

CASE REPORT

Successful management of cervical tuberculosis and severe kyphosis using polyetheretherketone expandable cage and titanium plate: A case report

Javeed Iqbal¹ | Muhammad Mohsin Khan¹  | Abdunnasser Thabet¹ |
Kazim Mohammed¹ | Gianluca Scalia²  | Bipin Chaurasia³ 

¹Department of Neurosurgery, Hamad General Hospital – Surgical Specialty Center, Doha, Qatar

²Neurosurgery Unit, Department of Head and Neck Surgery, Garibaldi Hospital, Catania, Italy

³Department of Neurosurgery, Neurosurgery Clinic, Birgunj, Nepal

Correspondence

Bipin Chaurasia, Department of Neurosurgery, Neurosurgery Clinic, Birgunj, Nepal.
Email: trozexa@gmail.com

Key Clinical Message

Successful management of cervical tuberculosis and severe kyphosis was achieved using a PEEK expandable cage and titanium plate, demonstrating favorable outcomes in restoring cervical alignment and stability. This approach represents a promising alternative for addressing complex cervical pathologies, highlighting the potential of PEEK-based interventions in surgical management.

Abstract

Cervical tuberculosis can lead to severe vertebral destruction and kyphosis, posing challenges in surgical management. Recent advancements, including the use of polyetheretherketone (PEEK) expandable cages and titanium plates, show promise in addressing multilevel cervical pathologies. This report details the successful treatment of a 27-year-old male with cervical tuberculosis and severe kyphosis. Surgical intervention involved prevertebral abscess evacuation, C5-C7 corpectomy, and insertion of a PEEK expandable cage with an anterior titanium plate. Postoperative care included a Philadelphia collar, and follow-up demonstrated restored cervical alignment and stability. The use of PEEK-based surgical interventions, as demonstrated in this case, represents a significant evolution in managing complex cervical conditions. The successful outcome highlights the potential benefits of PEEK expandable cages in addressing cervical tuberculosis and kyphosis. Further research is needed to validate these findings and establish PEEK-based interventions as a viable alternative in such cases.

KEYWORDS

cervical spine surgery, cervical tuberculosis, kyphosis, polyetheretherketone (PEEK) expandable cage, titanium plate

This is an open access article under the terms of the [Creative Commons Attribution-NonCommercial-NoDerivs](https://creativecommons.org/licenses/by-nc-nd/4.0/) License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

© 2024 The Authors. *Clinical Case Reports* published by John Wiley & Sons Ltd.

1 | INTRODUCTION

Cervical tuberculosis can lead to severe destruction of vertebrae and kyphosis, presenting a challenging condition for surgical treatment. In recent years, the use of polyetheretherketone (PEEK) expandable cages and titanium plates has shown promise in addressing multilevel cervical pathologies. This case report presents the successful treatment of a patient with cervical tuberculosis and severe kyphosis using a PEEK expandable cage and titanium plate, resulting in restored cervical alignment and long-term stability.

While traditional operative procedures, including the use of titanium cages, autologous bone grafts, and expandable titanium cages, have been established for cervical corpectomy in various cervical diseases, the PEEK expandable cage offers a potential alternative with favorable outcomes. Building on the work of Tarantino et al.,¹ which demonstrated improved patient outcomes with winged expandable titanium cages following corpectomy, this case report contributes to the growing body of evidence supporting the efficacy of PEEK-based surgical interventions in cervical pathologies.

In this context, the introduction of novel surgical techniques and implants, such as the PEEK expandable cage, represents an important evolution in the management of complex cervical conditions. This report aims to contribute to the understanding of the potential benefits of PEEK-based interventions in addressing cervical tuberculosis and severe kyphosis, while also highlighting the need for further research and evaluation of these emerging techniques.

