European Journal of Orthopaedic Surgery & Traumatology (2019) 29:1187–1197
https://doi.org/10.1007/s00590-019-02434-2

ORIGINAL ARTICLE • SPINE - SPONDYLODISCITIS

A unilateral less invasive posterolateral approach for disc debridement and titanium cage insertion supplemented by contralateral transfascial screw fixation for high-morbidity patients suffering from septic thoracolumbosacral spondylodiscitis

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Received: 1 May 2018 / Accepted: 2 April 2019 / Published online: 16 April 2019

Abstract

Purpose This case series reports on the efficacy and safety of a less invasive posterolateral approach for septic thoracolumbosacral spondylodiscitis in high-morbidity patients.

Methods Twenty consecutive severe sick (ASA > III) patients (14 men and 6 women), with an average age of 64 ± 14 years, suffering from septic subacute and chronic thoracolumbosacral spondylodiscitis were selected to undergo a one-stage less invasive unilateral posterolateral disc space debridement, supplemented by an ipsilateral titanium cage implantation and pedicle screw fixation plus a contralateral transfascial pedicle screw fixation.

Results Two high-risk patients with severe comorbidities (ASA stage IV and V, respectively) died on days 1 and 8 postoperatively because of non-surgical complications such as massive lung embolism and acute myocardial infract, respectively. Three patients with incomplete paraplegia (ASIA C) preoperatively were improved after the surgery to ASIA D (two patients) and E (one patient), respectively, while there was no neurological deterioration in any patient postoperatively. From the 18 patients that survived, ten patients were available for the final follow-up 8.8 ± 2.7 years postoperatively. In two patients with spondylodiscitis caused by gram(−) bacteria, the posterior instrumentation was finally removed because of asymptomatic fistula emerging from posterior instrumentation solely, 15 and 19 months after surgery. The survivals at 2.5 and 10 years with revision as end point was 87.4% (95% CI 58.1–96.7); while in the "worst case scenario" the survivals at 2.5 and 10 years were: 66.7% (95% CI 40.4–83.4%); 47.7% (95% CI 23.2–68.8%) and 47.7% (95% CI 23.2–68.8%), respectively.

Conclusions The less invasive posterolateral approach for disc debridement and titanium cage insertion seems to be an alternative surgery for severe sick adult immunosuppressed patients with septic thoracolumbosacral spondylodiscitis that cannot tolerate traditional open transthoracic, thoracolumbar, retroperitoneal or combined approaches.
The study has been registered in the Public Registry ClinicalTrials.gov PRS with the ID: NCT03472131.

Keywords Spondylodiscitis · Titanium cage · Posterolateral debridement · Immunosuppressed · Less invasive · Spine infection

Introduction

Haematogenous pyogenic spondylodiscitis is a serious illness with rising incidence [1, 2]. Pyogenic infections of the spine, although present a seldom entity, are associated with a high mortality of up to 17% [3, 4]. Most cases of uncomplicated pyogenic spondylodiscitis can be managed successfully with conservative measures including empirical antibiotic therapy and bracing.

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Surgical intervention should only be warranted in the case of development of neurological signs, spinal instability, progressive spinal deformity and abscess formation. When operative treatment is indicated, an anterior approach of an open thoracotomy or of a thoraco-abdominal approach or a combined anterior and posterior approach is traditionally recommended [5–8].

However, in the case of severe sick patients, an anterior approach is reported to be associated with high morbidity and mortality [9]. Host immune-competence and the presence of multiple existing medical comorbidities have an important influence on the outcome [10]. Permanent neurological deficits still remain a common occurrence. It is the severity of the neurological findings on presentation that dictates the neurological outcome [11].

The present case series assess the efficacy and safety of a less invasive unilateral posterolateral disc debridement, with titanium cage implantation, plus a bilateral pedicle screw fixation (open fixation ipsilaterally and transfascial fixation contralaterally) in 20 consecutive high-morbidity patients with thoracolumbosacral septic spondylodiscitis.

Materials and methods

Our basic regimen for treating septic spondylodiscitis resistant to antibiotics and bracing or complicated with instability or abscess formation and/or neurological impairment is the combined anterior debridement via an open thoracotomy, thoracolumbotomy or a retroperitoneal approach, titanium mesh cage implantation plus posterior pedicle screw fixation, combined with appropriate (culture, biopsy) antibiotics administration. Exceptionally, in severe sick patients with high morbidity (e.g. chronic renal insufficiency, severe heart or lung insufficiency, drug abuse, malignancy, etc.), where an anterior approach is at least theoretically, contraindicated for increasing the perioperative morbidity and mortality, a posterolateral approach is selected.

