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Anterior debridement and fusion using expandable mesh cage only for the treatment of paraparese due to spondylitis tuberculosis: A case report

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ABSTRACT

INTRODUCTION: There is a controversy in the recent literature regarding the most appropriate approach to treat spondylitis tuberculosis, whether to choose anterior, posterior, and combined approach as well as one-stage versus two-stage approach. Mesh cage has potential advantages, including inhibition of infection by fusion and reconstruction technique combined with corpectomy. Anterior surgery has advantage as it allows direct access to the diseased vertebral bodies and intervertebral disc.
CASE ILLUSTRATION: We present a case of spondylitis tuberculosis of lower lumbar vertebrae (L5) and L4-L5 intervertebral disc causing paraparese treated with anterior debridement and fusion with expendable mesh cage. Patient presented with weakness of lower limb and back pain, with history of anti-tuberculosis drugs. Patient was diagnosed with paraparesis due to spondylitis Tb of L4-S1 with paravertebral abscess at L4-S1 Frankle D.
DISCUSSION: The patient was treated with anterior debridement and fusion using expendable mesh cage. Immediate postoperative radiograph showed restoration of vertebral height. This case showed that paraparesis can occur in lower lumbar vertebrae with distinct clinical appearance to that of lower thoracal or upper lumbar spondylitis tuberculosis, and that anterior approach for debridement and fusion using expendable mesh is a logical and direct means of addressing a tuberculous spine lesion, which predominantly affects anterior elements.
CONCLUSION: The anterior approach has the advantage of leading the surgeon directly into the lesion and allowing a good visualization. Instrumentation after debridement and bone graft can provide instant stability for the spinal column, which can lead patients to resume activities.

1. Introduction

Tuberculous spondylitis or Pott's disease is one of the most prevalent spinal infection, especially in developing countries. It affects around 1,7% of world population and accounts for up to 50% of all bone and joint tuberculosis [1]. Most of spinal TB are located in lumbar region, with thoracal and cervical segments as the second and third most frequent infection site [2]. The incidence of bone and joint tuberculosis has increased in the past two decades, this is mainly due to the occurrence of immunocompromised conditions. In spite of advances in treatment, one person dies of tuberculosis in every 15 s, and a person is newly infected with *M. tuberculosis* every second. Spondylitis tuberculosis is an important cause of non-traumatic spinal cord injury and in endemic countries, it may be the most common cause of non-traumatic spinal cord injury [3]. Incidence of neurological complication among patients with spondylitis tuberculosis ranges from 10 to 20% and 20–41% in in developed and developing countries, respectively. Paraplegia usually occurs in tuberculous infection above lumbar two (L2) where the spinal canal is narrower due to bony structure and physiological thoracic kyphosis which drives necrotic tissue inside the spinal canal. At dorsal spine segment, abscess formed tends to remain below anterior longitudinal ligament and enters the spinal canal through intervertebral foramina causing cord compression. In contrast, the abscess leaks down in psoas muscle at lumbar spine segment [4].

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Fig. 1. Lateral and Anteroposterior (AP) Lumbosacral Radiograph of the Patient. There was loss of lumbar lordosis, decrease of body height at L5, burst fracture of L5, end plate sclerosis at level L4-L5 and L5-S1, decrease intervertebral body height at L4-L5 and L5-S1, and fusiform soft tissue opacity around vertebrae L4-S.

Table 1
Timeline of Patient's Clinical Course.

Dates	Relevant Past Medical History and Intervention		
April 26 2018	Complaints of weakness on both lower limbs and back pain, and history of night sweating and loss of body weight.		
Dates	Summaries from Initials and follow-up Visits	Diagnostic Testing	Interventions
April 26 2018	Complaints of weakness on both lower limbs and back pain. Patient went to RS PELNI	X-ray examination of the spine	Anti-tuberculosis drugs for 2 months
June 15 2018	Complaints of weakness on both lower limbs and back pain. Patient went to RSCM	X-ray and MRI examinations of the spine	Preoperative preparation
October 26 2018	Complaints of weakness on both lower limbs and back pain. Patient went to RSCM		Anterior debridement and fusion using expendable mesh cage.

