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Clinical Study

Stand-alone minimally invasive lateral lumbar interbody fusion: Multicenter clinical outcomes

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ABSTRACT

Stand-alone minimally invasive lateral transpsoas interbody fusion (MIS-LIF), without posterior instrumentation, is feasible because the technique does not necessitate the disruption of the stabilizing elements. The objectives of this study are to evaluate the efficacy and clinical outcomes of patients who underwent stand-alone lateral interbody fusion. A multicenter chart review was conducted to identify patients who underwent stand-alone MIS-LIF between 2008 and 2012. Patients were classified by spinal pathology (degenerative disc disease [DDD], spondylolisthesis [SL] and adult degenerative scoliosis [ADS]). Routine clinical follow-up was scheduled at 3, 6, and12 months. Outcome measures included hospital length of stay, fusion rates, neurologic complications, integrity of construct and clinical outcome questionnaires (Visual Analog Scale [VAS] and Oswestry Disability Index [ODI]). A total of 59 patients met the inclusion criteria. The average age was 60 years (range 31–86 years). Spinal pathologies treated were DDD in 37 (63%), SL in four (7%) and ADS in 18 (30%) patients. Fusion rate was 93% of patients (95% of levels) at 12 months. Two patients required re-operation. Mean hospital stay and follow-up were 3.3 days (range 1–10) and 14.6 months, respectively. The mean preoperative VAS and ODI were 69.1 and 51.8, respectively. VAS improved to 37.8 ($p < 0.0005$). ODI improved to 31.8 ($p < 0.0005$). Seventy percent of patients had grade 0 subsidence while 30% had grade I and grade II subsidence. Stand-alone MIS-LIF is viable option in a carefully selected patient population for both single and multilevel disease and shows significant improvement in health related quality of life.

1. Introduction

Minimally invasive lateral retroperitoneal transpsoas interbody fusion (MIS-LIF) was developed to minimize approach-related morbidity compared to traditional open posterior spinal surgery [1,2]. The implementation of MIS techniques in spine surgery, including MIS-LIF, continues to expand [3–9]. MIS-LIF has been used to deliver stand-alone interbody cages or combined with supplemental instrumentation. There are certain advantages to the MIS-LIF approach that make stand-alone constructs feasible. With this approach important stabilizing structures are not violated to gain access to the intervertebral disc space as compared to posterior approaches. In addition, it is associated with shorter operative time and decreased blood loss [2,10].

Indication for operative intervention with MIS-LIF is similar to open approaches and involves pain (radicular), neurological deficits and progressive deformity. Similarly the goals of intervention are to halt progression of deformity and decompress involved neural elements. The selection of an appropriate construct for spinal arthrodesis involves not only the degree of deformity but also co-factors such as patient co-morbidity. Patient selection is key in any surgical intervention but is particularly important for a MIS-LIF stand-alone construct. Current literature is limited in regards to indications and clinical outcomes for stand-alone lumbar MIS-LIF. The objective of this study is to provide clinical outcomes of patients who underwent stand-alone lateral interbody fusion in a carefully selected cohort across three independent centers.

2. Methods

A retrospective multicenter database review was performed on all patients who underwent stand-alone lumbar MIS-LIF between

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Table 1
Clinical details of patients undergoing minimally invasive lateral lumbar interbody fusion

