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ORIGINAL STUDY

Iliac screws in multi-level degenerative spine treated via long constructs crossing the lumbosacral junction

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The purpose of this retrospective study was to evaluate the effectiveness of iliac screws in the multilevel degenerative spine where long segmental instrumentation crossing the lumbosacral junction is required. Thirty-three patients underwent decompression combined with long instrumented fusion extending distally to the sacrum. The distal anchors were augmented with iliac screws. The minimum follow-up period was 2 years. The mean preoperative VAS for back pain was 7.69 ± 0.91 ; this improved to 3.21 ± 1.02 (p< 0.05). The mean preoperative ODI was 62.06 ± 7.72 ; it was reduced to 31.81 ± 13.2 (p< 0.05). Fusion across L5S1 was assessed with plain radiographs. It was achieved in all patients at final follow-up. Iliac screw placement is effective in providing distal support in long fusions.

Keywords : iliac screw fixation ; long fusion ; lumbosacral junction.

INTRODUCTION

Surgery involving the lumbosacral junction remains challenging as regards reliability of fixation and fusion rate. This is attributed to the compromised bone quality of the sacrum in the elderly as well as to the peculiar biomechanical forces applied to this junction zone of the spinal column. The challenges are more evident where multi-segment fixation of the degenerative spine is performed : the long lever arm is a concern *(7)*.

In an attempt to improve S1 fixation, screws are placed with bicortical or tricortical purchase, towards the sacral promontory *(5)*. Distal structural support in the form of pelvic screw fixation may be added to unload the S1 screws. This added support has been found to prevent complications related to overloading of the sacral screws, such as sacral fractures, screw failure and pseudarthrosis. Pelvic fixation can be achieved by several methods. However, iliac screws are superior to other methods such as the Galveston technique, as to pullout strength, application and handling *(1,8)*.

The aim of this retrospective study was to evaluate the effectiveness of iliac screw fixation in patients with multilevel degenerative spine disease where long segmental spinal fusion is required.

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MATERIALS AND METHODS

This retrospective study was conducted according to the ethics committee rules in our institute. All 33 patients (Table I) had multi-level degenerative spine disease with canal stenosis requiring multi-segment decompression combined with long instrumentation and fusion involving at least 4 levels. The fixation extended proximally to the Th10-L2 area and distally to the sacrum. The distal anchor was augmented by iliac screw fixation.

The study included 19 females and 14 males. Their mean age was 67.48 ± 6.3 years (range 56-80 years). Preoperative assessment was performed radiologically, using whole spine plain radiographs and MRI. Clinically, a visual analogue scale (VAS) was used for back and buttock pain, and the Oswestry Disability Index (ODI) for functional assessment. Surgery was performed after failure of conservative treatment for at least 3 months.

Degenerative lumbar scoliosis was found and corrected in 10 cases. Fourteen patients had adjacent segment disease following previous fusion. Preoperatively all patients were neurologically intact. Proximal levels of fixation were recorded. Iliac screws were inserted bilaterally, augmenting the S1 screws. The diameter of the iliac screws was 7 mm, with lengths varying from 70 to 90 mm. Interbody fusion was performed with PEEK cages in all cases, at least at the L5/S1 level, along with posterolateral fusion. The levels of the cages were also registered. Morselized local bone was placed in the cages and anterior to the cage as a marker for fusion on follow-up radiographs.

The minimum follow-up period was 2 years; the mean follow-up period was 30 months. Postoperatively all patients were screened with plain radiographs. A CT-scan was used when fusion was questionable. Any complications such as implant failure and pseudarthrosis were recorded.

Statistical analysis was performed using a paired t-test ; p values < 0.05 were considered as statistically significant.

RESULTS

In this series the proximally fixed level was TH10 in five patients, Th11 in six patients, Th12 in eight patients, L1 in six patients and L2 in eight patients. Eight patients had a cage at 3 levels (L3L4, L4L5, L5S1), 22 had a cage at the distal two levels (L4L5, L5S1), and 3 had a cage at the L5S1 level (Fig. 1,2).

Clinically the mean preoperative VAS for back and buttock pain was 7.69 ± 0.91. This improved to 3.21 ± 1.02 at the final follow-up ($p<0.05$). The mean preoperative ODI was 62.06 ± 7.72, while it was 31.81 ± 13.2 at the last visit ($p<0.05$).

Fusion across the lumbosacral junction (L5S1) was achieved in all patients at final follow- up. A radiolucent halo around a single iliac screw was detected in 3 cases (9%), and around both iliac screws in 6 patients (18%). However, no implant failure, such as pullout or breakage, was observed in any case.