Management of spinal TB is challenging, particularly because of unspecific and myriad clinical manifestation that result in late diagnosis and risk of morbidity and mortality due to several complications. Early diagnosis and treatment is the key to avoiding this long-term disability [4]. The goals of spinal TB treatment are to confirm diagnosis, achieve bacteriological cure, alleviate compression of the spine and correct spinal deformity and its sequelae. Paraplegia in active disease needs active treatment of anti-tuberculosis drug with or without surgical decompression. Direct observed treatment (DOT) is a universally accepted policy to ensure treatment adherence. Corticosteroid drugs is not usually given unless there is meningeal involvement. Surgical method is usually performed in patients with neurological deficits caused by spinal cord compression, severe or progressive kyphosis, spinal deformity with instability, substantial amount of paraspinal abscesses, and poor response or failure of anti-tuberculosis drug [5]. Surgical strategy is based on several aspects, including neurological complication, location of the infection, and severity of bone destruction. Radical debridement and strut grafting (the Hong Kong method) with or without supplemental instrumentation are the mainstay for spinal TB surgery [6]. Posterior decompression and fusion could be an option in case of epidural infection with minimal destruction of the vertebral body. In thoracic spine spondylitis, posterior approach is recommended. For those cases, anterior approach is necessary only for monosegmental lesion without involvement of posterior elements. Generally, it is acceptable that anterior approach for debridement, decompression and fusion with bone graft is recommended in advanced anterior bone destruction and collapse [7].

There is a controversy in the recent literature regarding the most appropriate approach to treat spondylitis tuberculosis, whether to choose anterior, posterior, and combined approach as well as one-stage versus two-stage approach. Mesh cage has potential advantages, including inhibition of infection by fusion and reconstruction technique combined with corpectomy. Anterior surgery has advantage as it allows direct access to the diseased vertebral bodies and intervertebral disc, through which radical debridement

