MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.59218/makrjms.2023.61.65

A Study of Neurological Recovery and Magnetic Resonance Imaging in Pott's Paraplegia

[1]Mata Prakash Aditya, [1]Navin Singh and [2]Atin Kumar Kundu

[1]*Department of Orthopaedics, Raipur Institute of Medical Sciences, Raipur, CG, India*

[2]*Department of Orthopaedics, Pt JNM Medical College and Hospital, Raipur, CG, India*

ABSTRACT

Despite a large body of research on the use of MRI in spinal TB, investigations examining the connection between MRI results and clinically determined neurological deficits have been scarce. The purpose of this study was to identify potential links or correlations between neurological recovery and MRI results as well as risk factors for inadequate neurological recovery. Prior Consent from the patients was obtained for this cross-sectional analytical investigation, which was determined to be ethically acceptable. 100 patients with spinal TB confirmed by MRI, cytology and histopathology were assessed, classified into the ASIA impairment scales A through E and then reclassified six months later to evaluate functional improvement. They also had MR imaging to evaluate the structural healing at the beginning and end of the six-month treatment period. The real neurological recovery as determined by the ASIA and the recovery MRI characteristics were connected. The presence or absence of cerebrospinal fluid (CSF) prior to the cord, thecal sac compression, epidural abscess and cord compression and cord edoema (described as a strong all of these cord compression-related traits (such as a shift in signal on a T2-weighted imaging) were present. Between people who can walk and those who can't, there was a statistically significant difference in the thickness of the epidural abscess (p = 0.02). About 69% of those with cord 86% with thecal compression and compression. between patients who are ambulatory and those who aren't, there was a statistically significant difference in thecal compression and cord compression correspondingly p = 0.003 and p = 0.000). The CSF loss before the cord was observed in 77% of patients, with ambulatory versus non-ambulatory patients showing a significant difference (p = 0.001). According to the ASIA score, there are a number of MRI parameters that correspond with the degree of neurological impairment and the resolution of those features following treatment is also positively connected with neurological recovery.

OPEN ACCESS

Key Words

Potts paraplegia, MRI, Neurological recovery, american spinal injury association score

Corresponding Author

Atin Kumar Kundu,
Department of Orthopaedics, Pt JNM Medical College and Hospital, Raipur, CG, India
Tel: 9826183555

Received: 7 March 2023
Accepted: 19 March 2023
Published: 12 April 2023

Citation: Mata Prakash Aditya, Navin Singh and Atin Kumar Kundu, 2023. A study of neurological recovery and magnetic resonance imaging in Pott's paraplegia. Res. J. Med. Sci., 17: 61-65, doi: 10.59218/makrjms.2023.61.65

INTRODUCTION

If the vertebrae are affected by TB, the implications could be fatal. Particularly frequent in countries like India is this sickness. A tubercular epidural abscess causes spinal cord/nerve root compression, which causes neurological disability[1]. Depending on the severity and duration of compression, the final result after therapy could be anything from complete recovery to permanent deficit[2]. To evaluate neurological injury brought on by various disease processes, a number of classification systems have been used, including the Tuli grading system[3], Frankel grading system[4], American Spinal Injury Association's measure of functional impairment (ASIA)[5], Nurick classification system, Japanese Orthopaedic Association scale, etc. Despite being commonly used to correlate between traumatic spine injuries and other conditions, there have been few studies to evaluate the usefulness of ASIA in these cases.

MATERIALS AND METHODS

This analytical cross-sectional study required prior patient consent and was determined to be ethical. It involved patients who were enrolled in or visiting a variety of tertiary medical care facilities and health institutions in Raipur CG.

Informed consent was acquired from each participant. This study included 100 consecutive patients with TB of the spine confirmed on cytology/histopathology or clinic-radiologically (MRI) suspicious cases. Every patient had a thorough clinical and neurological evaluation before being categorised using the ASIA impairment scale. The classes for each patient ranged from A to E. The American Spinal Injury Association (ASIA) divided the patients into non-ambulatory (ASIA A, B and C) and ambulatory (ASIA D and E) categories. At the commencement of the study and following the beginning of the treatment, MRIs were performed on all participants. A 1.5 T Siemens Magnetom Symphony, Maestro Class machine was used for the MRI. Important spinal involvement characteristics were noted.