Complications: 4 patients were bothered by palpable prominence of the iliac screws, but none wanted the hardware to be removed. Two patients had a superficial wound infection, which responded to antibiotics. One patient suffered from unilateral weak ankle dorsiflexion and big toe extension (Manual Muscle Testing 3/5) ; it did not improve throughout the follow-up period. Plain radiographs at final follow-up showed no problems in the sacroiliac joints.

DISCUSSION

Achievement of firm screw purchase at the S1 level can be limited by its relatively large antero-posterior diameter and its cancellous nature *(6)*. Surgical techniques and instrumentation have been developed over the previous years in an attempt to overcome poor fixation in S1 and the high pseudarthrosis rate *(7)*.

Most authors, who used iliac screws as an augmentation for long spinal fusion constructs extending to the sacrum, reported high fusion rates at the lumbosacral junction. Kuklo et al. *(4)* reported a pseudarthrosis rate of only 5% in a series of 81 patients. Placement of iliac screws was not a problem in 34 of their patients who had previous

Table I. — Demographics and clinical outcome

	Gender	Age	Proximal fixation level	Pre-op ODI	Final ODI	Pre-op VAS back pain	Final VAS back pain
1	M	67	L_1	62	26	7	3
2	F	63	L_2	70	44	9	4
3	M	71	Th_{12}	78	48	9	5
4	F	61	L_2	48	22	6	3
5	F	70	Th_{11}	72	52	9	4
6	M	66	L_2	50	24	7	3
7	M	72	Th_{11}	58	28	7	3
8	F	67	L_2	76	58	9	5
9	F	71	Th_{10}	72	48	9	4
10	M	79	Th_{12}	70	34	9	3
11	F	56	L_2	58	26	7	2
12	F	80	Th_{10}	50	16	6	2
13	M	67	Th_{12}	60	28	8	3
14	F	70	Th_{12}	56	18	7	2
15	F	68	D_{11}	60	26	8	2
16	F	60	L_1	62	42	8	4
17	M	59	L_1	64	46	8	4
18	F	58	L_2	58	16	7	2
19	F	73	Th_{12}	68	44	8	4
20	M	65	L_1	66	46	8	4
21	M	62	Th_{11}	62	22	8	2
22	F	77	Th_{10}	66	26	8	3
23	F	62	L_2	64	24	8	3
24	M	79	Th_{11}	68	48	8	5
25	M	67	Th_{10}	60	16	7	2
26	F	62	Th_{12}	66	50	8	5
27	M	70	Th_{11}	50	12	7	2
28	F	59	L_2	58	24	7	3
29	M	74	Th_{10}	70	36	9	4
30	F	65	L_1	50	18	7	3
31	F	66	Th_{12}	56	20	6	2
32	F	73	Th_{12}	62	44	8	4
33	M	68	L_1	58	18	7	2

iliac bone graft harvesting. Seung et al. *(9)* reported 100% radiographic fusion across the lumbosacral junction in a series of 13 patients. Radiologically no sacroiliac joint problems were noted. These authors stated that, although it was difficult to clinically assess sacroiliac joint problems caused by the sacroiliac fixation, the overall functional outcome was acceptable : the mean ODI improved significantly from 40.0 preoperatively to 17.5 at the last follow-up. These results correlate well with our study, where the average pre- and post-operative ODI scores were 62.06 and 31.81 respectively ($p<0.05$).