Patient	Age/Sex	Diagnosis	LIF levels (all lumbar unless noted)	F/U (months)	Hospital stay (days)	Arthrodesis	VAS pre/ post (diff)	ODI pre/ post (diff)	Complications[a]	Biologics
1	56/F	DDD	4–5	47	4	No	66.7/50 (16.7)	74/64 (10)	Left thigh (Zone III) paresthesia/burning	Allograft
2	74/F	SL	2–3, 3–4, 4–5	18	4	Yes	87/50 (37)	60/50 (10)	Psoas weakness	Allograft
3	49/F	DDD	4–5	26	5	Yes	100/96.6 (3.4)	91.1/56 (35.1)		Allograft
4	55/F	ADS	2–3	51	4	Yes	93.3/80 (13.3)	93.3/54 (39.3)		Allograft
5	59/M	SL	2–3	12	4	Yes	76.7/60 (16.7)	68.9/50 (18.9)		Allograft
6	58/F	ADS	2–3	12	5	Yes	63.3/13.3 (50)	68.9/12 (56.9)		Allograft
7	64/M	SL	1–2, 2–3, 3–4, 4–5	12	5	Yes	56.7/13.3 (43.4)	35.6/32 (3.6)	Left hip (Zone I) paresthesia/pain Psoas weakness	Allograft
8	46/M	DDD	1–2	12	4	Yes	100/50 (50)	30/4 (26)		BMP + Allograft
9	55/M	SL	3–4	12	4	Yes	100/0 (100)	54/0 (54)		BMP + Allograft
10	64/F	DDD	3–4	12	5	Yes	100/30 (70)	62/16 (46)		BMP + Allograft
11	73/F	DDD	2–3	12	4	Yes	90/30 (60)	62/34 (28)		BMP + Allograft
12	64/F	DDD	2–3, 3–4	12	4	Yes	100/100 (0)	56/56 (0)		BMP + Allograft
13	75/M	ADS	3–4	12	5	Yes	70/0 (70)	30/4 (26)		BMP + Allograft
14	58/F	DDD	4–5	12	5	Yes	80/20 (60)	54/24 (30)		BMP + Allograft
15	86/F	DDD	4–5	12	5	Yes	80/100 (–20)	47/67 (–20)		BMP + Allograft
16	65/F	DDD	2–3	12	4	Yes	100/0 (100)	70/12 (58)		BMP + Allograft
17	72/F	ADS	4–5	12	4	Yes	80/80 (0)	64/64 (0)	Mild left inguinal (zone I) pain/paresthesia	BMP + Allograft
18	55/M	ADS	4–5	12	4	Yes	70/40 (30)	72/34 (38)		BMP + Allograft
19	64/F	ADS	2–3	12	4	Yes	70/30 (40)	56/27 (29)		BMP + Allograft
20	81/F	DDD	3–4, 4–5	12	4	Yes	80/20 (60)	58/20 (38)		BMP + Allograft
21	63/F	DDD	2–3, 4–5	12	4	Yes	80/20 (60)	52/14 (38)		BMP + Allograft
22	82/F	DDD	4–5	12	6	Yes	80/50 (30)	58/58 (0)		BMP + Allograft
23	49/F	ADS	4–5	12	5	Yes	80/20 (60)	56/24 (32)		BMP + Allograft
24	74/F	DDD	4–5	12	5	Yes	70/70 (0)	60/60 (0)		BMP + Allograft
25	81/F	ADS	2–3	12	4	Yes	70/50 (20)	53/31 (22)		BMP + Allograft
26	48/M	DDD	4–5	12	5	Yes	80/20 (60)	46/22 (24)		BMP + Allograft
27	50/M	DDD	4–5	12	4	Yes	80/50 (30)	62/38 (24)	Left ant. thigh paresthesia (Zone III)	BMP + Allograft
28	56/F	DDD	3–4	12	2	Yes	30/15 (15)	32/28 (4)		Allograft
29	54/F	DDD	2–3, 3–4	12	3	Yes	75/50 (25)	56/42 (14)	Urinary retention	Allograft
30	45/M	DDD	4–5	12	2	Yes	30/5 (25)	38/4 (34)		Allograft
31	63/F	DDD	T11–12	12	10	Yes	75/0 (75)	28/40 (–12)	Pneumonia and DVT w/PE	Allograft
32	56/F	DDD	1–2, 2–3, 3–4, 4–5	12	2	Yes	95/70 (25)	67/49 (18)	Ant. thigh numbness/ tingling (Zone III)	Allograft
33	65/F	DDD	3–4	12	1	No	35/25 (10)	38/28 (10)		Allograft
34	67/F	DDD	3–4, 4–5	12	1	Yes	85/40 (45)	58/50 (8)		Allograft
35	54/M	DDD	3–4	12	1	Yes	65/65 (0)	28/36 (–8)		Allograft
36	42/M	DDD	3–4	12	1	Yes	55/55 (0)	51/38 (13)	Psoas weakness	Allograft
37	67/F	DDD	3–4, 4–5	12	3	Yes	55/50 (5)	36/29 (7)		Allograft
38	59/M	ADS	2–3, 3–4, 4–5	12	3	Yes	75/50 (25)	32/42 (–10)	Thigh numbness/ tingling (Zone III)	Allograft
39	68/M	DDD	4–5	12	1	Yes	50/5 (45)	34/0 (34)	Thigh pain and psoas weakness (Zone III)	Allograft
40	31/F	DDD	4–5	12	1	Yes	85/20 (65)	62/16 (46)		Allograft
41	71/M	DDD	2–3, 3–4, 4–5	12	3	Yes	65/50 (15)	42/26 (–16)		Allograft
42	58/F	DDD	4–5	12	3	Yes	65/55 (10)	34/20 (–14)	Thigh numbness/ tingling (Zone III) and psoas weakness	Allograft
43	34/M	DDD	3–4	12	3	Yes	10/30 (–20)	66/44 (–22)		Allograft
44	44/M	DDD	4–5	12	1	No	70/20 (50)	46/0 (–46)		Allograft
45	51/M	DDD	4–5	12	2	No	25/35 (–10)	34/38 (–4)		Allograft
46	33/M	DDD	3–4, 4–5	12	3	No (L3/L4) Yes (L4/L5)	40/55 (–15)	66/62 (–2)	Thigh numbness tingling (Zone III), psoas weakness, subsequent L3/4 cage migration requiring re–operation	Allograft

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