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Posterior Vertebral Column Resection (PVCR) in Fixed Lumbosacral Deformity

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- Abstract -

Study Design: A retrospective study.

Objectives: To report the results and techniques of posterior vertebral column resections for fixed lumbosacral deformity.

Summary of Literature Review: Fixed lumbosacral deformity results in gross imbalance and progressive compensatory thoracolumbar deformity due to the absence of a mobile spine caudally.

Material and Methods: Twenty-five consecutive fixed lumbosacral deformity patients subjected to PVCR were reviewed after a minimum follow-up of 2 years. The offending vertebra was below the L4 in all cases. The etiological diagnoses were congenital scoliosis, congenital kyphoscoliosis, post-traumatic kyphosis and post-infectious kyphosis in 6, 3, 2 and 14 patients, respectively. The average age at the time of operation was 38 years, with a male:female ratio of 7:18. The indication for PVCR was fixed lumbosacral deformities that could not be brought to a reasonable balance on traction or forced side bending.

Results: On average 2.1, ranging from 1 to 5, vertebrae were removed, with 52 removed in all. The average fusion extent was 4.5 vertebrae, ranging from 2 to 8. An anterior column reconstruction was carried out with an autogenous bone graft in all patients, with the additional insertion of titanium mesh in 12. The distal anchor went down to the L5, S1 and S2 in 4, 12 and 9 patients, respectively. A preoperative scoliosis of 38.1° was corrected to 15.8° (60% correction), and a preoperative kyphosis of 35.2° was corrected to -5.1° (40% correction). A preoperative coronal imbalance of 2.0cm was improved to 0.9cm, and a preoperative sagittal imbalance of 9.3 cm was improved to 4.6 cm. The mean operation time and blood loss were 280 minutes and 2810ml, respectively. Following complications were encountered in 5 patients: 2 transient neurologies, 2 compression fractures at proximal adjacent vertebra and 1 pseudoarthrosis.

Conclusions: A posterior vertebral column resection is an effective procedure for the management of a fixed lumbosacral deformity. It provides satisfactory correction and improved functional outcomes. However, it is a technically demanding and exhausting procedure, with possible risks for complications

Key words: lumbosacral deformity, posterior vertebral column resection (PVCR), pedicle screw fixation

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* 2003

* 2003

, 20 (80%)

(Estimated blood loss)

가 , 2

1-3)

4)

Cobb

, 7

가

4)

1

Cobb

, 7

1

5

12

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1

.25

가 6 ,

가

가 16 ,

가 3

5-7)

1.

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가

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(Posterior

Vertebral Column Resection, PVCR)

2

2

2

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7,8)

2 (2.0 6.3) 가가

25 . 가 7 , 가 18

, 38 (2.5 61)

6 ,

3 , 2 , 14

(Table 1). 25

4

1 cm

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surgicel

12 (48%)

Table 1. Patient characteristics and surgical outcome

No	Sex	Age	Dx*	CP [†]	F/U(month)	Res.	No.of RV [‡]	Ant.recons	Distal anchor	Cx**
1	M	2.5	CS		76	L4	1	Chip bone	L5	
2	F	34	CS	P	56	L5	1	Chip bone	S2	
3	M	9.9	CS		26	L5	1	Chip bone	S1	
4	M	25	CS	P	26	L56	2	Mesh	S1	
5	M	8.9	CS		25	L4	1	Chip bone	L5	
6	F	41	CS	N, P	24	L5	1	Mesh	S2	
7	F	35	CKS	P	52	L5	1	Chip bone	S2	
8	F	61	CKS	N, P	46	L34	2	Mesh	S2	Comp fx
9	M	16	CKS		28	L4	1	Mesh	L5	
10	F	69	PTK	P	73	L4	1	Chip bone	S1	
11	F	61	PTK	P	29	L4	1	Chip bone	S1	
12	F	52	PIK	N, P	73	L3	1	Chip bone	L5	
13	F	36	PIK	N	71	L1234	4	Chip bone	S1	TN
14	F	37	PIK	N, P	70	L1234	4	Chip bone	S1	
15	F	44	PIK	N, P	69	L234	3	Chip bone	S1	
16	M	37	PIK	P	65	L34	2	Chip bone	S1	
17	F	38	PIK	N, P	65	L12345	5	Mesh	S2	
18	F	61	PIK	N, P	65	L3	1	Mesh	S1	NU
19	F	40	PIK	P	60	L1234	4	Mesh	S1	
20	M	61	PIK	N, P	58	L5	1	Mesh	S2	TN
21	F	40	PIK	P	57	L345	3	Mesh	S2	
22	F	60	PIK	N, P	49	L45	2	Mesh	S2	Comp fx
23	F	26	PIK	P	44	L234	3	Mesh	S1	
24	F	49	PIK	N, P	26	L234	3	Chip bone	S1	
25	F	49	PIK	N, P	25	L345	3	Mesh	S2	