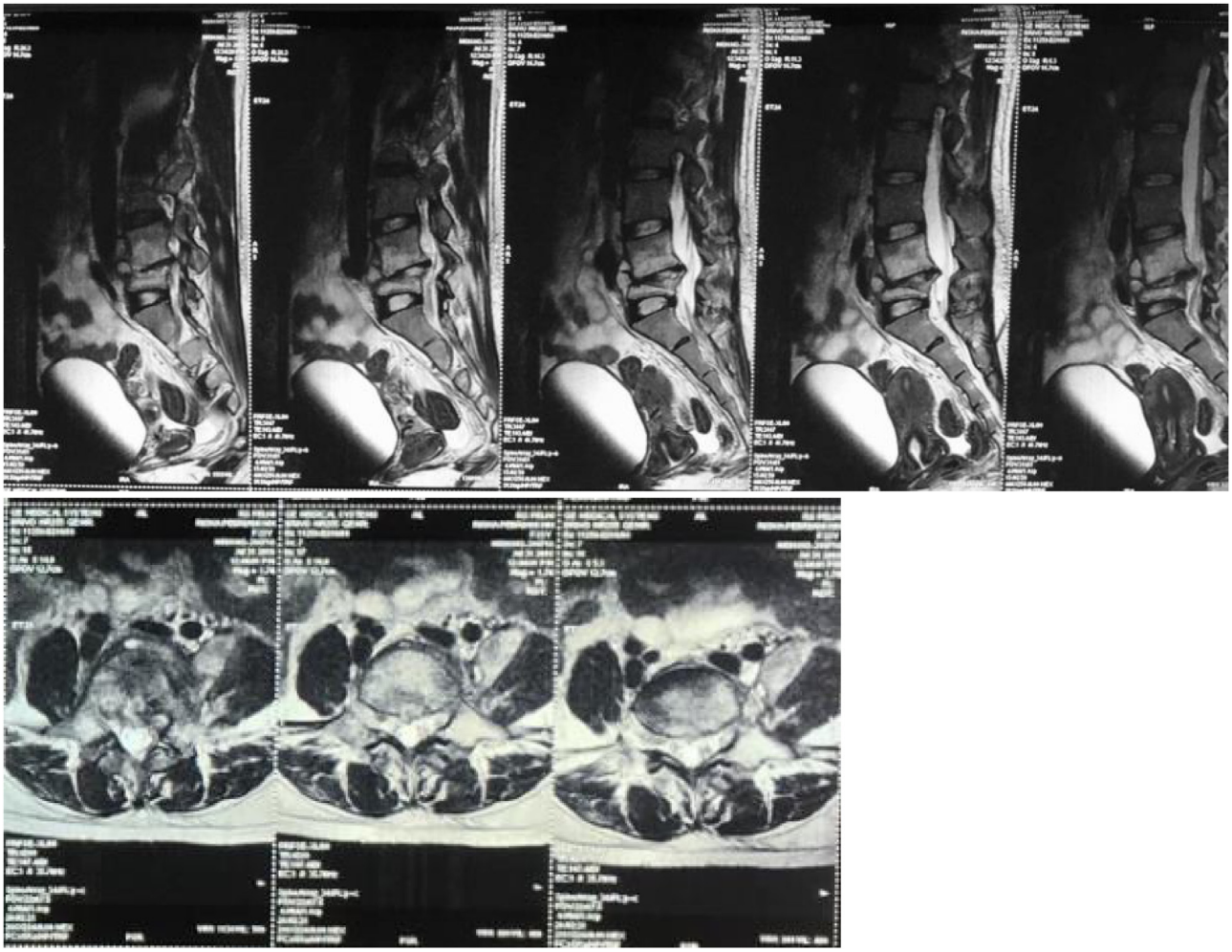

Fig. 2. Lumbosacral MRI. The findings were loss of lumbar lordosis, corpus destruction of L5, decrease intervertebral body height at L4-L5 and L5-S1, protrusion of L4-L5 intervertebral disc into the spinal cord, and paraspinal abscess.

of the infected tissues and placement of a strut graft are performed. Anterior decompression, debridement, and interbody fusion with the use of autologous tricortical iliac crest autograft, without addition of metallic devices anteriorly, are the most commonly used techniques for operative treatment of spondylitis because it is incorporated even in the presence of sepsis [8]. However, long-term results have shown that tricortical bone graft only partially restored segmental vertebral stability because its use was associated with pseudarthrosis, graft collapse, and extrusion even in the presence of rigid posterior instrumentation. In contrast, the use of mesh cage possesses three significant advantages. First is the ideal shape to be positioned between adjacent often severely destructed vertebral endplates, the second is the load distribution between cage and vertebra is applied close to the periphery of the endplate where the bone is stronger, and the third is the significant interface strength between the cage and osteoporotic vertebral bone [8]. Despite the fact that the technical expertise and preference of each surgeon are the final determinant of which approach should be used, it is largely agreed that anterior approach is the most logical and direct means of addressing a TB spine lesion, which predominantly affects anterior elements. Posterior stabilization should be performed in patient with pan-vertebral disease, or with the need for kyphosis reduction through posterior column shortening, or multi-level disease [9].

We present a case report of a patient with spondylitis tuberculosis treated by anterior approach using single expendable mesh

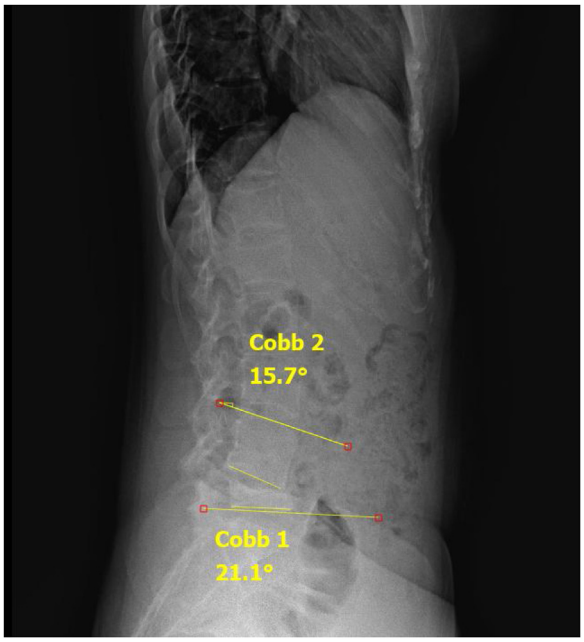

Fig. 3. Local and Regional Kyphotic Angle based on Lateral Radiograph. The local kyphotic angle is 21.1° and regional kyphotic angle is 15.7°.

Fig. 4. Surgical Procedure of Anterior Debridement and Fusion. (A) Patient preparation and draping. (B) Exposure of peritoneum by anterior approach. (C) Exposure of the corpus of vertebrae L4 and L5. (D) Corpectomy of L5 and discectomy of L4-L5 intervertebral disc. (E) Expendable mesh insertion. (F) Final construct.

cage only. The present case report is unique in which the common technique used is using posterior pedicle screw and rod or anterior mesh cage combine with pedicle screw from posterior, whereas the technique used in this case was single anterior mesh cage. Our manuscript has been reported in line with the SCARE criteria [10].