2 | CASE HISTORY/ EXAMINATION/PRESENTATION

A 27-year-old male, employed as a security guard, presented to the emergency department with a two-week

history of persistent neck and upper back pain. The pain had intensified, significantly affecting his daily activities. The patient denied constitutional symptoms such as weight loss, night sweats, or fever and reported no history of trauma, smoking, alcohol or drug abuse, infections, surgeries, or hospitalizations. Neurological examination revealed no abnormalities, with the patient maintaining normal bladder and bowel functions. Laboratory investigations revealed normal results for complete blood count, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), and liver function tests. Additionally, renal function tests and HIV screening were within normal limits.

3 | METHODS (DIFFERENTIAL DIAGNOSIS, INVESTIGATIONS, AND TREATMENT)

3.1 | Differential diagnosis

Considering the persistent neck and upper back pain, initially considered diagnoses included musculoskeletal issues, traumatic injuries, infectious, and inflammatory conditions.

3.2 | Investigations

Cervical spine radiographs revealed collapse of the C6 vertebral body, kyphotic changes, and increased prevertebral soft tissue thickness, suggestive of spondylodiscitis.

CT Scan (Figure 1A,B): showed an acute gibbus deformity at C6, Cobb's angle of 29 degrees, mild-to-moderate spinal canal stenosis, and lytic lesions in C5, C7, and T2 vertebral bodies.

Spine MRI (Figure 2A,B,C): confirmed kyphotic deformity, markedly reduced height of C6 vertebral body, and evidence of infectious spondylitis involving C5-C7



FIGURE 1 (A) Sagittal CT scan of the cervical spine with bone window demonstrating an acute gibbus deformity at the C6 level with vertebral plana of C6. Lytic lesions are noted in the posterior aspect of C5, C7, and T2 vertebral bodies with disruption of the posterior cortex. (B) Axial CT scan of the cervical spine with bone window showing an extensive lytic lesion involving the C6 vertebra with complete collapse of the C6 vertebral body.

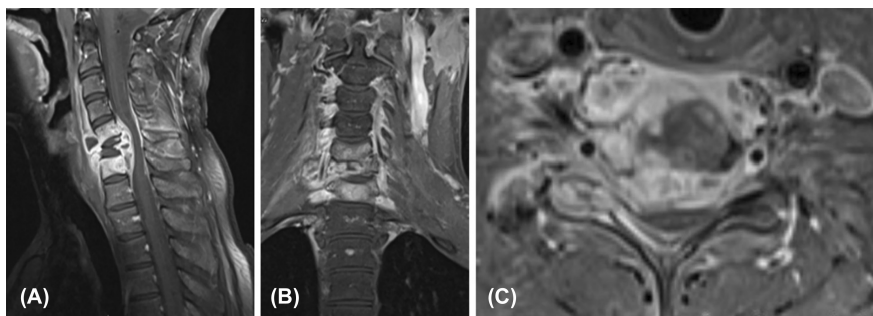


FIGURE 2 (A) Sagittal image of the spine MRI with T1-weighted contrast. It demonstrates a marked reduction in the height of the C6 vertebral body, with a residual posterior part measuring approximately 4 mm in maximum height. The vertebral bodies of C5, the residual part of C6, and C7 exhibit abnormal mixed signal intensities on T1-weighted MRI, high signal intensity on T2-weighted MRI, and intense contrast enhancement. (B) Coronal spine MRI T1 with contrast image showing the lateral extent of the collection. (C) Axial spine MRI T1 with contrast image demonstrating the intracanal epidural collection causing severe cord compression.

with multilocular anterior extradural and paravertebral abscesses.

3.3 | Treatment

Surgical intervention was deemed necessary, involving prevertebral abscess evacuation, C5-C7 corpectomy, and insertion of an expandable cage device from C4 to T1. Purulent material was collected from disrupted posterior longitudinal ligament during surgery for microbiological analysis, and phlegmon adherent to the dura was noted. An expandable PEEK cage device (size 48) was inserted, secured with an anterior plate (size 66 mm), and four screws (14 mm each). Postoperatively, the patient was prescribed a Philadelphia collar for 3 months for postoperative care.