In this series, 20 consecutive very sick patients (ASA > III), suffering from complicated (intractable pain, abscess, neurologic impairment, etc.) thoracolumbosacral spondylodiscitis, resistant to appropriate antibiotics administration, bed rest and bracing, were selected to be operated via a posterolateral unilateral approach including infected disc and end-plates debridement, insertion of a titanium cage filled with autogenous bone graft, open pedicle screw fixation unilaterally and transfascial pedicle screw fixation contralaterally. The selection criteria were: (a) single-level subacute and chronic spondylodiscitis (b) ASA > III with associated comorbidities and (c) no previous surgery at the level of spondylodiscitis. There were 14 men and 6 women, with an average age of 64 ± 14 years, range 44–80 years. All patients had single-level thoracic, thoracolumbar, lumbar or lumbosacral spondylodiscitis. There were eight thoracic segments; one thoracolumbar, nine lumbar and two lumbosacral lesions (Table 1). The medical comorbidities that were present in all 20 patients (Table 1) included diabetes mellitus, chronic renal insufficiency, advanced heart insufficiency, hypertension, cortisone abuse, drug abuse and/or advanced age (> 65 years) (Table 1). Three patients had on admission incomplete neurologic lesions (ASIA C-D) score (Table 1). Paravertebral abscess was associated with spondylodiscitis in 7/20 patients. No patient had previous spine surgery at the segment of spondylodiscitis.

On admission, all 20 patients had anteroposterior and lateral standing or supine radiographs, CT scan and/or MRI (Figs. 1, 2). Postoperative plain roentgenograms were taken following surgery and at the subsequent follow-ups in the 18 survived patients. The angulation at the spondylodiscitis segment was measured preoperatively, postoperatively and until the last evaluation by the Cobb method between the upper endplate of the cephalad vertebra to the lower endplate of the caudal vertebra. The radiological interbody fusion was evaluated postoperatively by means of CT scan (interbody fusion) and on plain roentgenograms by means of bridging osteophytes without osteolysis (Figs. 1, 2).

The ASA physical status classification system was used for general health evaluation preoperatively.

Preoperative and postoperative laboratory evaluation routinely included complete blood count analysis with differential, ESR and CRP.

The indications for surgery were intractable painful mechanical instability, abscess formation, progressive neurologic compromise and failed pharmaceutical therapy. Percutaneous biopsy and culture under local anaesthesia were made in all 20 patients on admission under an image intensifier or CT. On admission, immediately after biopsy, empirical broad-spectrum antibiotics (ciprofloxacin plus rifampicin) were administrated intravenously in all 20 patients. Following culture sensitivity results, the antibiotics were subsequently modified accordingly. Any preoperatively administrated anticoagulation prophylaxis or treatment was changed to low-molecular-weight heparin subcutaneously after the consensus of cardiologists and anaesthesiologists. At the surgery, the patient was positioned on a four-point frame, preventing any compression of the abdomen. A midline skin incision was made following subcutaneous preparation of the fascia contralaterally to the decompression side; two pedicle screws were inserted under fluoroscopy control and connected temporarily with a subfascially inserted rod (Fig. 3). This unilaterally placed longitudinal rod facilitates distraction across the involved level during exposure and provides stability during manoeuvres for debridement and titanium implant insertion that is crucial in particular for the thoracic and thoracolumbar spine. Following that, the contralateral paravertebral muscles were mobilized from the one

Table 1 Cumulative data on 20 consecutive patients with septic spondylodiscitis operated via a posterolateral approach