2. Case illustration

A 22-years-old Male presented with chief complaint of weakness on both lower limbs for 6 months prior to admission. The weakness also came along with back pain. There was no previous history of trauma or fever. There was history of night sweat and decrease of body height. Patient then went to nearest hospital, underwent x-ray examination, and was told that there was a spondylitis TB. Patient got anti TB drugs for 2 months, and after that the weakness improved. Patient was able to walk, but the back pain persisted. Patient was then referred to our hospital for further treatment. There was no disturbance in micturition and defecation. There were no other families with the same condition as the patient.

From physical examination we could not find any abnormality. Muscle power for both lower limbs were +4. The timeline of patient's clinical course is shown in Table 1.

The results of X-ray examination were loss of lumbar lordosis, decrease of body height at L5, burst fracture of L5, end plate sclerosis at level L4-L5 and L5-S1, decrease intervertebral body height at L4-L5 and L5-S1, and fusiform soft tissue opacity around vertebrae L4-S1 (Fig. 1). The findings of MRI examination of the lower vertebrae were loss of lumbar lordosis, decrease of body height at L5, decrease intervertebral body height at L4-L5 and L5-S1, protrusion of L4-L5 intervertebral disc into the spinal cord, and paraspinal abscess (Figs. 2 and 3). The local kyphotic angle is 21.1° and regional kyphotic angle is 15.7°.

The patient was diagnosed by paraparesis due to spondylitis Tb of L4-S1 with paravertebral abscess at L4-S1 Frankle D then underwent anterior debridement and fusion (Fig. 4). Patient was given two months of intensive four-drug therapy, including isoniazid (H), rifampicin (R), ethambutol (E), and pyrazinamide (Z), followed by two drugs (RH) therapy for a continuation phase of 4 months.

Patient was followed up physically and radiographically at one, three, six months, and one year after the surgery. Postoperative radiograph showed restoration of vertebral height and visible expendable mesh (Fig. 5).

Three months and six months and one year post operative follow up showed good functional outcome and sign of fusion from x

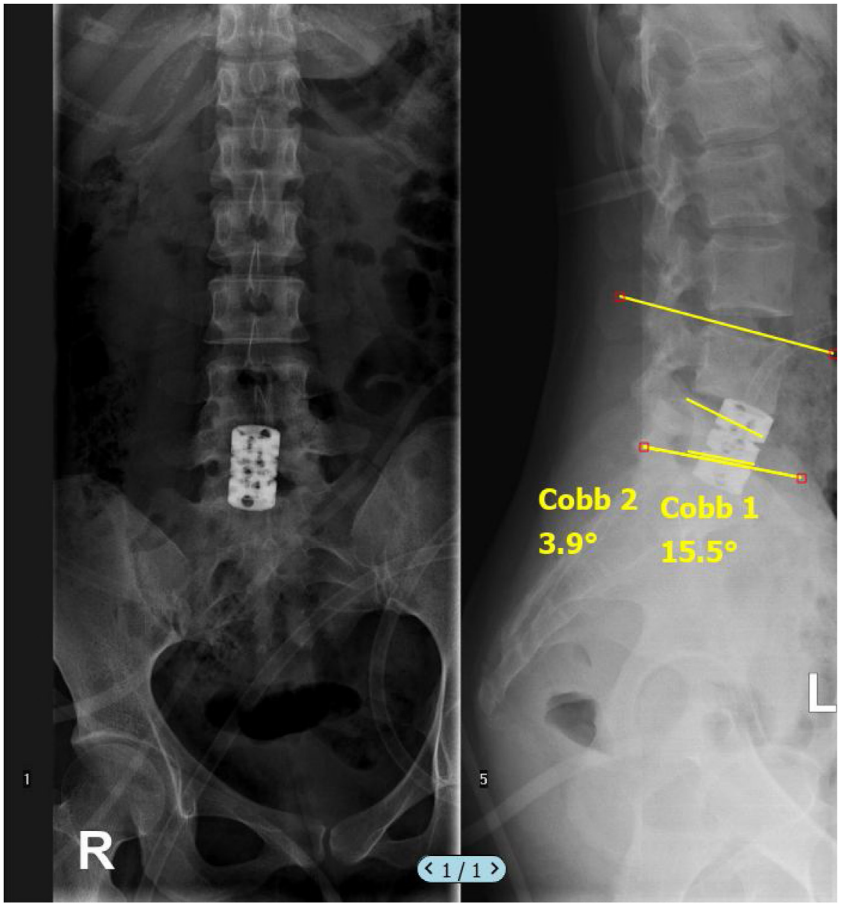

Fig. 5. Six months Postoperative Radiograph. Expendable mesh was visible through x-ray examination. The local kyphotic angle is 15.5° and regional kyphotic angle is 3.9°.