3.4 | Microbiological analysis

During the surgical procedure, samples were collected for microbiological analysis. Cultures were obtained from the prevertebral abscess and vertebral tissue using standard microbiological techniques. Polymerase chain reaction (PCR) testing was employed to detect the presence of *Mycobacterium tuberculosis* DNA. The microbiological analysis confirmed the presence of *Mycobacterium tuberculosis*, confirming the diagnosis of cervical tuberculosis. Additionally, sensitivity testing was performed using the disk diffusion method to guide antibiotic therapy.

4 | RESULTS (OUTCOME AND FOLLOW-UP)

Postoperatively, a spine CT scan confirmed the accurate positioning of the expandable cage device

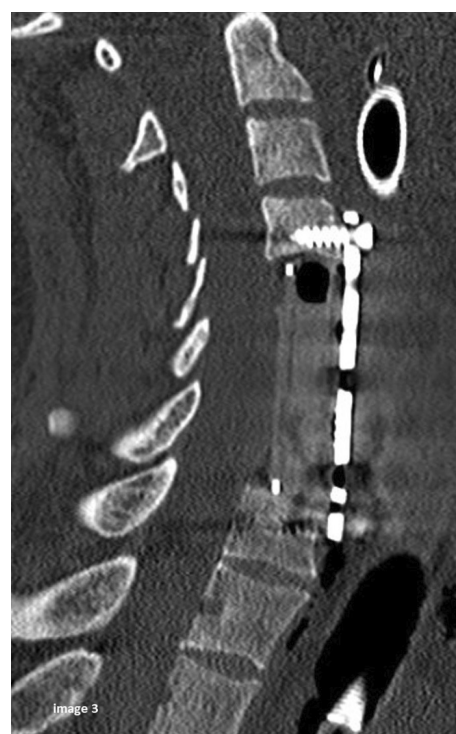


FIGURE 3 Intraoperative CT scan with bone window demonstrating C4, C5, C6 corpectomy, with the insertion of an Expandable PEEK cage.

(Figure 3). The patient was subsequently started on a complete course of anti-tuberculosis medication, resulting in a complete recovery. Radiographic follow-up was performed at 6 months post-surgery (Figure 4A,B). Analysis of serial cervical radiographs revealed a notable decrease in kyphosis, with the device maintaining stable positioning and cervical alignment. No signs of subsidence (gradual collapse or sinking of the cage device into the adjacent vertebrae) were observed during the follow-up period.

