



Single-stage posterior debridement and single-level instrumented fusion for spontaneous infectious spondylodiscitis of the lumbar spine

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Spontaneous infectious spondylodiscitis (SIS) is an uncommon condition. The purpose of this retrospective study of 10 adult patients (6 males and 4 females, average age 52 years), all with lumbar SIS and epidural abscess, was to analyze the efficacy of single-stage posterior débridement plus single-level interbody grafting with autologous bone, and transpedicular screw-rod instrumentation. The mean follow-up period was 43 months, with a minimum of 30 months. The back pain was relieved within 3 to 8 days after surgery. Neurologic deficits, present in 5 cases, all improved. Solid fusion was achieved at 6 months in all 10 cases. The mean VAS for pain improved from 7.5 to 1.6, the mean Oswestry Disability Index from 57.8% to 8.1%. The mean physical component of SF-36 (PCS) improved from 32.4% to 54.7%, the mean mental component of SF-36 (MCS) improved from 33.8% to 57.2%. All these changes were significant ($p < 0.001$). No recurrence of infection was noted. The outcome was quite satisfactory in terms of fusion rate and quality of life.

Keywords: spontaneous infectious spondylodiscitis; single-stage surgery; single level fusion; posterior instrumented fusion.

INTRODUCTION

Pyogenic spondylodiscitis is most often secondary to spinal surgery; spontaneous infectious spondylodiscitis (SIS) is relatively rare. It typically affects children and older individuals (16,23,42). An increase in the incidence of SIS has recently been

noted due to increasing life expectancy, diabetes mellitus, drug abuse, use of endovascular and genitourinary devices, HIV and steroids (10,16-17,23,33).

The exact pathogenesis of SIS is not clear yet, but most scholars support the thesis of haematogenous spread of bacteria. In adults, the avascular nature of the disc counters inoculation, but it facilitates infection once inoculation has occurred (10,13-14,16,42).

The morbidity and mortality rate of SIS have declined because of earlier diagnosis and prolonged

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administration of antibiotics : conservative treatment is effective in most cases (2,7,17). However, surgical intervention is still indicated in case of poor response to conservative treatment, progressive neurologic impairment, spinal instability and/or local kyphosis (11,18,28,34).

The choice of the surgical technique is still controversial. Some authors advocate anterior débridement and fusion with or without second-stage instrumentation (1,5,6). Other spine surgeons propose anterior débridement and fusion combined with anterior or posterior single stage instrumentation (11,28,29,32,34). The authors of the current study preferred posterior débridement and single-level interbody fusion with iliac crest grafts, plus single-stage instrumentation using a transpedicular screw-rod system.

PATIENTS AND METHODS

The authors retrospectively reviewed 10 adult patients, 6 males and 4 females, with a mean age of 52 years (range : 26-79), diagnosed with lumbar SIS and operated upon between August 2000 and December 2007. Post-surgery spondylodiscitis was excluded. Seven patients had predisposing conditions : diabetes mellitus (4 patients), urinary tract infection (UTI) (2 patients) and prostate biopsy (one patient) (Table I). It

has been reported that diabetes mellitus is the most frequent predisposing factor in patients with SIS (16,17,33). The average follow-up period was 43 months, with a minimum of 30 months.

Diagnosis was based on clinical picture, physical examination, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), MRI and cultures. Back pain and quality of life (QOL) were evaluated with a Visual Analog Scale (VAS), the Oswestry Disability Index (ODI) and the Short form-36 (SF-36) : the Physical Component Summary (PCS) and the Mental Component Summary (MCS).

A paired t-test and SPSS 16.0 were used for statistical analysis. A p-value < 0.05 was seen as significant.