* Dx = diagnosis; CS = congenital scoliosis; CKS = congenital kyphoscoliosis; PTK = post-traumatic kyphosis, PIK = post-infectious kyphosis.

[†] CP = clinical presentation; N = neurologic impairment; P = pain.

[‡] No. of RV = Number of resected vertebra(e)

** Cx = complications; Comp fx = proximal adjacent compression fracture; TN = transient neurology; NU = non-union.

curette

가

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5 mm

5 mm

mesh

, mesh

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2.



Fig. 1. Case 6. 41-year-old female with lumbosacral scoliosis and L5 hemivertebra. (A) Preoperative anteroposterior radiograph shows lumbosacral scoliosis of 25 ° and proximal compensatory curve of 33 °. (B) Preoperative lateral radiograph. (C) Preoperative tomograph shows L5 hemivertebra. (D) Postoperative anteroposterior radiograph. She was treated with posterior vertebral column resection of L5 with interbody cage. The lumbosacral scoliosis is corrected to 6 ° and proximal compensatory curve is corrected to 6 °. The trunk is balanced postoperatively. (E) Postoperative lateral radiograph.

Table 2. Coronal correction

No	LS curve (°)				Compensatory curve (°)				Balance (cm)			
	Pre	IMPO	Last	Net	Pre	IMPO	Last	Net	Pre	IMPO	Last	Net
1	26	4	3	23	8	1	2	6	1.0	0.2	0	1.0
2	37	16	18	19	40	15	23	17	3.5	1.6	2.3	1.2
3	40	14	16	24	7	4	4	3	1.5	0	0	1.5
4	29	8	10	19	40	14	15	25	3.5	1.2	1.2	2.3
5	35	12	12	23	8	6	3	5	0	0.2	0	0
6	25	6	6	19	33	8	6	27	1.2	0.5	0.6	0.6
7	37	18	18	19	47	30	33	14	6.0	2.8	3.0	3.0
8*	56	21	25	31	26	7	6	20	0	0.2	1.2	-1.2
9	57	30	28	29	28	8	14	14	1.0	0.1	0	1.0

Pre = preoperative; IMPO = at 2 weeks after surgery; Last = at most recent follow-up; Net = Pre-Last.

* with complication of proximal adjacent compression fracture.

3, 4.6 ± 5.0 cm(-1 20 cm)
 3, 4.7 cm (Fig. 2) (Table 3).
 5, 2
 6, 1
 1, 1
 2.1 (1 5), 52
 4.5 (2 8)
 가
 , 12 mesh
 5 가 4 , 1 가 12 , 2 가 9
 4 40 (3 10 6 45
), 2810 ml (320 5460 ml)
 12
 20 17 (85%)
 visual analogue scale 50%
 38.0 ± 11.7 (25
 57) 2 14.3 ± 8.1 (4 30) 62%
 15.1 ± 8.3 (3 28)
 60% 2
 3%
 26.3 ± 15.4(7
 47) 2 10.3 ± 8.6 (1 30)
 (61%), 11.8 ± 10.6 (2 33)
 55%
 2 9%
 2.0 ± 2.0 cm(0 6 cm) 2
 0.8 ± 0.9 cm(0 2.8 cm)
 0.9 ± 1.1 cm(0 3 cm) 1.1 cm
 (Fig. 1) (Table 2).
 35.4 ± 25.1 (0 84)
 2 -6.3 ± 10.6 (-30 12) 42 °
 -4.8 ± 11.0 (-30 18)
 40 ° 2
 2 °
 19.9 ± 32.6 (-28 83) 2 -20.8 ± 13.6 (-39
 7) 41 °
 14.9 (-38 7) 37 °
 2 4 °
 -16.0 ± 21.5 (-40 20) 2
 2.7 ± 13.1 (-18 23) 19 °
 4.1 ± 14.2 (-21 24)
 20 ° 2 1 °
 가 9.3 ± 5.6 cm(3 21 cm) (Combined
 2 2.4 ± 3.5 cm(-4 9 cm) anterior and posterior vertebral column resection)