ray (Fig. 6) and CT (Fig. 7). This kind of procedure is currently rare procedure without clear comparison between conventional pedicle screw and rod system for corpus destruction of lumbal spondylitis tuberculosis with anterior debridement and fusion using expendable mesh cage. However, we hope this case report will provide further evaluation and long-term larger follow up study (cohort study) for another kind of spondylitis tb procedure as an alternative treatment despite better or worse for selective patient.

3. Discussion

Spinal tuberculosis is a common extrapulmonary form of the disease. In developed nations, most cases of spinal tuberculosis are seen primarily in immigrants from endemic countries. Because the epidemic of human immunodeficiency virus (HIV) infection or other immunocompromised conditions caused resurgence in all forms of tuberculosis, increased awareness about spinal tuberculosis is necessary [11]. Despite its common occurrence and the high frequency of long-term morbidity, there are no straightforward guidelines for the diagnosis and treatment of spinal tuberculosis. Early diagnosis and prompt treatment is essential for preventing permanent neurological disability and to minimize spinal deformity [11].

Spinal TB accounts for approximately half of all cases of musculoskeletal TB, and is more common in children and young adults. The incidence of spinal TB is increasing in developing nations, especially in China [12]. Chemotherapy is a very effective way of controlling and treating TB and most individuals with spinal TB can be cured by conservative treatment. However, patients whose disease is not sensitive to anti-TB chemotherapy and who develop progressive kyphosis, bone destruction or neurological impairment usually require surgical treatment [12].

Spinal tuberculosis initially appears in the anterior inferior portion of the vertebral body. Subsequently, it spreads into the central part of the body or disk [11]. Vertebra plana indicates complete compression of the vertebral body. In younger patients, the disk is primarily involved because it is more vascularized. In old age, the disk is not primarily involved because of its age-related avascularity [11].

The characteristic clinical manifestation of spinal tuberculosis include local pain, local tenderness, stiffness and spasm of the muscles, a cold abscess, gibbus, and a prominent spinal deformity [11]. The cold abscess slowly develops when tuberculous infection extends to adjacent ligaments and soft tissues. Cold abscess is characterized by lack of pain and other signs of inflammation [11].

This patient was unique. Patient presented with early onset paraparese due to spondylitis TB in L5 vertebra and L4-L5 intervertebral disc, as we know that paraparese is most commonly occurs in infection above L2 vertebra where the spinal canal is narrower due to bony structure and physiological thoracic kyphosis which drives necrotic tissue inside the spinal canal. From history taking patient said her lower motor strenght is severe until patient cant walk but after taking anti tuberculosis drug for 1 months her motoric function is increased. Physical examination showed no gibbus but we found decreased lower motoric strength +4. The diagnosis was then established through radiograph and MRI examination of the back, supported by history of anti-tuberculosis medication.

The purpose of surgical treatment is debridement of focal TB, reconstruction of segmental stability, neural decompression and

Fig. 6. One Year Postoperative Radiograph. Expendable mesh with sign of fusion was visible through x-ray examination.