Patient nos.	Gender	Age	ASIA pre	ASIA post	ASA preop	Comorbidities	Diagnosis/level of infection	Causative agent	Posterior instrumentation levels and anterior cage insertion segment	Complications	Last follow-up (years)	Overall antibiotic therapy duration (intravenous and per os) postoperatively in months
1	M	62	E	E	3	Drug abuse, liver insufficiency	L2–L3	Brucella	L2–L4 and cage L2–L3	No	Not available > 5 years	3
2	F	44	E	E	3	Drug abuse, liver insufficiency	L3–L4 and psoas abscess	*Staphylococcus aureus*	L3–L4 and cage L3–L4	No	11	6
3	F	73	E	E	3	Diabetes mellitus, heart and lung insufficiency	L2–L3	Negative	T12–L3 and cage L2–L3	No	10	4
4	F	55	E	E	3	Diabetes mellitus, heart insufficiency	L4–L5	Negative	L4–L5 and cage L4–L5	No	9	4
5	M	68	E	E	3	Chronic renal insufficiency, diabetes mellitus	T10–T11and epidural abscess	*Staphylococcus aureus*	T9–T12 and cage T10–T11	No	Not available > 2 years	6
6	M	71	E	E	3	Chronic pulmonary insufficiency, heart insufficiency	T9–T10	*Pseudomonas aeruginosa*	T8–T12 and cage T9–T10	No	Not available > 1.5 years	3
7	M	60	E	E	3	Diabetes mellitus, chronic renal insufficiency	T9–T10 and paravertebral abscess	Coagulase(–) staph.	T8–T11 and cage T9–T10	No	Not available > 1.5 years	6
8	F	78	E	E	3	Liver insufficiency, diabetes mellitus	L5–S1	Negative	L4–S1 and cage L5–S1	No	8	4

Table 1 (continued)

Patient nos.	Gender	Age	ASIA pre	ASIA post	ASA preop	Comorbidities	Diagnosis/level of infection	Causative agent	Posterior instrumentation levels and anterior cage insertion segment	Complications	Last follow-up (years)	Overall antibiotic therapy duration (intravenous and per os) postoperatively in months
9	M	75	E	E	3	Chronic renal insufficiency	T7–T8	*Proteus mirabilis*	T5–T10 and cage T7–T8	Deep posterior infection plus sinus emerging from the posterior implants. Removal of posterior instrumentation 15 months post-op	8	4
10	M	75	E	E	4	Chronic renal insufficiency	T6–T7	Negative	T5–T8 and cage T6–T7	Death first day post-op	Death first day post-op	Ø
11	M	53	E	E	5	Chronic pulmonary insufficiency, heart insufficiency	T11–T12 and paravertebral abscess	*Acinetobacter baumannii*	T9–L1 and cage T11–T12	Death eighth day post-op	Death eighth day post-op	Ø
12	M	77	C	D	3	Significant heart insufficiency	L3–L4	Negative	L3–L5 and cage L3–L4	Adjacent above segment degeneration	Not available > 3 years	4
13	F	67	E	E	3	Significant heart insufficiency	T7–T8 and paravertebral abscess	*E. coli*, Coagulase(−) staph.	T6–T11 and cage T7–T8	No	3	6
14	M	51	E	E	4	Significant heart insufficiency	T12–L1	Negative	T11–L2 and cage T12–L1	No	Not available > 2 years	5
15	M	73	C	D	4	Chronic renal insufficiency, heart insufficiency	L5–S1	Negative	L4–S2 and cage L5–S1	No	Not available > 1 year	4
16	M	80	E	E	3	Diabetes mellitus, chronic renal insufficiency	T12–L1 and psoas abscess	Negative	Th10–L3 and cage T12–L1	No	9	4

Table 1 (continued)

Patient nos.	Gender	Age	ASIA pre	ASIA post	ASA preop	Comorbidities	Diagnosis/level of infection	Causative agent	Posterior instrumentation levels and anterior cage insertion segment	Complications	Last follow-up (years)	Overall antibiotic therapy duration (intravenous and per os) postoperatively in months
17	M	56	C	E	4	Diabetes mellitus	L2–L3	Brucella	L2–L4 and cage L2–L3	Deep posterior infection plus sinus emerging from the posterior implants. Removal of posterior instrumentation 19 months post-op	7	3
18	M	72	E	E	4	Drug abuse, liver insufficiency	L2–L3 and paravertebral abscess	Negative	L2–L4 and cage L2–L3	No	Not available > 3 years	6
19	M	64	E	E	3	Chronic alcoholic cirrhosis	L3–L4	Brucella	L3–L4 and exp cage L3–L4	No	9	3
20	F	54	E	E	3	Drug abuse	T12–L1	*Staphylococcus aureus*	T10–L3 and cage T12–L1	No	14	4