RESULTS

On admission all patients presented with fever and localized back pain. CRP and ESR were elevated in all of them, WBC in 50% (Table I). Frankel score was grade C in one patient, grade D in 4 and grade E in 5 (Table I). The vertebral levels involved were L3L4 (one patient), L4L5 (5 patients), and L5S1 (4 patients). Pre- and post contrast MRI showed a low signal of the subcortical bone marrow, which became intermediate or high on T2-weighted sequences (Fig. 1). An epidural abscess was noted in all 10 cases ; in 5 of them, it led to a

Table I. — Clinical data

Patient	Age (years)	Culture			Pre-disposing diseases	WBC (*10 ⁹ /l)	CRP (mg/l)	ESR (mm/h)	Frankel	
		Blood Urine	Percutaneous biopsy	Surgical specimen					Pre-Op.	F.U.
1	26	–	–	–	UTI	13	75	53	E	E
2	32	E.coli	E.coli	E.coli		20	98	120	E	E
3	79	–	S. aureus	S. aureus	DM	14	78	50	D	E
4	68	–	S. aureus	S.aureus	UTI	17	54	48	C	D
5	30	–		–		8.1	55	49	D	E
6	52	–	–	–	PB	6.8	48	50	E	E
7	72	–	–	–	DM	7.0	70	78	D	E
8	70	–	–	–	DM	8.5	50	55	E	E
9	50	–	S. aureus	S. aureus	DM	37.8	72	54	D	E
10	41	–	–	–		9.8	79	81	E	E

E.Coli : Escherichia coli ; S.aureus : Staphylococcus aureus ; UTI : Urinary tract infection ; PB : Prostate biopsy ; DM : Diabetes mellitus ; WBC : White blood cell count ; CRP : C-reactive protein ; ESR : Erythrocyte Sedimentation Rate ; Preop : Preoperative ; F.U. : Follow-up ; – : Negative.



Fig. 1. — Preoperative sagittal MRI-scan of the lumbar spine. T1-weighted (left) and T2-weighted (right) images showing spontaneous infectious spondylodiscitis L5S1 with epidural abscess.

neurological deficit, which was progressive in 3 of these. Indeed, epidural abscesses are correlated with a high risk of neural involvement (11,13,16). The causative organism was isolated in 4 out of 10 patients (Table I).

The indication for surgery was poor response to 4 weeks of antibiogram-based therapy in 7 patients (31), and progressive neurologic deficit in three.

The surgical technique consisted of posterior débridement plus single-level interbody fusion with iliac crest grafts, and single stage instrumentation: a transpedicular screw-rod system (Fig. 2). All the procedures were performed by the same surgical team. The mean hospital stay was 25 days (range: 12-50). There were no operative complications, except mild donor site pain in 2 patients.

The back pain was relieved within 3 to 8 days after surgery. ESR and CRP gradually normalized within 6 to 12 weeks. Antibiotics were administered from 6 to 12 weeks. All 5 patients with a preoperative neurological deficit improved: 4 had complete recovery (from grade D to E) within 1-6 months, while one with a grade C improved to grade D.

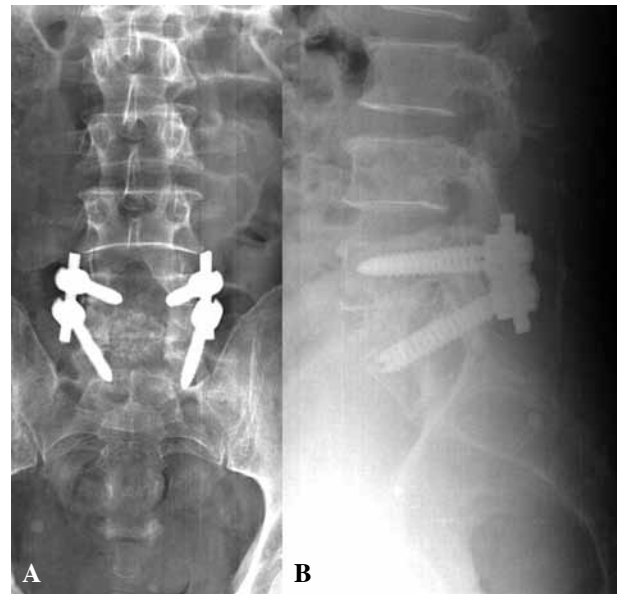


Fig. 2. — Postoperative antero-posterior (A) and lateral radiograph (B) following single-stage posterior débridement plus single-level interbody grafting L4L5 with autologous bone, and transpedicular screw-rod instrumentation.