ATT, which consists based on body weight of pyrazinamide, ethambutol, isoniazid and rifampicin, was started for all patients. Abscess removal and lateral/anterior decompression were performed on patients who completed the requirements for surgical decompression according to Tuli's intermediate path regimen. At six months, patients were reorganised onto the new ASIA impairment scale. In order to provide a reasonable amount of time to evaluate the treatment's effects, a 6-month treatment period and reassessment period was selected.

The statistical package for social sciences (SPSS) for Windows version 23 and the computer programme Epi Info version 6.2 (both from Atlanta, Georgia, USA) were used to evaluate the data after it had been entered into Microsoft Excel. Quantitative and qualitative data for unpaired observations (ambulatory and nonambulatory) that they were parametric and analysed by Fisher exact test and student t test, respectively. The paired t test was used for quantitative data for the pairs of observations (during and following treatment), while the McNemar's test was utilized for qualitative data.

RESULTS

Finally, 100 patients were assessed. It was 40.15 16.74 years on average. There were 47% women and 53% men. The average disease duration at presentation was 3.15 0.91 months. Patients who were unreachable for follow-up were excluded from the trial. Cervical involvement was most in 10% (Fig. 1), thoracic involvement was highest in 72% (Fig. 2) and lumbosacral involvement was highest in 18%. 2.87 vertebra on average (287 vertebra in 100 individuals) were impacted. Some individuals were disqualified from having their spinal cord characteristics evaluated because their involvement at a lower vertebral level than L1 than L1. No patient had isolated posterior element involvement. compression of the thecal sac, epidural abscess, the Cerebrospinal fluid (CSF) anterior to the cord's presence or absence, cord compression and cordedoema (described as a strong signal change on a T2-weighted imaging) were all characteristics related to compressed cord. ambulatory versus non-ambulatory individuals, there was a statistically significant difference in the thickness of the epidural abscess ($p = 0.02$). About 69% of those with cord compression and 86% with thecal compression. between patients who are ambulatory and those who aren't, there was a statistically significant difference in thecal compression and cord compression ($p = 0.003$ and $p = 0.000$, respectively). CSF loss before the cord was observed in 77% of patients, with ambulatory versus non-ambulatory patients showing a significant difference ($p = 0.001$) (Table 1 and 2).

About 75% of patients had cord edoema prior to therapy beginning. Cord edoema and ambulatory status were not observed to be significantly correlated ($p = 1.6$). The various ambulatory function groups did not differ in terms of the shape or size of the signal change. On T1-weighted images, none of the MRIs used in our study showed low signal intensity.