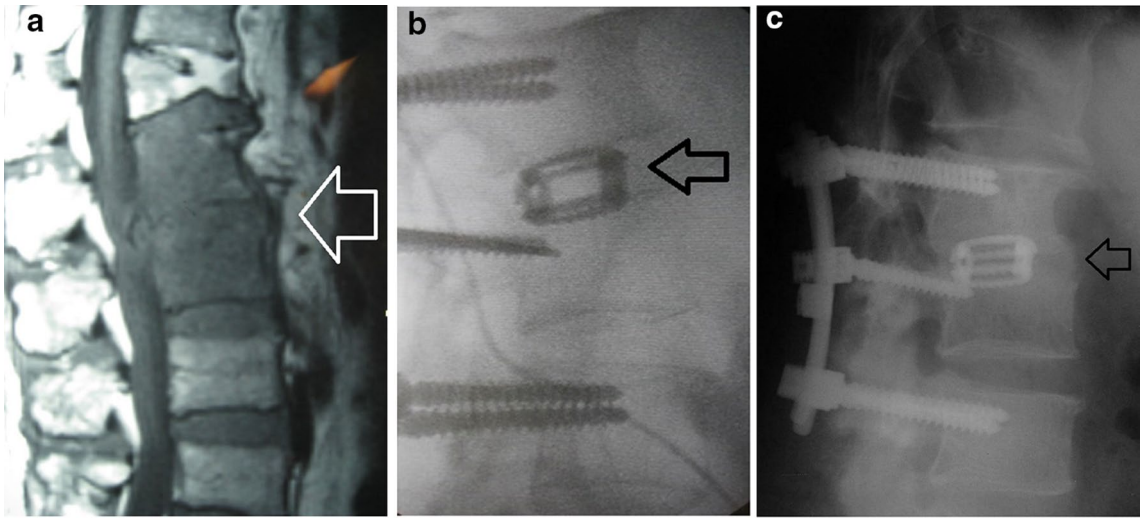

Fig. 1 **a** Preoperative lateral MRI of the lumbar spine of a 44-year-old male patient (case no 2, Table 1) with drug abuse and subsequent liver insufficiency, suffering from L3–L4 spondylodiscitis (arrow) and psoas abscess due to *Staphylococcus aureus*, **b** 6 months postoperatively, a lateral roentgenogram of the lumbar spine (case no 2, Table 1) showing the titanium cage (arrow) in situ with segmental lordosis restoration plus posterior pedicle screw fixation, **c** lateral roentgenogram of the lumbar spine (case no 2, Table 1) 4 years postoperatively showing fusion at the level of instrumentation with maintenance of segmental L3–L4 lordosis and anterior bridging osteophytes (arrow)

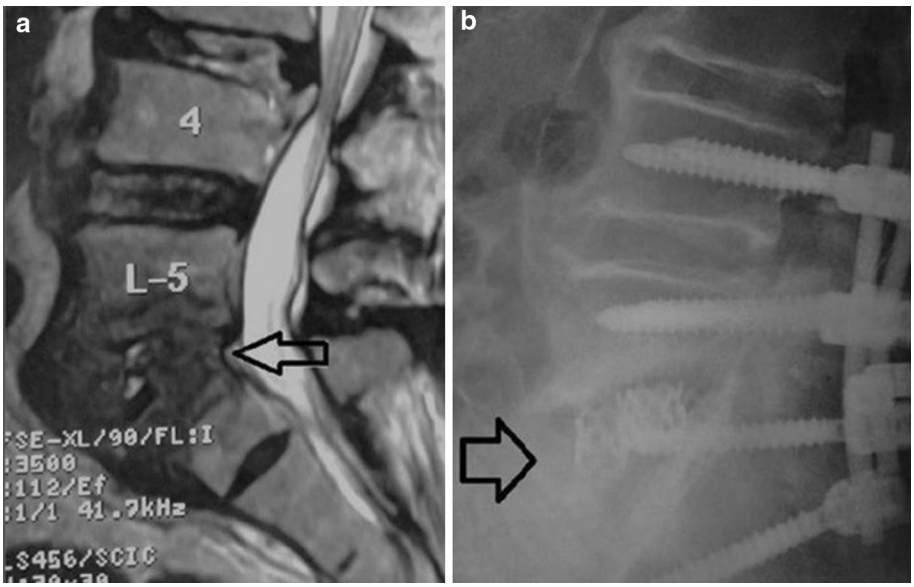

Fig. 2 **a** Lateral MRI of the lumbosacral spine of a 73-year-old male patient (case no 15, Table 1) with chronic renal insufficiency and heart insufficiency suffering from spondylodiscitis L5–S1 (arrow), **b** lateral roentgenogram (case no 15, Table 1) 2 years postoperatively demonstrating maintenance of the sagittal sacral slope with interbody fusion