Radiological fusion occurred after 3 months in 60% of the patients, and after 6 months in 100% of the patients (Fig. 3).

The mean VAS (Table II) improved from 7.5 (range: 5-10) preoperatively to 1.6 (range: 0-3) ($p < 0.001$). The mean preoperative ODI improved from 57.8% (range: 32.5%-80%) to 8.1% (range: 2.2%-22.2%) ($p < 0.001$). The mean physical component score (PCS) of the SF-36 improved from 32.4 (range: 26-42) to 54.7 (range: 46-60) ($p < 0.001$), the mean mental component score (MCS) of the SF-36 improved from 33.8 (range: 30-37) to 57.2 (range: 49-62) ($p < 0.001$).

No recurrence of infection was noted. Implant failure was not seen.

DISCUSSION

Age

SIS has been reported more frequently in older individuals (15,23). Consistent with the literature, the mean age of the patients in this study was 52 years (range: 26-79).



Fig. 3. — Antero-posterior (A) and lateral radiograph (B) showing solid bone fusion L4L5 at 6 months follow-up.

Back pain

Back pain is the hallmark clinical manifestation in most of the patients, regardless of the causative microorganism (10,16,42). In our series, all 10 patients presented with back pain as their first symptom.

Inflammatory markers

Elevated inflammatory markers (ESR, CRP) were seen in all our patients. Elevated ESR has a strong association with epidural abscess (13), which was confirmed in the current study as all the patients had an abscess and a very elevated ESR. These inflammatory markers are also best suited for the post-surgical monitoring of the patients (10-11,13).

Pathogens

The most commonly isolated organism in this study was *Staphylococcus aureus* (30%), followed by *Escherichia coli* (10%), consistent with other investigations (10,14,16,23,33). Therefore, in the absence of definite microbiologic data, empiric

Table II. — Outcome analysis

	ODI %	SF-36		VAS
		PCS	MCS	
Preop.	57.8 ± 14.5	32.4 ± 4.8	33.8 ± 2.6	7.5 ± 1.9
F.U.	8.1 ± 5.6	57.3 ± 3.4	57.2 ± 4.1	1.6 ± 0.8
p-Value	< 0.001	< 0.001	< 0.001	< 0.001

Preop : Preoperative ; F.U. : Follow-up ; ODI : Oswestry Disability Index ; SF-36 : Short Form-36, PCS : Physical Component Summary ; MCS : Mental Component Summary ; VAS : Visual Analog Scale.

broad-spectrum antibiotics active against *Staphylococcus aureus* and *E.coli* are mandatory.

MRI

MRI appears to give the correct diagnosis or suggest pyogenic spondylodiscitis as a possible diagnosis in 55% and 36% of the cases, respectively, in patients who present with less than 2 weeks of symptoms. After 2 weeks, the percentage of definite and possible diagnosis of pyogenic spondylodiscitis is reported to be 76% and 20%, respectively (37).

Anterior or posterior approach ?

This is still a matter of debate. In most patients with SIS, only the anterior vertebral elements are affected and the intact posterior column maintains some degree of stability (9,11,26,31). The anterior approach allows direct access to the infected focus and is convenient for débridement and reconstruction (17,27,28,34). The posterior approach is also convenient for drainage and reconstruction (11,20), but decompressive laminectomy and discectomy alone may further destabilize the spine and result in increased neurologic deficit and spinal instability (17). Most spine surgeons prefer anterior surgery with radical débridement, fusion with autogenous grafts and anterior or posterior instrumentation correcting any sagittal deformity (13,19,28). However, if the epidural abscess extends beyond the limits of the compromised level, the anterior approach may not provide enough access to débride the epidural space, and the posterior approach should be used (11,22,31).

Instrumentation or not ?