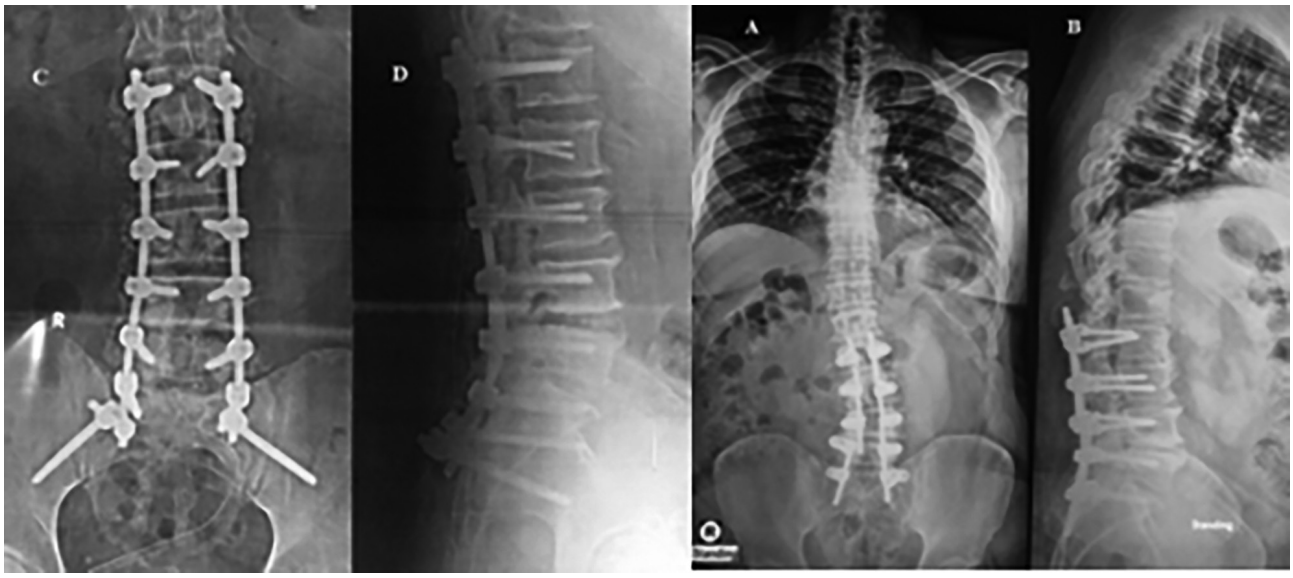

Fig. 1. — A, B : fusion L2S1 in a 60-year-old female with adjacent segment disease and degenerative scoliosis : failed implant. C, D : extension of fusion to L1 and os ilium ; cages L4L5 and L5S1.

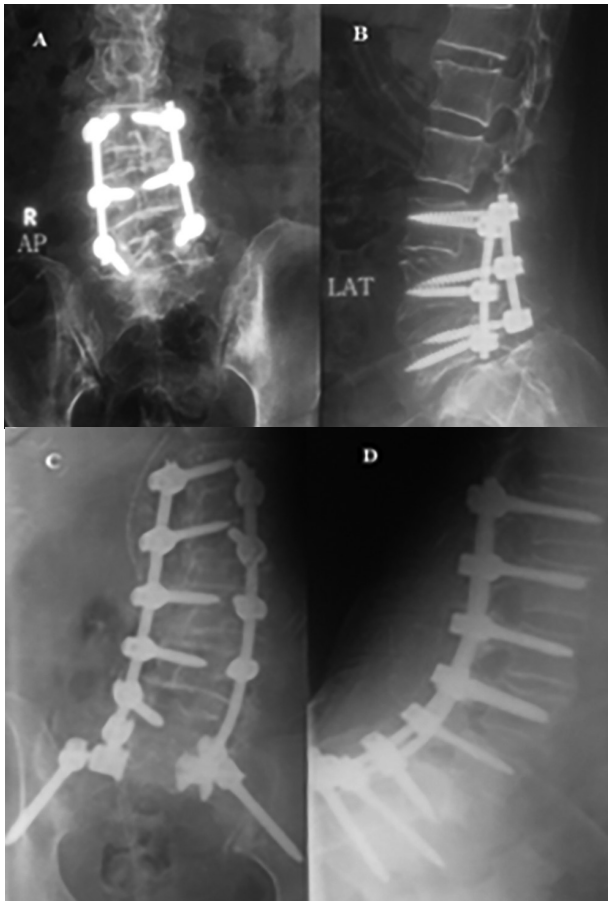

Fig. 2. — A, B : fusion L3L5 in a 67-year-old male, requiring revision surgery. C, D : original implant was removed and fusion was extended to L1, S1 and os ilium ; cage L5S1

As to the rate of postoperative infection, due to extensive surgical exposure, Kuklo et al. **(4)** reported a 4% infection rate, whereas Seung et al. *(9)* noted a single case (7.6%) of deep wound infection, which was successfully treated conservatively. In the current study two patients (6%) had a superficial wound infection which responded to conservative measures.

Prominence of the iliac hardware is another issue which may necessitate removal of either one or both iliac screws. Emami et al. *(2)* had this problem in 8 out of 36 patients (22%). Seung et al. *(9)* mentioned two patients (15.3%) who complained of screw prominence, but none of them wanted them to be removed. In the current study 4 patients (12%) had the same reaction. Tumialan et al. *(10)* felt that the screw prominence could be avoided by burying the screw heads into the posterior superior iliac spine.

Violation of acetabulum or sciatic notch is rare, even in large series. It did not occur in the current study. C-arm guidance eliminates this problem.

Radiographic halos *(3)* around the iliac screws are frequently seen as a result of micromotion around the screws, but they appear to have no effect on achieving solid lumbosacral fusion. Seung et al. *(9)* reported halos in 2 patients (15.3%). In the current study, a total of 9 patients (27%) had radiolucent halos around iliac screws without clinical consequences.

The authors intend to follow up their patients for a longer period to report any complications which may appear.

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