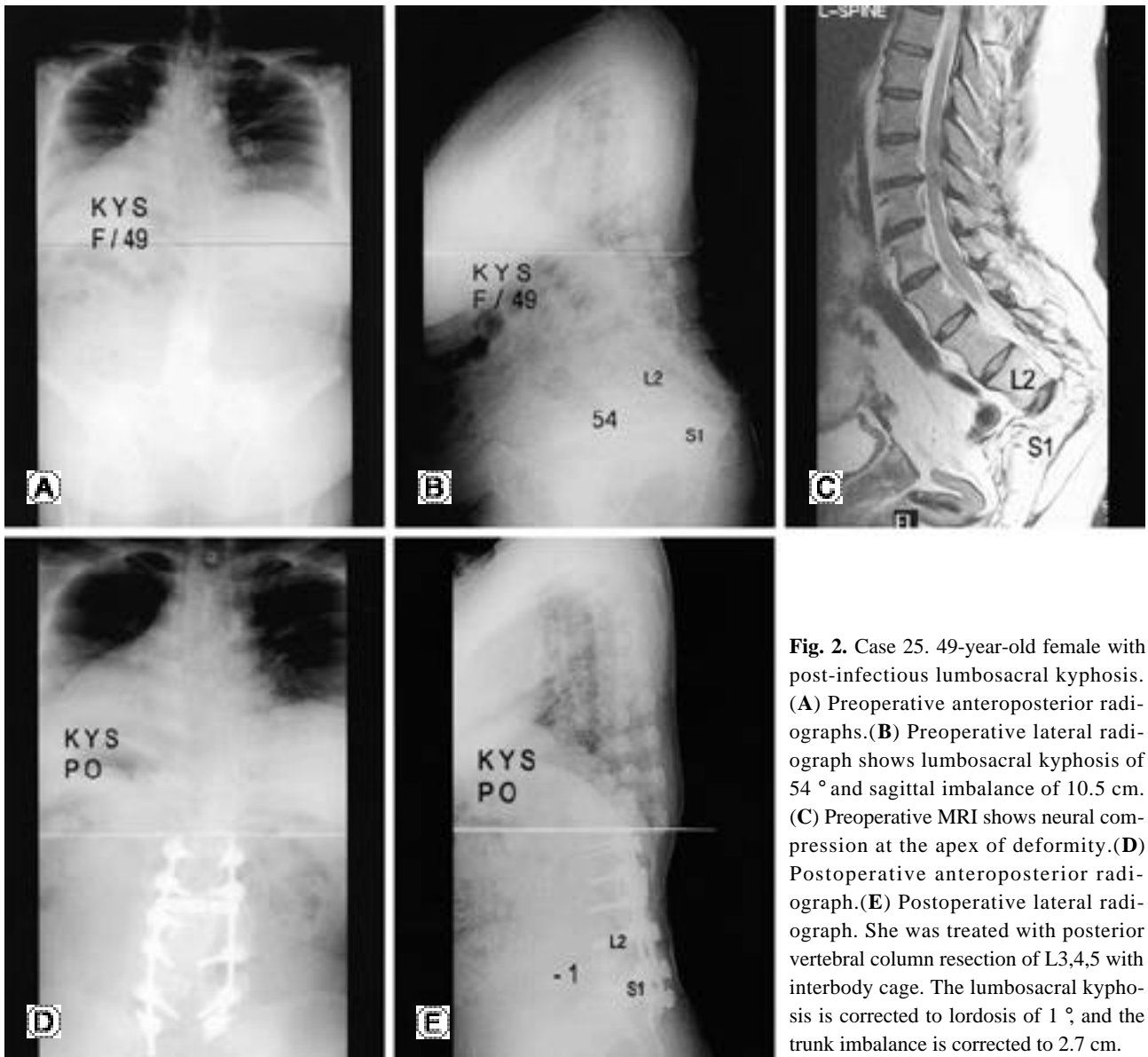


Fig. 2. Case 25. 49-year-old female with post-infectious lumbosacral kyphosis. (A) Preoperative anteroposterior radiographs. (B) Preoperative lateral radiograph shows lumbosacral kyphosis of 54 ° and sagittal imbalance of 10.5 cm. (C) Preoperative MRI shows neural compression at the apex of deformity. (D) Postoperative anteroposterior radiograph. (E) Postoperative lateral radiograph. She was treated with posterior vertebral column resection of L3,4,5 with interbody cage. The lumbosacral kyphosis is corrected to lordosis of 1 °, and the trunk imbalance is corrected to 2.7 cm.

Bradford Tribus 가 6).

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5 mm

mesh

(hypogastric plexus)

25
60%

가 , 40 °

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Table 3. Sagittal correction

No	Regional kyphosis (°)				Thoracic kyphosis (°)				Lumbar lordosis (°)				Balance (cm)			
	Pre	IMPO	Last	Net	Pre	IMPO	Last	Net	Pre	IMPO	Last	Net	Pre	IMPO	Last	Net
7	0	-10	-8	8	5	10	10	5	-28	-30	-32	4	5.0	4.5	4.5	0.5
8*	53	-17	-16	69	4	11	24	20	47	-22	-18	65	16.5	8.4	11.1	5.4
9	15	-13	-11	26	20	23	22	2	-25	-36	-38	13	5.2	0.3	0	5.2
10	3	-20	-17	20	3	10	12	9	-10	-35	-30	20	3.0	0.8	2.1	0.9
11	9	-17	-15	24	15	20	20	5	-15	-32	-28	13	7.7	3.2	3.5	4.2
12	50	10	11	39	-3	18	23	26	10	-36	-38	48	4.0	1.3	2.0	2.0
13	60	12	18	42	-32	-10	-12	20	35	-14	-1	36	7.0	1.5	3.2	3.8