segment immediately above to the one immediately below the spondylodiscitis segment. In the seven cases associated with paravertebral abscess, the side of abscess location (right/left) was the one selected for decompression (Table 1).

A unilateral subperiosteal dissection is carried out using cautery to the tips of the transverse processes in the affected by spondylodiscitis segment. In the thoracic spine the transverse process, rib head, costotransverse facet joints and pedicle are carefully exposed and removed using rongeur, air drill, kerrison and curettes. Care is taken to preserve the parietal pleura. One or two thoracic nerve roots are unilaterally sacrificed and ligated together with the segmental vessels to facilitate approach to the affected disc space for debridement, abscess evacuation and titanium mesh cage implantation. No formal laminectomy was made in any case since there was no posterior epidural compression or epidural abscess dorsally located. The locally excised non-infected bone (rib, transverse process) is used for the grafting purposes alone as autograft or together with allograft. Material from disc space debridement was sent for biopsy and cultures. Following meticulous debridement, under visual and fluoroscopy control two pedicle screws were

Fig. 3 Intraoperative view of the surgical approach. On the top the transfascially inserted tubes for pedicle screw insertion. On the bottom the unilateral approach with muscle retraction for disc debridement and titanium cage insertion

inserted in the pedicles of each vertebra involved by spondylodiscitis or one more level if necessary in the exposed side. We prefer to complete segmental instrumentation after open decompression so that instruments and screws do not interfere with "contaminated" instruments. In the lumbar spine, the approach was similar, followed by mobilization and protection of the exiting nerve root. Nerve roots in the lumbar spine are never ligated, but solely retracted for decompression and titanium implant insertion. Following decompression under continuous image intensifier guidance, bone graft was pushed into the debrided segment and a titanium implant filled with excised bone and allograft was inserted diagonally in the debrided intervertebral space taking into account the restoration of both segmental lordosis and disc height.

Neuromonitoring was used in all surgeries, and surgery was followed by intravenous and later per os antibiotic administration according to the sensitivity of the bacteria cultured in the preoperatively specimens, as well as in the intraoperative specimen culture.

After the operation, the patients were braced with a TLSO for 3 months.

The criteria for the cessation of antibiotic therapy were: (a) the return of ESR and CRP to baseline; (b) the radiologic evidence of solid fusion; or when the cessation of the antibiotic treatment was recommended by the attending infectious diseases specialist, based on infection's signs and symptoms disappearance and normal laboratory results.

Two survivals (Kaplan–Meier curve) were calculated taking as end points: (1) the revision and (2) the "worst case scenario" including both revision and no availability at the final follow-up.

Even on admission, the majority of the patients were already in a significantly debilitated state (ASA grades > III), particularly from the nutritional point of view. During the perioperative period, increased effort was given in improving the overall nutritional and physiologic status of the patients by administrating human albumin intravenously in order to increase the low albumin level to an amount of greater than 2.5 g. Thereafter, albumin rich alimentation was given per os.

Results

Positive cultures were found in 11 patients, while negative cultures were found in the remaining nine patients (Table 1). Gram(+) bacteria were identified in four patients, gram(−) bacteria were found in six patients, and combined gram(+) and gram(−) bacteria were found in one patient (Table 1). In patients with negative cultures, the antibiotic treatment was regulated by specialists in infectious diseases and usually included ciprofloxacin plus clindamycin and in some cases the addition of amoxicillin and clavulanic acid. The same antibiotics were mostly used in the cases that the antibiotic scheme was modified after the culture sensitivity results. The antibiotic therapy was kept on for 2 weeks after ESR and CRP had reached normal levels and the overall (intravenous and per os) duration of the antibiotic therapy lasted from 3 to 6 months.

Estimated perioperative blood loss averaged to 400 ml (range 250–650 ml). The operative time averaged to 2 h and 45 min (range 1 h 45 min–3 h and 30 min).