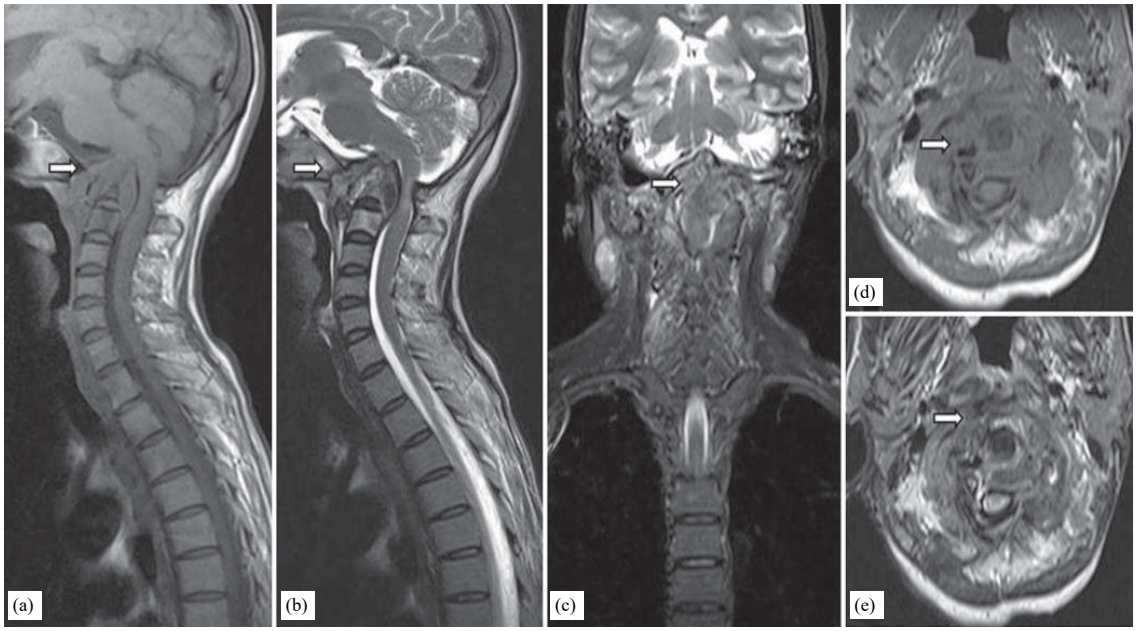

Fig. 1(a-e): (a) Magnetic resonance imaging cervical spine sagittal T1W (b) Sagittal T2W (c) Coronal short tau inversion recovery (d) Axial T1W and (e) axial T2W in a 35 year female presenting with upper and lower limb weakness

American spinal injury association class A, Tuberculous spondylitis involving C1-C2 and clivus (a-c), Periodontoid and epidural granulation tissue (6.0 mm in maximum thickness) extending up to C3 level (b), Basilar invagination and atlantoaxial dislocation with epidural granulation tissue causing kinking and compression of cervico medullary junction with compressive myelopathy

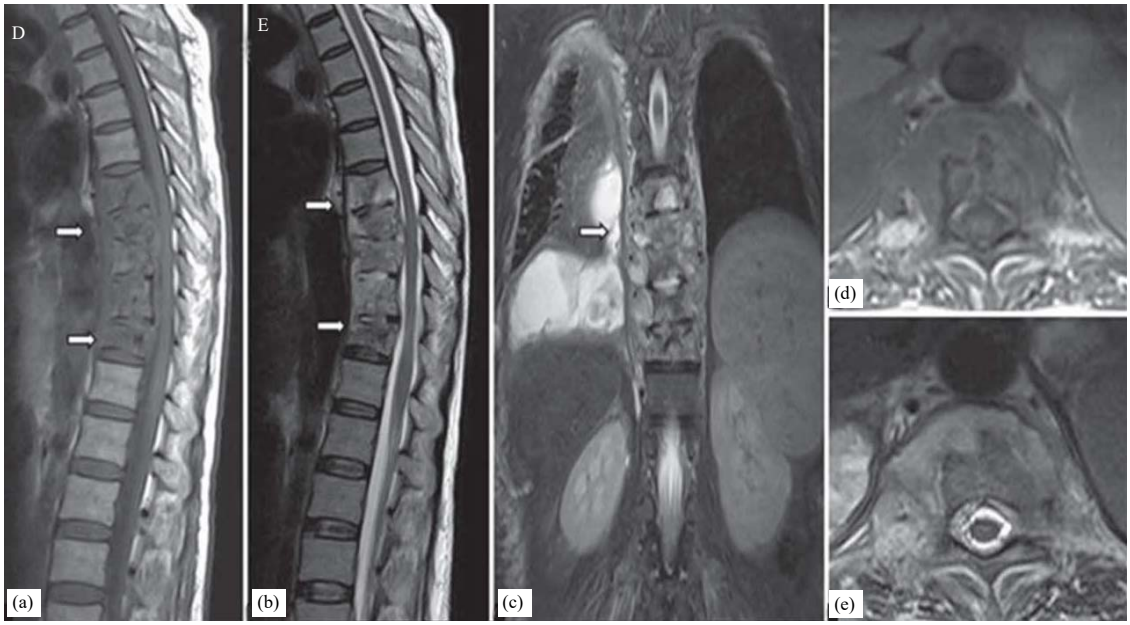

Fig. 2(a-e): (a) Magnetic resonance imaging dorsal spine sagittal T1W (b) Sagittal T2W (c) Coronal short-tau inversion recovery (d) Axial T1W and (e) Axial T2W in a 48 year female presenting with black pain and fever, with weakness in both lower limbs

American spinal injury association class D. Multilevel tuberculous spondylitis of D7-D11vertebral bodies and bacterial pedicles (a-c). Intervening intervertebral discs involved. Epidural collection extending from D8 to D10 level measuring 10 mm in maximum thickness (b and e) and causing cord compression. Pre and para vertebral collection extending from D7 to D11 level (a-e). Right loculated pleural collection noted (c)

Table 1: MRI features before and after treatment

MRI finding	Before treatment (%)	After treatment (%)
Thecal sac compression	86	20
Absent CSF anteriorto cord	77	16
Cord compression	69	17
Cordedema	75	5

MRI: Magnetic resonance imaging and CSF: Cerebrospinal fluid

Table 1: Neurological status before and after treatment

	Epidural abscess in mm (mean±SD)	
Neurological status	Before treatment	After treatment
Ambulatory	4.8±2.7	1.4±1.3
Non-ambulatory	7.1±2.9	2.03

SD: Standard deviation

ATT was given to all 100 patients. About 21 out of 100 patients required surgical intervention. The surgical treatment involved costotransversectomy, dural release, debridement and spinal fixation for posterior or anteromedial decompression.

