



Anterior-only instrumentation and grafting after L5 corpectomy for non-traumatic lesions

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Anterior decompression and reconstruction have been used for the treatment of various conditions at the lumbosacral junction, particularly those necessitating corpectomy because of destruction due to primary or secondary bone tumour or infection. The authors conducted a prospective study on 15 consecutive patients who underwent L5 (L4-L5 in 3 cases) corpectomy for tumour or infection, between 2000 and 2005 : 6 for tumour, 7 for tuberculous spondylitis, and 2 for pyogenic spondylitis. Corpectomy, bonegrafting (tricortical iliac bone graft or titanium mesh-bone graft) and anterior-only instrumentation (screw-plate or screw-rod) were performed via a retroperitoneal approach. One month of bed rest yielded additional stability. The patients were followed up for an average of 39.7 months (range : 7-73 months). Pain relief and neurological recovery were excellent. Solid fusion was obtained in all patients. There were no cases of plate or screw failure. Three patients with metastases died after 7, 17, and 13 months, in spite of successful fusion. No recurrence was noted in all 9 patients with spinal infection. The results observed indicate that grafting and anterior-only instrumentation and grafting is an effective and safe procedure for reconstruction of the lumbosacral junction following L5 (or even L4-L5) corpectomy ; it may obviate the need for additional posterior stabilization in selected patients.

Keywords : lumbosacral spine ; L5 ; anterolateral approach ; corpectomy ; spinal fusion ; anterior-only instrumentation.

INTRODUCTION

The lumbosacral junction has long been a troublesome region for spine surgeons. Destruction, leading to instability and compression of neural elements, is predominantly anterior, so that anterior decompression and reconstruction may be necessary, particularly in those undergoing L5 corpectomy for primary or secondary bone tumour or infection (3,8,9,15,20). Access to these anterior lumbosacral lesions may be difficult because the anatomy is unfamiliar to some surgeons. Moreover, the anterior approach has been associated with vascular and neural complications ; some of these may be catastrophic.

After corpectomy, a combined anterior and posterior procedure during the same anaesthesia is

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a classical approach. This may be due to concern about insufficient stability provided by anterior-only instrumentation. Posterior transpedicular screw instrumentation is most frequently used. However, this combined single-stage surgery is associated with a high rate of major complications, so that staged surgery has also been recommended.

The authors describe a single-stage technique of anterior grafting and anterior-only instrumentation.

MATERIALS AND METHODS

Patient population

A total of 15 patients underwent anterior lumbosacral surgery for tumour or infection between April 2000 and August 2005. Inclusion criteria were : tumoral or infectious lesions of the vertebral body (L4)L5 requiring corpectomy, anterior decompression and reconstruction. Exclusion criteria were lesions requiring decompressive

laminectomy, and burst fractures with significant canal compromise necessitating surgical intervention. There were 9 men and 6 women, who ranged in age from 37 to 65 years (mean : 42.5 years). Six had a tumour, 7 a tuberculous spondylitis, and 2 a pyogenic spondylitis. The average follow-up duration was 39.7 months (range, 7-73 months). Patients were examined clinically and radiologically at 3, 6, and 12 months, and annually thereafter.

Clinical evaluation

All patients suffered from severe low back pain : 7 to 10 on a visual analog scale (VAS) (table I). Their neurological status was graded according to the scoring system of Frankel *et al* (11) : there were 2 patients with Frankel grade C, and 7 with grade D (table I). One patient (case 14) had sphincter disturbance since 2 months.

All patients underwent radiological assessment with plain radiography, magnetic resonance imaging, and computerized tomography scanning as part of their pre-operative evaluation.

Table I. — Clinical Summary of 15 cases

Case No.	Sex/ Age (yrs)	Histology	Level	Preop Frankel Grade	Preop Pain (VAS)	Surgery	Postop Frankel Grade	Postop Pain (VAS)	Follow-up Period (mos)
1	M/53	TB	L5	E	9	SP	E	0	73
2	F/45	TB	L5	D	8	SP	E	0	60
3	M/44	TB	L5	E	9	SR	E	0	60
4	M/56	M, lung	L5	E	8	SP, TM	E	0	7
5	M/65	M, prostate	L5	C	9	SP, TM	E	2	47
6	M/60	PO	L4-L5	C	10	SR, TM	D	1	54
7	F/46	TB	L5	E	7	SR	E	0	42
8	F/62	TB	L5	D	8	SR	E	0	36
9	M/51	Solitary plasmacytoma	L5	D	7	SP, TM	E	0	40
10	F/63	TB	L5	D	8	SP	E	0	36
11	M/56	M, unkown	L5	E	9	SP, TM	E	2	17
12	F/40	PO	L4-L5	D	10	SP, TM	E	0	36
13	M/48	Lymphoma	L5	D	7	SP, TM	E	0	24
14	M/37	TB	L5	D	9	SP	E	0	24
15	F/52	M, breast	L5	E	7	SP, TM	E	2	13

TB = tuberculosis. M = metastasis. PO = pyogenic osteomyelitis. SP = screw-plate. SR = screw-rod. TM = titanium mesh.