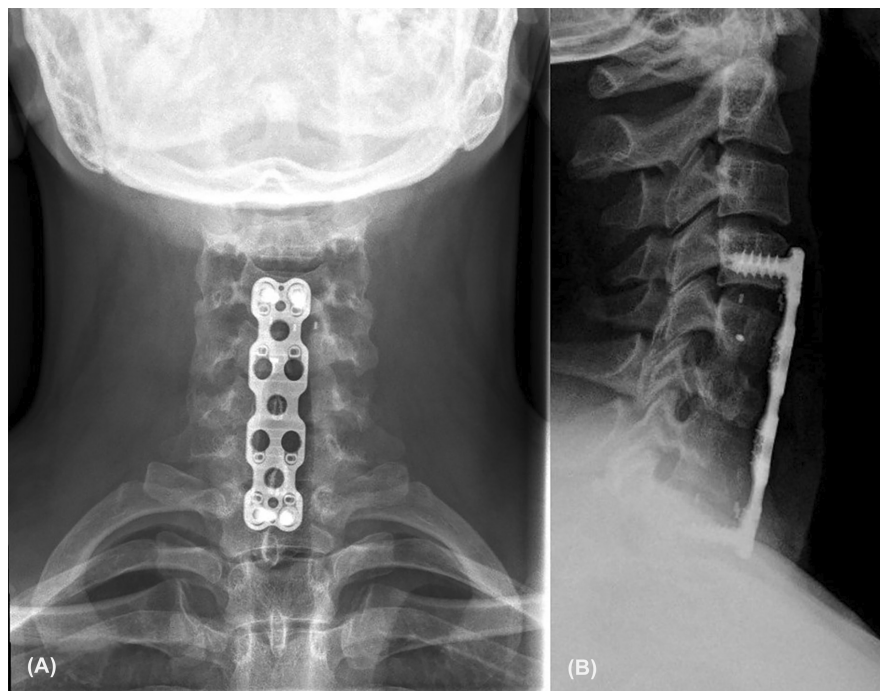


FIGURE 4 (A) AP view of the cervical spine X-ray showing a good position of the instrumentation. (B) Lateral view of the cervical spine X-ray showing good alignment with a reduction of the kyphosis and satisfactory fusion.

5 | DISCUSSION

Tuberculosis is known to affect the cervical spine, but its occurrence as a cause of spondylodiscitis in this region is rare. This rarity is attributed to tuberculosis typically sparing the disk spaces, unlike the more common presentation in the lumbar and thoracic regions, often referred to as Pott's disease.² While tuberculosis can involve the cervical spine, spondylodiscitis is not a typical manifestation. Clinicians should remain vigilant for other potential etiologies of cervical spine pathology in symptomatic patients. The incidence of cervical tuberculosis among spinal tuberculosis cases is on the rise in developed nations, partly due to the increase in HIV infections, immunocompromised patients, and the emergence of multidrug-resistant tuberculosis. Surgical intervention is often necessary when medical treatment is insufficient or fails.³

Multiple reconstructive procedures have been advocated following cervical corpectomy, including the use of autologous bone grafts from the iliac and fibular bones. Several studies have associated iliac crest bone graft (ICBG) use with complications such as donor site morbidity, pseudoarthrosis, and potential graft dislodgement.⁴ Despite these issues, polyetheretherketone (PEEK) cages have been shown to be an effective treatment option for cervical spondylosis, even in infectious cases. Traditionally, ICBG has been a common choice for anterior cervical discectomy and fusion (ACDF), but due to associated complications, alternative grafting methods such as PEEK cages are being considered. These alternatives offer structural support to facilitate fusion while minimizing the risk of donor site complications.⁵

While some authors report no implant complications using metal implants in infections,⁶ others recommend long-term oral antibiotics, implant removal, and cultures from the infected site.⁷ Mondorf et al.⁸ demonstrated that abscess drainage and ventral fusion with PEEK-cage disc replacement could be successfully performed in a single procedure. Our case is unique, as it involves a long segment fusion with a PEEK cage and plating. Clinical and radiological outcomes with PEEK expandable cages for various conditions have been favorable.^{9,10} However, high rates of subsidence have been reported with autologous bone grafts (ABG), non-expandable titanium cages (NETC), and expandable titanium cages (ETC), regardless of the disease. Their use without posterior fixation is discouraged when multiple levels of decompression are necessary.^{11,12} Sasso et al.¹³ reported a low failure rate with two-level anterior cervical fusion but a significantly higher failure rate with three-level fusion, suggesting simultaneous posterior fusion as a consideration.

Conversely, Heyde et al.¹⁴ found success treating spondylodiscitis with either combined anterior-posterior fixation or anterior approach alone. Shousha et al.¹⁵ also supported anterior surgery alone in their study of cervical spondylodiscitis treatment over two decades. However, in a separate series, Shousha et al.¹⁶ cautioned against ventral plating after corpectomy for spondylodiscitis due to potential space creation for abscess formation. They suggested that radical surgical debridement combined with appropriate antibiotics was a successful strategy for resolving inflammation in

