

Intraoperative Reduction Does
Not Result in Better Outcomes in
Low Grade Lumbar
Spondylolisthesis with Neurogenic
Symptoms after Minimally
Invasive Transforaminal Lumbar
Interbody Fusion
– A 5 year Follow-up Study

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Background

LOW-GRADE LUMBAR SPONDYLOLISTHESIS (LGLS) is typically treated surgically with decompression and fusion. There is controversy regarding the benefits of reduction versus in-situ fusion.

REDUCTION:

- Indirect decompression of neuroforamina
- Restoration of sagittal balance
- Risk of complications

MIS TLIF:

- One of the latest techniques for spine fusion
- Comparable outcomes to open TLIF
- Additional benefits related to reduced soft tissue injury and thus faster recovery.

KNOWLEDGE GAP

Only three short-term comparative studies assessing the effects of reduction have been performed.

STUDY AIM: To compare mid-term clinical, radiological and peri-operative outcomes for reduction versus in-situ fusion in LGLS with neurogenic symptoms.

Methodology

A **retrospective review of prospectively collected spine registry data** was performed.

Inclusion criteria:

- Low grade lumbar spondylolisthesis (Meyerding grade 1-2)
- Neurological symptoms
- Failed conservative therapy > 6 months
- Correlated positive radiological findings
- Underwent MIS TLIF with complete 5 year follow-up

Exclusion criteria:

- Multiple level or high grade spondylolisthesis
- Previous lumbar surgery
- Tumour
- Infections
- Acute trauma

Two groups formed based on the immediate post-operative radiograph:

1. **Reduction group (RG)** with complete reduction of spondylolisthesis;
2. **Non-Reduction Group (NRG)** comprising the rest

Both groups were compared for demographics, peri-operative parameters, clinical and radiological outcomes.

Patients were evaluated pre-operatively, 6 months, 2 years and 5 years after surgery.

Methodology

Clinical outcomes

- Oswestry Disability Index (ODI)
- Neurogenic Symptom Score (NSS)
- 36-Item Short Form Health Survey (SF-36)
- Numerical Pain Rating Scale scores (NPRS) for back and leg pain

Radiological findings

- Fusion
- Implant failure/loosening/migration
- Adjacent Segment Disease (ASD)
- Slip angle, segmental and lumbar lordosis

Peri-operative outcomes

- Intra-operative blood loss
- Fluoroscopic time
- Opioid analgesic usage
- Time to ambulation
- Length of operation
- Length of hospitalization

Results

DEMOGRAPHICS

	RG (n=30)	NRG (n=26)	p value
Age (years)	56.43 ± 11.69	58.28 ± 12.22	0.599
Gender (% male)	36.7%	19.2%	0.150
Race distribution (Chinese:Malay:Indian:Others)	24 : 3 : 3 : 0	20 : 4 : 1 : 1	0.526
Co-morbidities (% with ≤3)	96.7%	92.3%	0.592
Body Mass Index (kg/m ²)	25.86 ± 4.36	26.11 ± 3.87	0.793
Etiology of spondylolisthesis (Isthmic : Degenerative)	6 : 24	8 : 18	0.353
Spondylolisthesis grade (I : II)	30 : 0	22 : 4	0.041
Spinal level operated (L3/4 : L4/5 : L5/S1)	2 : 27 : 1	2 : 20 : 4	0.277
Type of graft (Autograft : Autograft + DBM*)	13 : 17	7 : 19	0.201
Bone morphogenetic protein use	3.3%	0%	1.000

*DBM: Demineralised Bone Matrix.

PERI-OPERATIVE OUTCOMES

	RG	NRG	p value
Blood Loss (ml) (±SD)	127.33 ± 61.86	119.23 ± 69.39	0.240
Fluoroscopic Time (sec) (±SD)	69.96 ± 40.85	55.12 ± 33.78	0.138
Length of Operation (min) (±SD)	173.37 ± 40.09	164.27 ± 51.86	0.099
Morphine Use (mg) (±SD)	13.02 ± 12.85	11.57 ± 12.10	0.469
Time to Ambulation (days) (±SD)	1.33 ± 0.72	2.15 ± 4.80	0.710
Length of Stay (days) (±SD)	3.23 ± 1.18	4.06 ± 4.43	0.857

Results

RADIOLOGICAL OUTCOMES

	RG	NRG	p-value
Fusion (Bridwell grade 1)	100%	100%	-
New ASD	10.0%	0%	0.252
Implant failure/loosening	10.0%	23.1%	0.184

		RG	NRG	p-value
Slip angle (mean±SD)	Pre-op	8.84° ± 7.96°	8.63° ± 7.13°	0.919
	5-years	4.15° ± 6.76°	5.78° ± 5.87°	0.344
	Difference*	4.31° ± 5.22°	2.86° ± 4.89°	0.294
Segmental lordosis (mean±SD)	Pre-op	16.66° ± 8.49°	13.81° ± 7.51°	0.195
	5-years	11.93° ± 7.11°	11.36° ± 6.07°	0.749
	Difference*	4.60° ± 5.39°	2.45° ± 4.68°	0.123
Global lumbar lordosis (L1-S1) (mean±SD)	Pre-op	44.95° ± 15.08°	45.68° ± 13.58°	0.852
	5-years	43.64° ± 12.92°	47.01° ± 15.47°	0.378
	Difference*	0.54° ± 8.97°	-1.33° ± 8.73°	0.436

*Difference between pre-operative and 5-year follow-up values

Results

CLINICAL OUTCOME SCORES

	Pre-op		p-value
	RG	NRG	
ODI	47.40	39.16	0.124
NSS	53.33	39.77	0.116
SF-36	45.00	57.31	0.114
NPRS (back)	6.83	5.08	0.062
NPRS (leg)	6.33	5.27	0.252

	5 year follow-up		p-value
	RG	NRG	
ODI	11.28	8.92	0.192
NSS	6.33	7.56	0.774
SF-36	74.33	78.46	0.278
NPRS (back)	1.20	0.46	0.079
NPRS (leg)	0.57	0.27	0.702

COMPLICATIONS

	RG	NRG	p-value
Overall complication rate	13.3%	38.5%	0.061
Early complications (<30 days)	3.3%	19.2%	0.086
Late complications (>30 days)	10.0%	23.1%	0.184

Discussion

No significant differences in peri-operative, radiological and clinical outcomes between reduction and in-situ fusion for low-grade spondylolisthesis.

Largely consistent with the existing literature.

Similar outcomes were sustained at 5 years' follow up.

Strengths

- Comparative study
- Longest follow-up (5 years)
- Comprehensive outcome measures

Weaknesses

- Retrospective study
- No global sagittal measurements
- Small cohort

Conclusion

Intra-operative reduction, while safe, does not result in better outcomes in low grade lumbar spondylolisthesis with neurogenic symptoms after MIS TLIF at 5 years' follow-up.

It appears that a solid fusion and adequate decompression are the keys to achieving good results.

Disclosure declaration

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