14	35	-5	-3	38	-37	-10	-11	26	23	-17	-13	36	9.5	0.5	1.0	8.5
15	58	-3	-2	60	-38	-15	-7	31	51	-3	0	51	14.1	6.2	6.7	7.4
16	0	-30	-30	30	-27	-5	0	27	-4	-35	-32	28	3.5	-3.8	0.5	3.0
17	64	-3	-1	65	-26	2	3	29	64	-3	-1	65	14.8	6.1	6.0	8.8
18†	10	10	10	0	-6	10	0	6	-5	-37	-25	20	21.0	8.5	20.1	0.9
19	55	-7	-7	62	-40	-18	2	42	55	-7	-7	62	3.3	-4.2	-0.9	4.2
20	18	0	0	18	16	20	22	6	-21	-39	-35	14	6.2	3.6	4.2	2.0
21	40	-10	-10	50	-35	-10	-10	25	27	-18	-12	39	10.9	4.5	4.8	6.1
22*	25	-7	-7	32	-20	2	-21	-1	20	-15	7	13	19.0	3.7	12.0	7.0
23	40	-6	-4	44	-23	3	5	28	40	-6	-4	44	4.3	0	2.5	1.8
24	84	0	2	82	-40	5	11	51	83	-4	-4	87	12.0	0	2.2	9.8
25	54	-3	-1	55	-40	-15	-15	25	32	-6	-5	37	10.5	0.9	2.7	7.8

Pre = preoperative; IMPO = at 2 weeks after surgery; Last = at most recent follow-up; Net = Pre-Last.

* with complication of proximal adjacent compression fracture.

† with complication of non-union.

3 16
2.8 cm (Table 2,3).
Bradford Tribus 가 6)
2
82%
87% 52% 가
6,7,16-18)
2
25 5 가
7).

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 : 2 가 가 25 .25
 4
 3 , 2 , 14 . 38 , 7 , 18 .
 가
 : 2.1 (1 5), 52 . 4.5 (2 8) .
 가 , 12 mesh . 5
 가 4 , 1 가 12 , 2 가 9 . $38 \pm 12^\circ$ $15 \pm 8^\circ$
 (60%), $35 \pm 25^\circ$ $-5 \pm 11^\circ$ (40%). 2.0 cm
 0.9 cm , 9.3 cm 4.6 cm . 4
 40 , 2810 ml .5 . 2 6
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