It is generally accepted that all foreign materials may decrease the effectiveness of the antibiotics. They facilitate biofilm formation and bacterial adherence, a condition not readily recognizable for the immune system, and hampering the penetration of antibiotics (5,18,31). Nevertheless, clinical studies (11,28,34,38) have demonstrated that instrumentation is safe and efficacious in the face of an active infection. It can be assumed that internal fixation is safe after thorough and radical débridement.

Anterior or posterior instrumentation ?

Posterior pedicle screw-rod systems can provide rigid segmental fixation along all the three columns of the spine and allow intraoperative distraction of the compromised disc space, allowing débridement and bone grafting. Thus, the surgical exposure and fixation can be reduced to a minimum number of segments to decrease the loss of normal motion segments (11,20,28).

Autogenous grafts ?

Autogenous bone grafts are still the gold standard in spine reconstruction because of their low cost, fewer complications and higher fusion rate (8,12). The iliac crest grafts successfully used for interbody fusion in the current study demonstrate that this is possible in an infected area.

How many levels ?

When internal fixation and fusion become unavoidable, the question how to delimit the fusion area becomes important. It is generally believed that the hardware should be inserted into the adjacent levels, so as to avoid the infected zone. However, long-segment fixation not only increases the surgical trauma, but also reduces the scope of activities and favours adjacent segment degeneration. Gonzalvo *et al* (11) have reported single-level débridement and posterior instrumented fusion for the treatment of spontaneous discitis.

Their outcome was satisfactory in terms of fusion rate and quality of life. We came to a similar conclusion.

One or two stages ?

Surgeons may be afraid to plan débridement, instrumentation and fusion in a single stage because residual bacteria might lead to persistence of the infection (1,5,22). Inspired by the improvement of the surgical technique, some tried single-stage surgery for the treatment of SIS (19,26,28,30,40,41). A single-stage procedure has several advantages such as avoidance of a second anaesthesia, lower complication rate, shorter hospital stay and earlier mobilization. We saw no recurrence of infection after an average follow-up of 52 months, with a minimum of 30 months.

Fusion rate

The fusion rate was 100% in the current study. This confirms the findings of other authors after single-stage surgery: a fusion rate of 94% to 100% (11,19,26,30). Posterior stabilization through instrumentation was probably the critical factor in these improved results. Reliable fusion promotes control of infection and early return to normal activities.

Antibiotics

Antimicrobial therapy should be continued until clinical improvement is noted and inflammatory markers (ESR, CRP) have normalized (1,11,13). Most authors advocate a 6 to 8 weeks course of postoperative intravenous antibiotics, followed by 2 months or more of oral therapy (9,13,16,18-19). A therapy of less than 4 weeks duration is associated with a 25% recurrence rate (35). Shad *et al* (36) found bacterial colonization on cervical implants removed after arthrodesis, so they recommended long-term antibiotic regimes. We opted for a minimum of 4 weeks of intravenous antibiotics, followed by 4 weeks of oral antibiotics, until the inflammatory markers (ESR, CRP) had normalized.

Quality of life

The SF-36, consisting of a Physical Component Summary (PCS) and a Mental Component Summary (MCS), has been widely used in several studies about spinal disorders, including spondylodiscitis (25,43,44): 100 is the best possible score. Sobottke *et al* (38) used the SF-36 in a study on spondylodiscitis patients with a follow-up of ± 3.6 years; the resulting SF-36 PCS (38.2 ± 11.4) was less good than that of a normal population, but the SF-36 MCS (50.6 ± 14.4) was quite acceptable. In the current study the SF-36 PCS improved from 32.4 to 57.3 ($p < 0.001$), while the MCS improved from 33.8 to 57.2 ($p < 0.001$): a significant improvement. The ODI (0 to 100%, 0 being the best possible score) has been previously used in clinical studies about pyogenic spinal infection (25,39). Gonzalvo *et al* (11) noted a median ODI of 15.5% after single-stage posterior débridement and instrumentation. In the current study the ODI improved from 57.8% to 8.1% ($p < 0.001$), which is quite acceptable.

Limitation

Sample size was an obvious limitation of this study.

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