There were no serious intraoperative complications in any patient such as increased bleeding or pneumothorax (no thorax drain was inserted).

Two patients died early: 1 and 8 days postoperatively (Table 1) from non-surgical complications (massive lung embolism and heart infract, respectively), and were excluded from the follow-up analysis (Table 1).

The three patients who presented on admission with incomplete (ASIA C-D) neurologic deficits were improved following surgery at least one ASIA level (Table 1).

Ten from 18 (55%) responded to our invitation and did well at an average of 8.8 ± 2.7 years following surgery. The remaining eight patients were not available for the last interview because either died in the meanwhile for unrelated to surgery reasons or moved to another place. In the charts of the eight patients, who did not respond to our invitation, there were no records for recurrence of infection or for a reoperation.

There was no settling or migration of titanium cage and recurrence of spondylodiscitis, this being in accordance with the observed segmental kyphosis correction (Figs. 1, 2).

There was no significant preoperative kyphotic angulation in any of the 20 patients in these series. The preoperative kyphotic angulation averaged to 8° ± 2°, range 5°–15°. Postoperatively, the kyphosis was corrected to 2° ± 1°, with a range of 0°–4°, while a segmental lordosis of 5° ± 2° was restored in the involved lumbar segments (Figs. 1, 2). No measurable loss of correction (1°–2°) was shown in the lumbar spine in the last follow-up evaluation.

In one patient, there was radiologically recorded asymptomatic adjacent segment degeneration in the lumbar spine at the L2–L3 unfused segment above instrumentation (Table 1, case no 12).

The survivals at 2.5 and 10 years with revision as "event" were: 87.4% (95% CI 58.1–96.7); while in the "worst case scenario" the survivals at 2.5 and 10 years were: 66.7% (95% CI 40.4–83.4%); 47.7% (95% CI 23.2–68.8%) and 47.7% (95% CI 23.2–68.8%), respectively (Figs. 4, 5).

Reoperations

Asymptomatic sinus formation without associated general symptoms (fever, disability, etc.), obviously resulted from contamination of the posterior instrumentation during debridement of infection in the first operation, occurred in two patients 15 and 19 months following initial operation: a 56-year-old male patient and a 75-year-old male patient, in which the primary pathogen of spondylodiscitis was gram(−) bacteria (Brucella and *Proteus mirabilis*), respectively (Table 1, cases 9 and 17). Both these infection cases were not related to the spondylodiscitis infection, since it was a contamination of the posterior instrumentation solely, without deterioration of the patients' general health condition. Moreover, in the revision surgery no connection was disclosed between the anterior implants and the posterior infection site.

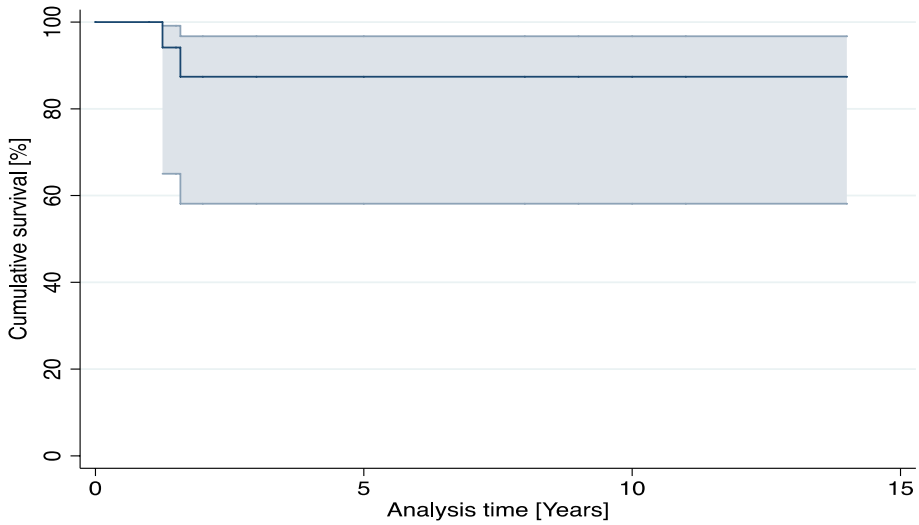

Fig. 4 Kaplan–Meier graph presenting survival with revision as end point of interest. The 2.5- and 10-year survival is 87.4% (95% CI 58.1–96.7%)