The thickness of the epidural abscess varied significantly between pre- and post-treatment (p = 0.000).

The compression of the thecal sac dramatically decreased from 86% before therapy to 20% after it (p = 0.001). Pretreatment CSF prior to cord loss was absent in 77% of patients and it decreased to 16% of patients following treatment (p = 0.000). The percentage of individuals with cord compression decreased significantly from 69% before treatment to 17% after treatment (p = 0.000). Only 2% of patients had cord edoema after treatment. Patients from all classes who were present at the follow-up exhibited complete remission of the impairment following therapy. Only the size of the epidural abscess on the MRI was revealed to be a poor predictor of failure to recover from neurological impairment (p = 0.008).

DISCUSSIONS

The pathological course of tuberculous lesions in the spine, which is marked by caseous necrosis and tissue loss, follows the same principles. In cases the spinal cord is prone to myelopathy in cases of spinal tuberculosis because of compression from an epidural abscess. The vertebral arch can develop the abscess anyplace along it. with respect to the cord, depending on where the cord is compressed and may display specific symptoms. Cord compression may result from an impinging dorsal fragment of a collapsed vertebra on the cord. Compression of the nerve root may also be caused by similar causes. In turn, gradual neurological symptoms including weakness, referred pain, or function loss are brought on by cord/nerve root compression. The initial sign of the deficit is spasticity, which progresses to sensory impairment and partial and complete motor loss[6,7].

Neurologically impaired patients in our study were classed into ASIA impairment scores A through D. Seventy-five percent of the patients in a related study by Khalid *et al*.[8] had a modest neurological impairment.

However, none of our patients had this syndrome. Desai *et al*.[9] (8%) and Gupta *et al*.[10] (73) both observed participation of a single posterior element. Of the 172 vertebrae afflicted in the 60 individuals, 60 vertebrae (34.88%) impacted the posterior part. There was spinal cortical erosion in all 60 individuals. This is a really helpful point to remember, say Sharif *et al*.[11]. distinguish between pyogenic spondylitis and TB spondylitis. Some of our patients' condition eventually progressed to the point that the vertebrae were destroyed, resulting in kyphotic/kyphoscoliotic deformity, anterior wedging, partial or total collapse some cases. In our investigation, we also noted subligamentous spread of the lesion. A detailed analysis of these studies by Jain *et al*.[12] revealed that 92 and 49.2% of the patients, respectively, showed Spread of the subligaments and kyphoscoliotic deformity. Subligamentous growth a feature of tuberculous spondylitis because the tubercle bacilli are absent from the lesion the proteolytic enzymes required to dissolve the ligaments. Extensions pre- and paravertebral soft tissue involvement of the lesion were found to be an abscess and granulation tissue. This amount is similar to what Jain *et al*.[12] found in their investigation[12-14].

About 80% (n = 56) of the patients in their analysis had cord edoema, according to Dunn *et al*.[15]. They also found a strong correlation between variations in cord signal and ambulatory state. There were no discernible prognostic indicators on the MRI for this.

Prior to therapy, participants in our study had cord edoema but this dropped to 2% after treatment. As a result, we also don't think cord edoema affects neurological recovery. Contrary to Dunn *et al*.[15], we were unable to discover a significant correlation between cord edoema and ambulatory state or a marker for non-recovery. No cases of myelomalacia, which is defined as low signal intensity on T1, or long-lasting compression were found in either the Dunn *et al*.[15] or Jain *et al*.[16] series. In any case, T1's low signal level was undetectable to us.