cervical spondylodiscitis. MRI of the entire spine was also recommended to avoid missing concurrent spinal infections. Frank Kandziora et al.¹⁷ found no biomechanical advantage of expandable cages over tricortical iliac crest bone grafts or non-expandable cages. Due to their lower extension and rotational stiffness, these implants require additional stabilization, such as anterior plating, to achieve biomechanical stability. The authors proposed that posterior stabilization should be reserved for cases of significant rotational instability.¹⁷ Our case adds to the body of evidence, illustrating that successful anterior fusion alone can be used to treat long-segment cervical spondylodiscitis. Despite concerns regarding subsidence and implant stability, the patient maintained good spinal alignment and mobility postoperatively. This outcome suggests that, in carefully selected cases, anterior plating with PEEK cages can provide sufficient stability for multi-level cervical spine reconstruction, even in the presence of infection.¹⁸⁻²⁰

6 | CONCLUSIONS

In this report, we presented a case of tuberculosis of the cervical spine resulting in kyphosis, which was successfully treated with multiple corpectomy, the use of a polyether ether ketone (PEEK) expandable cage, and a titanium plate. The patient experienced complete recovery in the postoperative period, with correction of the kyphosis and no evidence of subsidence at the radiological follow-up. These results suggest that this device can provide favorable clinical and radiological outcomes for similar cases with a significant risk of instability. There is increasing evidence to support the safe stabilization of the unstable spine in the presence of acute infection with instrumentation. However, further validation through a case series is necessary to establish it as a stand-alone alternative for such cases.

AUTHOR CONTRIBUTIONS

Javed Iqbal: Conceptualization; data curation; resources; writing – original draft. **Muhammad Mohsin Khan:** Conceptualization; data curation; resources; software. **Abdulnasser Thabet:** Data curation; resources; writing – original draft. **Kazim Mohammed:** Data curation; formal analysis. **Gianluca Scalia:** Supervision; validation; visualization; writing – review and editing. **Bipin Chaurasia:** Supervision; validation; visualization; writing – review and editing.

ACKNOWLEDGMENTS

Open access funding is provided by Qatar national library.

FUNDING INFORMATION

This manuscript did not receive any funds.

CONFLICT OF INTEREST STATEMENT

None.

DATA AVAILABILITY STATEMENT

Data sharing not applicable – no new data generated, or the article describes entirely theoretical research.

ETHICAL APPROVAL

This case report was compiled after obtaining informed consent from the patient for the disclosure of clinical history and management with the intention of publication. All attached imaging and clinical materials were de-identified to ensure patient anonymity.


CONSENT

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

ORCID

Muhammad Mohsin Khan  <https://orcid.org/0000-0001-8703-2328>

Gianluca Scalia  <https://orcid.org/0000-0002-9465-2506>

Bipin Chaurasia  <https://orcid.org/0000-0002-8392-2072>

REFERENCES

1. Tarantino R, Nigro L, Donnarumma P, Rullo M, Santoro A, Delfini R. Cervical reconstruction techniques. After adequate selection of the patient report of a series of 34 patients treated with winged expandable cages. *Neurosurg Rev.* 2017;40:281-286.
2. Muzii VF, Mariottini A, Zalaffi A, Carangelo BR, Palma L. Cervical spine epidural abscess: experience with microsurgical treatment in eight cases. *J Neurosurg Spine.* 2006;5:392-397.
3. Tarantino R, Donnarumma P, Fazzolari B, Marruzzo D, Delfini R. Pott's disease: medical and surgical treatment. *Clin Ter.* 2013;164:97-100.
4. Sarkar S, Nair BR, Rajshekhar V. Complications following central corpectomy in 468 consecutive patients with degenerative cervical spine disease. *Neurosurg Focus.* 2016;40(6):E10. doi:10.3171/2016.3.FOCUS1638
5. Stone JL, Cybulski GR, Rodriguez J, Gryfinski ME, Kant R. Anterior cervical debridement and strut grafting for osteomyelitis of the cervical spine. *J Neurosurg.* 1989;70:879-883.
6. Suess O, Weise L, Brock M, Kombos T. Debridement and spinal instrumentation as a single-stage procedure in bacterial spondylitis/spondylodiscitis. *Zentralbl Neurochir.* 2007;68:123-132.
7. Shad A, Shariff S, Fairbank J, Byren I, Teddy PJ, Cadoux-Hudson TA. Internal fixation for osteomyelitis of cervical spine: the issue of persistence of culture positive infection around the