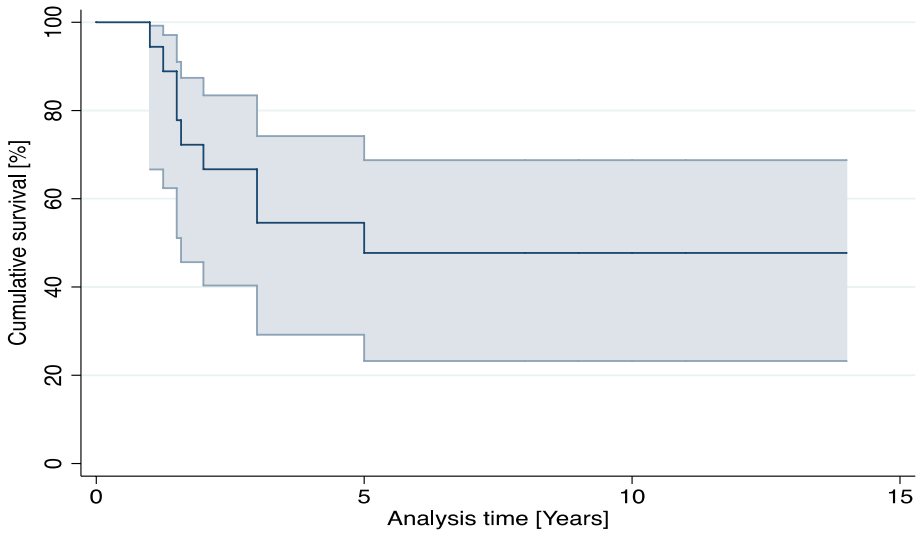

Fig. 5 Kaplan–Meier graph presenting the worst case scenario—with no availability at the final follow-up and revision as end points. The survivals at 2.5 and 10 years are: 66.7% (95% CI 40.4–83.4%); 47.7% (95% CI 23.2–68.8%) and 47.7% (95% CI 23.2–68.8%), respectively

In addition, the fusion was completed and after the removal of the implants the eradication of the infection occurred, while no recurrence had been presented in both patients, until the last follow-up of 8 and 7 years later (Table 1).

Discussion

Twenty consecutive selected patients (ASA > III) with septic thoracolumbosacral spondylodiscitis, who could not tolerate an open transthoracic, thoracolumbar or retroperitoneal approach, underwent a less invasively posterolateral debridement and stabilization. Two patients did not tolerate this "less invasive" surgery and died in the early postoperative period because of heart infract and lung embolism obviously related to their serious preoperative comorbidities. Ten from 18 patients, who were available at the final observation 8.8 ± 2.7 years following primary surgery, did well (no pain, CRP and ESR within normal limits). The charts of the remaining eight patients, who were not available for the most recent interview for reasons unrelated to surgery, showed uneventful postoperative courses in the previous evaluations.

In the authors department, the most commonly used approach to treat resistant or complicated spondylodiscitis, if the patient can tolerate it, is the combined anterior/posterior approach under the same anaesthesia [8]. The approach we have used in these series with thoracic spondylodiscitis is an advent of costotransversectomy described initially to treat TBC spondylitis and later thoracic disc herniations and thoracolumbar fractures [12, 13].

We have used the unilateral posterolateral approach to treat thoracolumbosacral spondylodiscitis in these selected sick patients with severe comorbidities because the anterior approaches negatively impact pulmonary function increasing this way the perioperative morbidity and mortality [9, 14–21]. Not only in adults, but also in adolescents, thoracotomy per se presents a risk factor for pulmonary function, while even mini-open thoracotomies report a complication rate of up to 31.3% [22–24].

The survival at 2.5 and 10 years with revision as "end point" was: 87.4%, while in the "worst case scenario" the survivals were lower: 66.7% and 47.7%, respectively, with a wide confidence interval, obviously due to the small sample size. Deaths and reoperations occurred 1 week to 19 months postoperatively because of the patients' increased perioperative mortality and morbidity. The 360° fixation restored the segmental sagittal balance without loss of correction, while no settling or migration of titanium cage occurred.

The increased comorbidity (ASIA > III) obviously increased the observed perioperative mortality, while the two deaths might have been occurred even if the surgery had not been performed.