Thus, in decreasing order of frequency, thecal compression, loss of CSF thickness, cord edoema and cord compression were the stages of compression development. Given that not all instances of cord compression result in a neurological disability, this makes reasonable. According to Cotten *et al*.[17], a neurological loss only occurs when the spinal canal is invaded by more than 60% above the level of the conus. Jain *et al*.[16] estimate that up to 76% of canal encroachment results in no discernible deficit. Only a small number of comparable studies have

demonstrated the effectiveness of the ASIA grading system in tracking patients with spinal TB and showing concomitant structural recovery on MRI.

CONCLUSION

The resolution of these features following therapy is also positively connected with neurological recovery, leading us to the conclusion that a number of MRI characteristics correlate with the level of neurological impairment as determined by the ASIA score. However, out of all the reported data, only the size of the epidural abscess is associated with a poor prognosis.

ACKNOWLEDGMENTS

We would like to express our gratitude to all of the participating patients, our head of department and Dean for his constant leadership.

REFERENCES

1. WHO., 2012. Global Tuberculosis Report. World Health Organization, https://apps.who.int/iris/bitstream/handle/10665/75938/9789241564502_eng.pdf?sequence=1
2. Jain, A.K., 2010. Tuberculosis of the spine. J. Bone Joint Surg. Br., 92: 905-913.
3. Tuli, S.M., 2021. Tuberculosis of the Skeletal System. 6th Edn., Jaypee Brothers Medical Publishers, ISBN-13: 9788194709022, Pages: 466.
4. Frankel, H.L., D.O. Hancock, G. Hyslop, J. Melzak and L.S. Michaelis *et al*., 1969. The value of postural reduction in the initial management of closed injuries of the spine with paraplegia and tetraplegia. Spinal Cord, 7: 179-192.
5. Ditunno, J.F., W. Young, W.H. Donovan and G. Creasey, 1994. The international standards booklet for neurological and functional classification of spinal cord injury. Spinal Cord, 32: 70-80.
6. Jain, A.K. and S. Sinha, 2005. Evaluation of systems of grading of neurological deficit in tuberculosis of spine. Spinal Cord, 43: 375-380.
7. Jain, A.K., I.K. Dhammi, S. Jain and J. Kumar, 2010. Simultaneously anterior decompression and posterior instrumentation by extrapleural retroperitoneal approach in thoracolumbar lesions. Indian J. Orthop., 44: 409-416.
8. Khalid, M., M.A. Siddiqui, S.M.D. Qaseem, S. Mittal, A.A. Iraqi, S.A.A. Rizvi, 2011. Role of magnetic resonance imaging in evaluation of tubercular spondylitis: pattern of disease in 100 patients with review of literature. JNMA J. Nepal. Med. Assoc., 51: 116-121.
9. Desai, S.S., 1994. Early diagnosis of spinal tuberculosis by MRI. J. Bone Joint Surg. Br., 76: 863-869
10. Gupta, R.K., P. Agarwal, H. Rastogi, S. Kumar, R.V. Phadke and N. Krishnani, 1996. Problems in distinguishing spinal tuberculosis from neoplasia on MRI. Neuroradiology, 38: S97-S104.
11. Sharif, H.S., J.L. Morgan, M.S.A. Shahed, M.Y.A. Thagafi, 1995. Role of CT and MR imaging in the management of tuberculous spondylitis. Radiol. Clin. North Am., 33: 787-804.
12. Jain, A.K., R. Sreenivasan, N.S. Saini, S. Kumar, S. Jain and I.K. Dhammi, 2011. Magnetic resonance evaluation of tubercular lesion in spine. Int. Orthop., 36: 261-269.
13. Gehlot, P.S., 2012. Pott's spine: Retrospective analysis of MRI scans of 70 cases. J. Clin. Diagn. Res., 6: 1534-1538.
14. Thrush, A. and D. Enzmann, 1990. MR imaging of infectious spondylitis. AJNR Am. J. Neuroradiol., 11: 1171-1178.
15. Dunn, R., I. Zondagh and S. Candy, 2011. Spinal tuberculosis: Magnetic resonance imaging and neurological impairment. Spine, 36: 469-473.
16. Jain, A.K., A. Aggarwal and G. Mehrotra, 1999. Correlation of canal encroachment with neurological deficit in tuberculosis of the spine. Int. Orthop., 23: 85-86.
17. Cotten, A., R.M. Flipo, M.H. Drouot, F. Maury, P. Chastanet, B. Duquesnoy and B. Delcambre, 1996. Spinal tuberculosis: Study of clinical and radiological aspects from a series of 82 cases. J. Radiol., 77: 419-426.