Is Indirect Decompression Achieved in Lateral Lumbar Interbody Fusion Dependent on Cage Location and Lumbar Level?

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Introduction

Minimally invasive lateral lumbar interbody fusion (LLIF) is an increasingly utilized technique to achieve indirect decompression in patients with lumbar canal stenosis. Recent studies have demonstrated successful resolution of lumbar canal stenosis through this approach. (1,2) It is unknown whether the degree of indirect decompression achieved is affected by lumbar level and location of the cage in the disc space in LLIF.

Methods

A review of 33 disc levels in consecutive patients who underwent LLIF with pre- and immediate post-op MRI was performed. The outcome variables included:

1. Intervertebral disc height at the level of the posterior longitudinal ligament (PLL)

2. Mid-sagittal antero-posterior (AP) canal diameter and axial thecal sac area from L1-L5

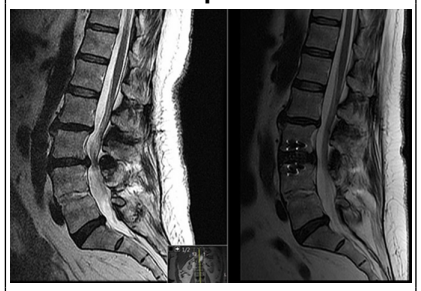
3. Ratio of the posterior aspect of the interbody cage relative to the width of the vertebral body at the disc level (cage location)

The ratio of mean change in canal diameter relative to increase in intervertebral disc height was termed the indirect decompression ratio.

Table 1

Lumbar Level	No. of Levels	Mean change (Δ) in Intervertebral Height – (A) (mm)	Mean change (Δ) in AP Spinal Canal Diameter –B (mm)	Indirect Decompression Ratio – B/A	Axial Area / A (Mean change in Intervertebral Height)
L1/2	2	3.4	4.4	1.29	7.8
L2/3	9	3.0	3.8	1.28	6.0
L3/4	10	3.7	4.0	1.07	4.9
L4/5	12	3.6	2.3	.627	4.1

Indirect Decompression in LLIF



Pre- and post-operative sagittal T2 MRI

Results

33 disc levels (L1/2 -1; L2/3 - 9; L3/4 - 10; L4/5 - 12) were assessed from consecutive patients from October 2015 to February 2017. Cage location varied from 0.02 to 0.49 along the width of the disc space as a ratio. There was a statistically significant relationship between the cage location and the indirect decompression ratio ($p<0.001$; CI 0.47-1.13).

The indirect decompression ratio (range 0.04-3.4) was calculated for each level (L1/2 -1.29; L2/3 – 1.28; L3/4 – 1.07; L4/5 – 0.63) as was the ratio of axial area to disc height (7.8; 6.0; 4.9; 4.1).

Conclusions

There appears to be a significant relationship between the location of the interbody cage placed during a LLIF and the degree of indirect decompression achieved. The indirect decompression ratio is proposed to quantify the improvement in canal diameter adjusted for the change in disc height achieved during LLIF. For each descending level both the indirect decompression ratio as well as the relative improvement of thecal sac area decreased – implying greater disc height change needed to achieve the same improvement in indirect decompression.

Learning Objectives

1) Identify key criteria needed to assess indirect decompression in Lateral Lumbar Interbody Fusion

2) Understand the concept of cage location and indirect decompression ratio

3) Identify the relationship between lumbar level and cage location in the degree of indirect decompression achieved in LLIF

References

1. Castellvi AE, Nienke TW et al. Clin Orthop Relat Res. 2014 Jun;472(6):1784-91
2. Malham, G etal. Clinical results and limitations of indirect decompression in spinal stenosis with laterally implanted interbody cages: results from a prospective cohort study European Spine Journal April 2015, Volume 24, Supplement 3, pp 339-345