Operative procedure

The patient was placed in the lateral decubitus position, with the surgical side up over the break in the table. A standard anterolateral retroperitoneal approach was used. The left side was preferred to avoid manipulation of the vena cava, unless the right side was dictated by the pathology. The retroperitoneal space was entered until the spine was exposed. An anterior corpectomy was performed for anterior decompression: L5 corpectomy in 12 cases and L4-L5 corpectomy in the remaining 3 cases. The discs on both sides of the removed vertebral bodies were resected. Adequate decompression was possible in all cases. In 7 patients a tricortical autograft, harvested from the anterior iliac crest, was placed into the bone defect with the help of a distractor. In 8 patients morselized autografts were packed into a cylindrical titanium mesh (Pyramesh, Medtronic Sofamor Danek, Memphis, USA), and then the mesh was tamped into the space. For anterior instrumentation, a screw-plate (Z-plate, Medtronic Sofamor Danek, Memphis, USA) or a screw-rod (TSRH or CD M8, Medtronic Sofamor Danek, Memphis, USA) was used. A deep suction drain was inserted during closure, and prophylactic antibiotics were administered for 3 to 5 days after surgery. Post-operatively, the patients spent 3 to 4 weeks in bed, after which ambulation and bracing were started. All patients with spinal infection received standard antibiotic and/or antituberculous treatment.

RESULTS

All 15 patients survived the operative procedure. There were no surgery-related complications, except one case of right-sided external iliac vein laceration, which was repaired immediately, without sequelae. Pain relief was complete in 11 patients; 3 patients improved to 2 on the visual analog scale, and one patient to 1 (table I). Neurological recovery was complete in all patients, except in one who improved from a C to a D score. One patient with sphincter dysfunction (case 14) recovered completely. Solid fusion was obtained in all patients. There were no cases of plate or screw failure. Three patients (cases 7, 11 and 15) with spinal metastases died after 7, 13, and 17 months, despite successful fusion. No recurrence was noted in the 9 patients with spinal infection.

Illustrative case

A 44-year-old man (case 3) presented with low back pain since two months. An MRI-scan showed destruction of the L4 and L5 vertebral bodies along with an anterior epidural abscess (fig 1). Anti-tuberculous chemotherapy was started, given a history of pulmonary tuberculosis. After two months this therapy was deemed ineffective, and an L4-L5 corpectomy was performed; a tricortical iliac bone graft was used for reconstruction, and was fixed with an anterior screw-rod. The patient experienced pain relief immediately after surgery, and his ESR returned to normal in two weeks. Radiographic studies at final follow-up, 60 months later, demonstrated a stable arthrodesis without recurrence of the tuberculosis.

DISCUSSION

Lumbosacral reconstruction following L5 corpectomy is not a common procedure (10,21,25). A *combined anterior-posterior procedure* is usually recommended to offer early and effective immobilization of the spine; it includes an anterior corpectomy and fusion to the sacrum without instrumentation, augmented with posterior segmental fixation. The use of pedicle-screw based implants has greatly increased the fusion rate of anterior strut-grafting by providing the necessary stabilization during bone healing (12,26). However, the incidence of major complications associated with combined anterior and posterior procedures is significantly higher than with isolated anterior or posterior procedures (18), although some authors (7,19,24) claim advantages of a one-stage combined procedure over a two-stage procedure.

The authors preferred *anterior-only instrumentation and grafting* after L5 corpectomy. Anterior spinal instrumentation has been recognized as a most effective technique after lumbar corpectomy and strut-grafting (5,27), but it is rarely used at the lumbosacral junction (4,14), even in scoliosis cases which need a long fusion to the sacrum anteriorly (16,22). The underlying reason might be that anterior instrumentation at the lumbosacral level is believed to be technically difficult and nearly

