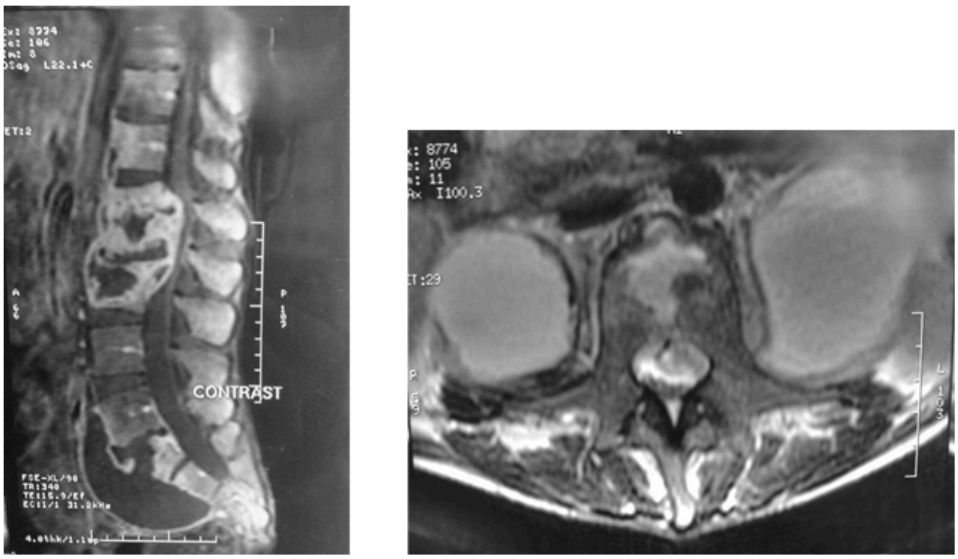
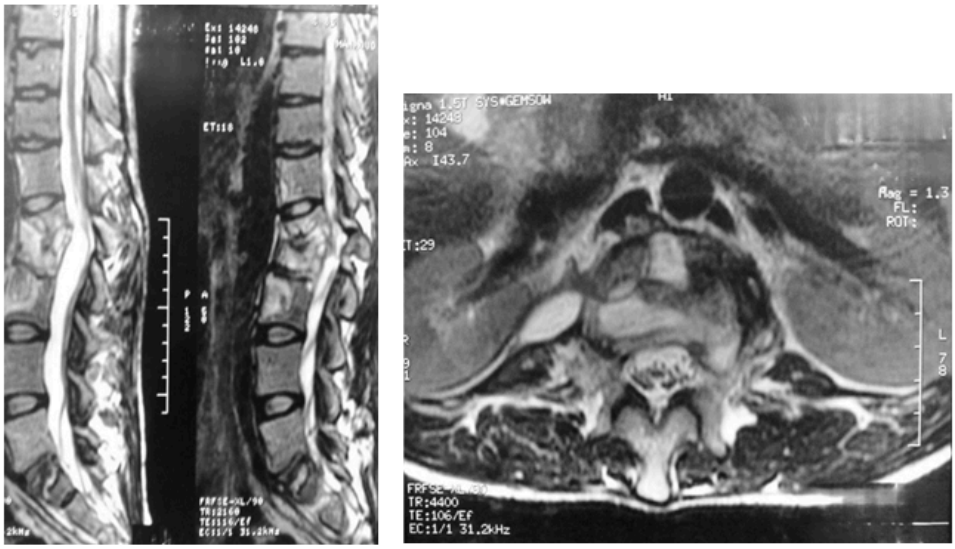


Figure 1

ASIA Impairment Scale (AIS) changes at 3 months follow-up



A)



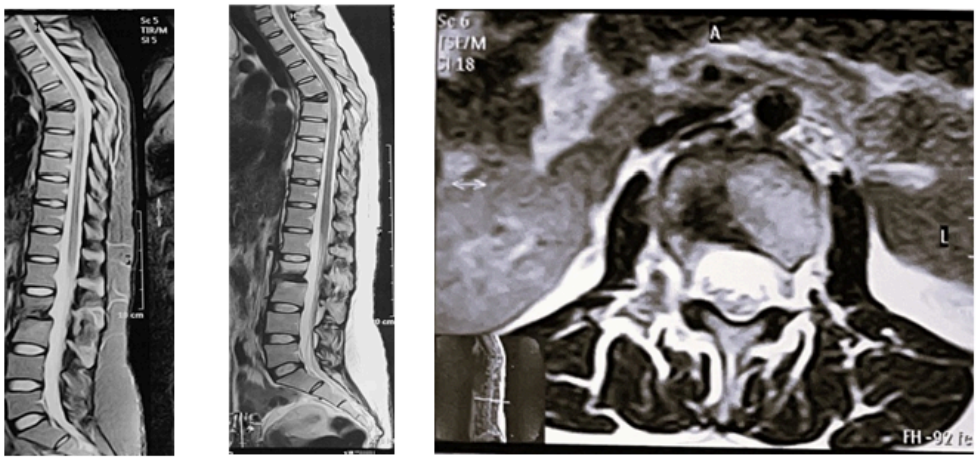
B)

Figure 2

MRI scans of 25-year-old male presenting with spondylodiscitis at the L2-L3 level, bilateral paravertebral and intravertebral epidural abscess, and L1 paraparesis (AIS C). Treatment involved PC aspiration and drainage, antituberculous drugs, and a thoracolumbar jacket. A) at presentation. B) 9 months follow-up



(A)



(B)

Figure 3

MRIs & CT images of 26-years-old female with L1 paraparesis (AIS D) and intravertebral / epidural abscess. (**A**): Initial MRI & CT images showing T6 spondylodiscitis and L2-L3 spondylodiscitis with abscess formation. (**B**) MRI images after treatment (18 months).