No patient in this series died from surgery-related complications but from general complications, while the two deep infections associated with fistula were asymptomatic and were completely resolved following the removal of the posterior fixation instrumentation.

Anterior approach alone or combined with posterior fixation is the most commonly used approaches for thoracic and lumbar pyogenic spondylodiscitis [5–8, 25, 26]. Combined approaches suffer because of associated intraoperative complications and the potential to cause, or exacerbate preexisting comorbidities which are associated with prolonged anaesthesia, increased blood loss, wound infection rate, etc. [6–9].

In the last decade, most surgeons advocated the use of titanium cages for vertebral reconstruction in TBC, mycotic and septic spondylodiscitis [6–8, 15, 26]. In the survived patients in this series, the use of titanium cages resulted in interbody fusion without recurrence of spondylodiscitis 8.8 years postoperatively.

A recent systematic review of 15 retrospective case series cohorts [26] reported an infection recurrence rate of 1.3%, a revision surgery rate of 0.65%; and a mortality rate of 5.8%, following open anterior debridement and titanium mesh cage implantation with or without posterior instrumentation for treatment of septic haematogenous spondylodiscitis. Bone cultures revealed in the great majority (71%) gram(+) bacteria [26], while in our series gram(−) bacteria were the most common causes.

Few studies [27, 28] compared complication rates between different surgical approaches to the thoracic spine reporting 39%, 17% and 15% for open thoracotomy, lateral extracavitary, respectively. This study concluded that open thoracotomy had the highest reoperation (3.5%) and mortality (1.5%) rates [27]. In the patients operated via a traditional costotransversectomy, the most common complications observed were wound infection (3.7%); 1.2% mortality; while 4.3% of the patients required additional surgery [27, 28]. Similar results were shown in our study.

Wang et al. [29] compared anterior, posterior and combined anterior plus posterior approach for thoracic spinal TBC in adults and recommended the posterior approach, not only because it achieves good results, but because it has reduced complications, operative time and blood loss. In our series, using a less invasively approach we had low average perioperative blood loss and short operative time.

A recent study reported the successful use of PEEK by means of TLIF in septic spondylodiscitis without recurrence even in immunosuppressed patients [30]. In our similar series, the titanium cage was inserted by means of TLIF and no nerve root injury was shown while it reduced surgical trauma to the abdominal muscles and diaphragm. The TLIF technique that we used in the spondylodiscitis has been sufficiently previously proven in degenerative

lumbar spine disease both clinically and experimentally that allows for extensive (70%) disc space removal via a unilateral approach [31–33]. This was our intraoperative impression since we were able to remove much infected and contaminated disc and endplate tissues and insert the titanium cage.

Minimally invasive spine stabilization using percutaneous pedicle screws can be appropriate for treating spondylodiscitis in patients with poor medical condition [34]. This was shown in our series using a transfascial approach, which is a modification of the percutaneous technique for screw insertion. With transfascial MIS techniques gaining in importance, future studies using minimal access-TLIF techniques for pyogenic lumbar spondylodiscitis may promise equally beneficial outcomes.

The limitations of this clinical study are: (a) the small number (20) of patients, (b) the retrospective design, (c) the lack of control group and (d) the high non-responders rate of 45% at the latest follow-up, 8.8 years postoperatively.

In conclusion, posterolateral spinal decompression and debridement in septic spondylodiscitis with a transfascial screw technique contralaterally made it possible for us to perform the surgery in our patients with thoracolumbosacral spondylodiscitis, who were otherwise considered non-surgical candidates due to their co-morbidities and severely compromised health. This technique seems to be relatively safe and effective in immuno-compromised patients suffering from pyogenic spondylodiscitis.

This less invasive surgical technique to operatively treat septic spondylodiscitis in immune-compromised adult patients, that cannot tolerate a major surgery, may present an alternative to thoracotomy, thoracolumbotomy and lumbotomy alone or 360° combined anterior plus posterior approaches, avoiding open anterior surgery-related comorbidities, increased blood loss, long surgery duration and denervation of paravertebral muscles.

Further research towards this surgical approach is recommended even in no high-risk patients that suffer from high resistant bacteria or in patients that cannot receive the appropriate antibiotics (allergies, etc.) or for cost issues, since it is not a major surgery and could help in the confrontation of the infection.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical standards All authors declare that all procedures performed in these series were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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