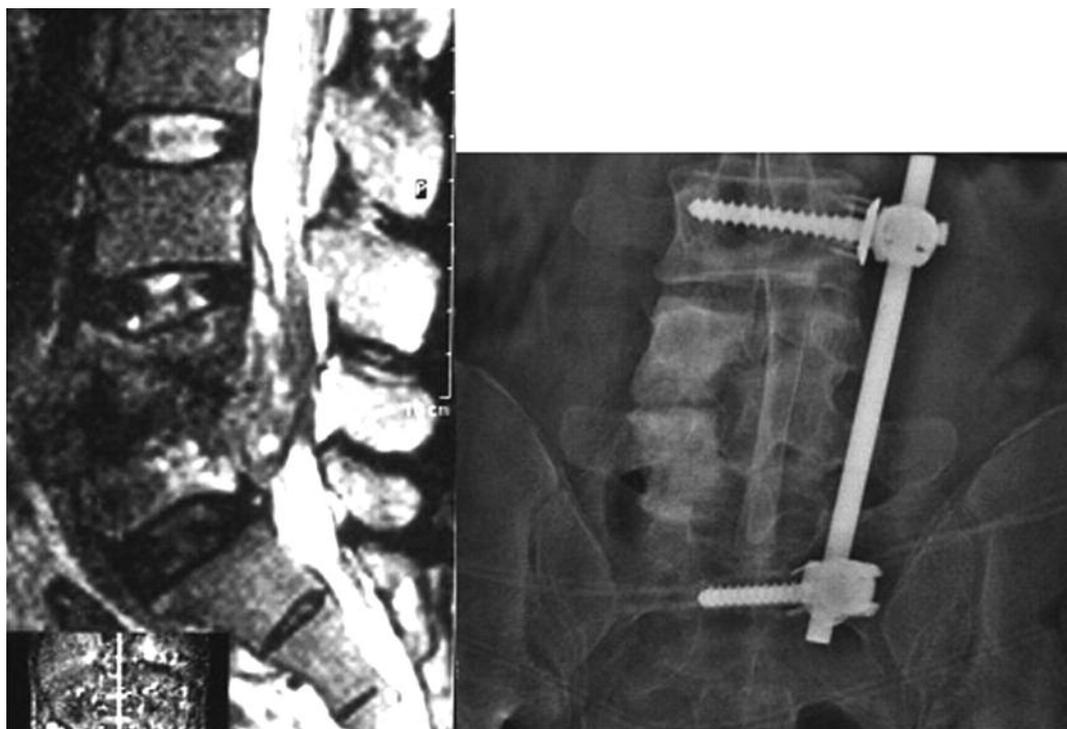


Fig. 1. — Case 3. A : Midsagittal MRI-scan showing anterior epidural abscess and destruction of the vertebral bodies L4 and L5. B : Plain radiograph, lateral view : tricortical iliac bone graft and instrumentation L3-S1, after corpectomy L4L5.

impossible. The authors however achieved solid fusion and maintenance of lordosis in their 15 patients. This procedure not only achieved decompression and instrumented reconstruction of the lumbosacral junction in a single approach, but also eliminated the risk of complications related with additional instrumentation and fusion surgery via a posterior approach.

The authors' success in terms of clinical and radiological outcomes does not mean that the single-approach anterior-only instrumentation in itself would have provided sufficient and safe stability. Indeed, the patients were kept in bed for one month, because of the unique anatomic and biomechanical characteristics of the lumbosacral junction. Moreover, subsequent ambulation was made safer by means of a brace for two or three months. Finally, stability was further enhanced by the fact that only the vertebral body L5 was removed, except in 3 patients who underwent an L4-L5 corpectomy. Additional posterior stabiliza-

tion might have been necessary, if more than 2 vertebral bodies would have been removed.

Another limitation of this technique is the fact that the implants used were not especially designed for anterior lumbosacral instrumentation. Obviously, implant failure was not seen in the short term, but this might occur in the long term. Novel implants, more suitable for anterior lumbosacral stabilization, need to be developed.

A few authors have gone further than corpectomy, by removing a whole vertebra : *spondylectomy*. Detwiler *et al* (6) reported an L5 spondylectomy for metastatic breast carcinoma. The posterior elements and the posterior third of the vertebral body were removed via a posterior approach. Pedicle screws were inserted at the L4 and S1 levels. Subsequently, the anterior two thirds of the body were removed via a transabdominal approach. An allograft bone strut replaced the body and was fixed with an interference bone screw, placed through the inferior aspect of the allograft and screwed into the body of

S1. Abe *et al* (1,2) reported on a patient with an L5 giant-cell tumour who underwent total spondylectomy. Anterior reconstruction was achieved using a titanium mesh cage and Zielke instrumentation. Recently the same team (23) presented the case of a 20-year-old woman with an L5 giant-cell tumour treated with spondylectomy in a one-day posterior-anterior approach. Pedicle screws L4-S1 and iliac bone grafts were used posteriorly. Anteriorly, iliac and fibular grafts replaced the vertebral body, without instrumentation. Gallia *et al* (13) performed a two-stage posterior-anterior spondylectomy L5 in 2 patients. After posterior instrumentation they reconstructed the vertebral body with a distractable cage and a tension band between L4 and S1. This tension band was contoured to the lumbosacral lordosis, placed underneath the iliac vessels and fixed with screws.

CONCLUSION

These preliminary results indicate that anterior-only grafting and instrumentation after corpectomy L5 or L4-L5, supplemented with one month of bed rest, may eliminate the need for additional posterior stabilization in selected patients.

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