- implants. *Acta Neurochir.* 2003;145(11):957-960; discussion 960. doi:[10.1007/s00701-003-0129-8](https://doi.org/10.1007/s00701-003-0129-8)
8. Mondorf Y, Gaab MR, Oertel JM. PEEK cage cervical ventral fusion in spondylodiscitis. *Acta Neurochir.* 2009;151:1537-1541.
 9. Auguste KI, Chin C, Acosta FL, Ames CP. Expandable cylindrical cages in the cervical spine: a review of 22 cases. *J Neurosurg Spine.* 2006;4:285-291.
 10. Zaïri F, Aboukais R, Thines L, Allaoui M, Assaker R. Relevance of expandable titanium cage for the treatment of cervical spondylotic myelopathy. *Eur Spine J.* 2012;21:1545-1550.
 11. Chen Y, Chen D, Guo Y, et al. Subsidence of titanium mesh cage: a study based on 300 cases. *J Spinal Disord Tech.* 2008;21:489-492.
 12. Kanayama M, Hashimoto T, Shigenobu K, Oha F, Ishida T, Yamane S. Pitfalls of anterior cervical fusion using titanium mesh and local autograft. *J Spinal Disord Tech.* 2003;16:513-518.
 13. Sasso RC, Ruggiero RA Jr, Reilly TM, et al. Early reconstruction failures after multilevel cervical corpectomy. *Spine (Phila Pa 1976).* 2003;28:140-142.
 14. Heyde CE, Bohem H, El Saghir H, et al. Surgical treatment of spondylodiscitis in the cervical spine: a minimum 2-year follow-up. *Eur Spine J.* 2006;15:1380-1387.
 15. Shousha M, Heyde C, Boehm H. Cervical spondylodiscitis: change in clinical picture and operative management during the last two decades. A series of 50 patients and review of literature. *Eur Spine J.* 2015;24:571-576.
 16. Shousha M, Boehm H. Surgical treatment of cervical spondylodiscitis: a review of 30 consecutive patients. *Spine (Phila Pa 1976).* 2012;37:E30-E36.
 17. Kandziora F, Pflugmacher R, Schaefer J, et al. Biomechanical comparison of expandable cages for vertebral body replacement in the cervical spine. *J Neurosurg.* 2003;99:91-97.
 18. Rashid MH, Hossain MN, Ahmed N, Kazi R, Chaurasia B. Mimics of spinal tuberculosis. *J Spine Surg.* 2023;10(2):66-72.
 19. Khan SI, Ahmed N, Chaurasia B. Multifocal non contagious and contagious spinal tuberculosis in an immunocompetent patient. *Int J Neurol Neurosurg.* 2018;10(4):165-170.
 20. Furnari M, Scalia G, Umana GE, et al. Rare spondylodiscitis due to *Mycobacterium mucogenicum*. *Surg Neurol Int.* 2020;12(11):289. doi:[10.25259/SNI_525_2020](https://doi.org/10.25259/SNI_525_2020)

How to cite this article: Iqbal J, Khan MM, Thabet A, Mohammed K, Scalia G, Chaurasia B. Successful management of cervical tuberculosis and severe kyphosis using polyetheretherketone expandable cage and titanium plate: A case report. *Clin Case Rep.* 2024;12:e8793. doi:[10.1002/ccr3.8793](https://doi.org/10.1002/ccr3.8793)