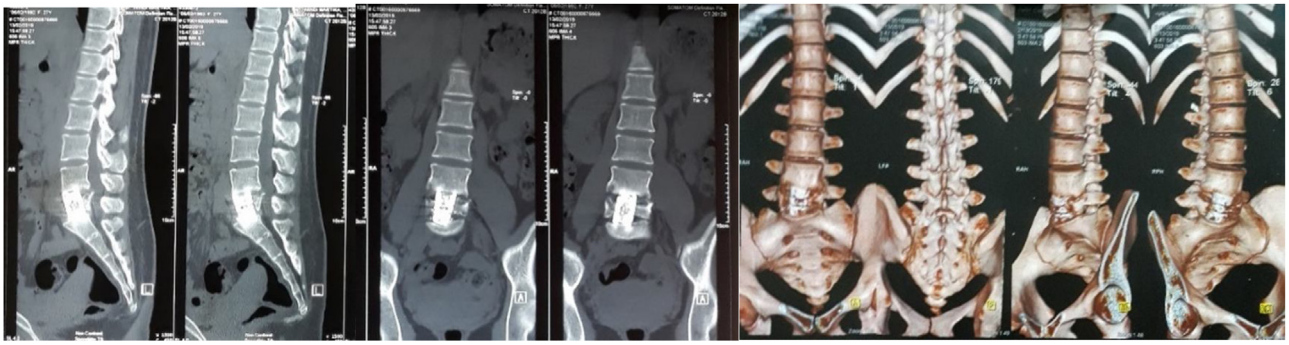

Fig. 7. Three Months Postoperative CT-Scan. Expendable mesh was visible through 2D/3D CT-scan examination. Shown good ossification and fusion around L4-S1 and expendable mesh cage corpus replaced showed internal ossification.

correction of kyphotic deformity. For the lesions mainly involved anterior and middle column of the spine, Hodgson et al. first reported their "Hong Kong operation" for treating spinal TB in 1960 [12]. With the development of instrumentation techniques, a one stage anterior procedure comprising debridement and fusion with internal fixation has become the most frequently performed surgical treatment for spinal TB. An anterior approach allows direct debridement, which facilitates focal debridement and nerve decompression, without destroying the spinal posterior column structure [12]. However, the anatomical structures encountered with an anterior approach are more complex, including major blood and lymphatic vessels, nerves and other important organs such as the lungs, heart, kidney, ureter and bowel. There is therefore a high risk of structural damage associated with such surgery [12].

In thoracic spine spondylitis, posterior approach is recommended. For those cases, anterior approach is necessary only for mono segmental lesion without involvement of posterior elements. The anterior approach for debridement, decompression and fusion with bone graft is recommended in advanced anterior bone destruction and collapse [7]. Despite the fact that the technical expertise and preference of each surgeon are the final determinant of which approach should be used, it is largely agreed that anterior approach is the most logical and direct means of addressing a TB spine lesion, which predominantly affects anterior elements

[9]. The posterior approach alone is rarely performed. It is usually indicated in cases with isolated posterior disease or in cases with multi-level non-contiguous spinal TB infection.

Radical debridement is the mainstay of operation for spinal tuberculosis. In spinal tuberculosis, many studies showed that the involvement of the vertebral body is highly frequent, and few cases have been found involving the posterior column. In a series by Ramachandran et al. [12], they concluded that when operating on spinal tuberculosis, anterior debridement and autogenous bone graft with one-stage instrumentation anteriorly or posteriorly is preferred [12].

As mentioned, the common procedure performed for spondylitis tuberculosis is posterior approach using pedicle screw and rod, or a combination of mesh cage and pedicle screw. Single stage operation through anterior approach using expendable mesh cage can be successfully performed, with the better result compared to the posterior approach. Author make sure stand-alone mesh would not displace by preventing patient form moderate-heavy physical activity and weight lifting/weight bearing. Moreover, patient used thoracolumbal orthosis brace for spine protection. Six months and one year after operation, we found sign of fusion so we confident that the stand-alone mesh did not displace. The postoperative rehabilitation after anterior approach is also better than the conventional posterior approach because of less dissected muscles performed. The major drawback of anterior approach is the demand of the skill of the operator. Moreover, the holder of the mesh cage is only in its sharp edge, which can cause it to be dislodged in the future.

The anterior approach has the advantage of leading the surgeon directly into the lesion and allowing a good visualization. Furthermore, decompression of the spinal cord anteriorly can be obtained directly and completely. In conclusion, instrumentation after debridement and bone graft can provide instant stability for the spinal column, which can lead patients to resume activities [13].

Declaration of Competing Interest

The authors report no declarations of interest.

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Ethical approval

Ethical approval was not required in this case report.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Fahmi Anshori contributes to the study concept or design, data collection and writing the paper.

Heka Priyamurti contributes to the study concept or design, supervising and critically review the manuscript.

Rahyussalim AJ contributes in the study concept or design, data collection, analysis and interpretation, oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team.

Registration of research studies

This is a case report and not a first in man trial, thus registry is not needed.

Guarantor

Rahyussalim AJ is the sole guarantor of this submitted article.

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