Postoperative Decrease in Intervertebral Lordosis and Disc Space Distraction Induce Neurological Complications Following Posterior Lumbar Interbody Fusion as Revision Surgery

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Background

To avoid direct neural damage,
fusion without nerve retraction by total facetectomy is the best procedure for revision surgery

However, neurological complications sometimes occurred

···Why?

Characteristics of the revision surgery

Adhesion and scarring decrease neural structure mobility

Research question

Stretching of the less mobile nerve anchored by adhesions induces neurological damage?

Objective

To clarify the risk factors,
especially the effects of nerve stretching,
for postoperative neurological complications
in PLIF as revision surgery

Study Population

Number : 50 — 2005－2014, 31 males, 19 females

Age : 68 yrs (29～82 years)

Time interval to revision : 5.4 yrs (0.2～43 years)

Follow-up : 3.8 yrs (1～10 years)

First operation : Fenestration 36(72%),
Fenestration w discectomy 6(12%),
Discectomy 8(16%)

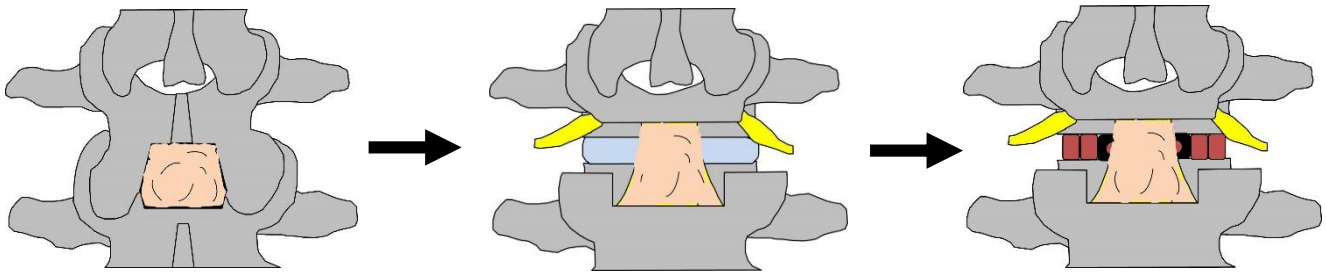
Diagnosis : Progressive Spondylolisthesis 20(40%),
Foraminal stenosis following segmental scoliosis 13(26%)
Restenosis due to fibrosis or bony regrowth 9(18%)
Recurrent disc herniaton 8(16%)

PLIF level : L2-3; 3(6%), L3-4; 9(18%), L4-5; 29(58%), L5-S1; 9(18%)

Surgical Techniques

To avoid direct neural damage

- No epidural scar resection and separation from dura mater
- Bilateral total facetectomy



Avoid retraction of the neural elements
during discectomy and bone grafting

Definition of Neurological complications

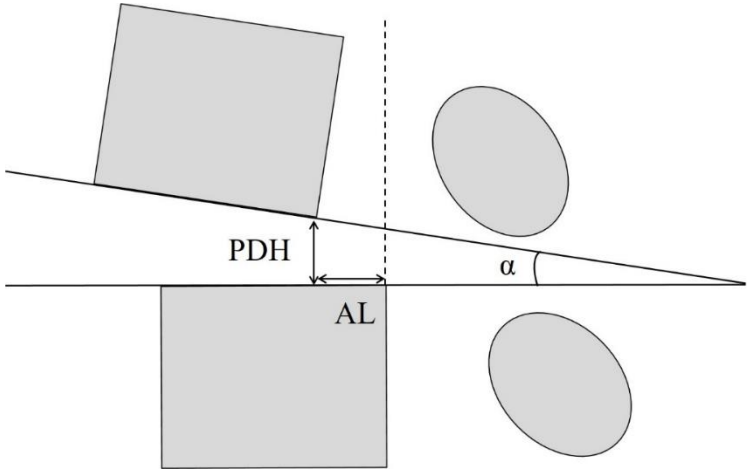
New or worsening leg pain or motor loss

(within five days. manual muscle test decrease of more than 1 level)

NC group: with neurological complications

non-NC group: without neurological complications

Radiological evaluations associated with the magnitude of nerve stretching



Anterolisthesis (AL)

Intervertebral Angle (α)

Posterior Disc Height (PDH)

Results - Neurological complications

	Number	
Total (leg pain or motor loss)	16	(32%)
Transient	12	(24%)
permanent	4	(8%)
Leg pain	13	(26%)
Transient	11	(22%)
Permanent	2	(4%)
Time to recovery (weeks, range)	4.2	(1-12)
Motor loss	10	(20%)
Transient	7	(14%)
Permanent	3	(6%)
Time to recovery (weeks, range)	4.9	(2-12)

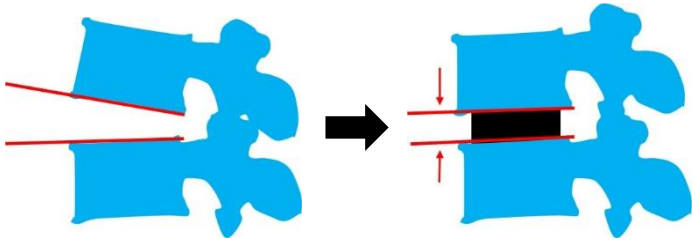
Risk Factors for Neurological Complications

Preoperative factors

	NC group	Non-NC group	P
	n=16	n=34	
Mean age (yrs, range)	69 (50-79)	67 (29-82)	0.70
Male : Female	6 : 10	25 : 9	0.01
Time interval to revision (yrs, range)	4.1 (0.3-11.8)	5.4 (0.2-43.2)	0.89
Preoperative motor loss	6 (40%)	4 (11%)	<0.05
Diagnosis			0.04
Progressive Spondylolisthesis	11 (69%)	9 (26%)	0.004
Foraminal stenosis	3 (19%)	10 (29%)	0.42
Restenosis	1 (6%)	8 (24%)	0.14
Recurrent disc herniaton	1 (6%)	7 (21%)	0.20
PLIF level			0.16
L2-3	2	1	
L3-4	5	4	
L4-5	7	22	
L5-S1	2	7	

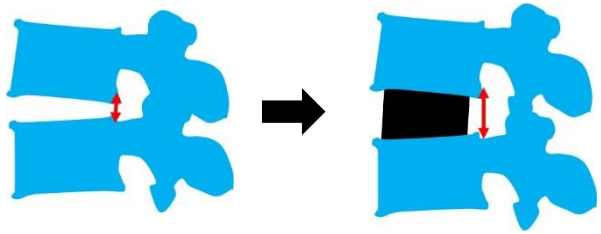
Intra- and postoperative factors

Decrease in intervertebral lordosis



NC group	0.8°	P=0.03
Non-NC group	-1.5°	

Posterior disc height distraction

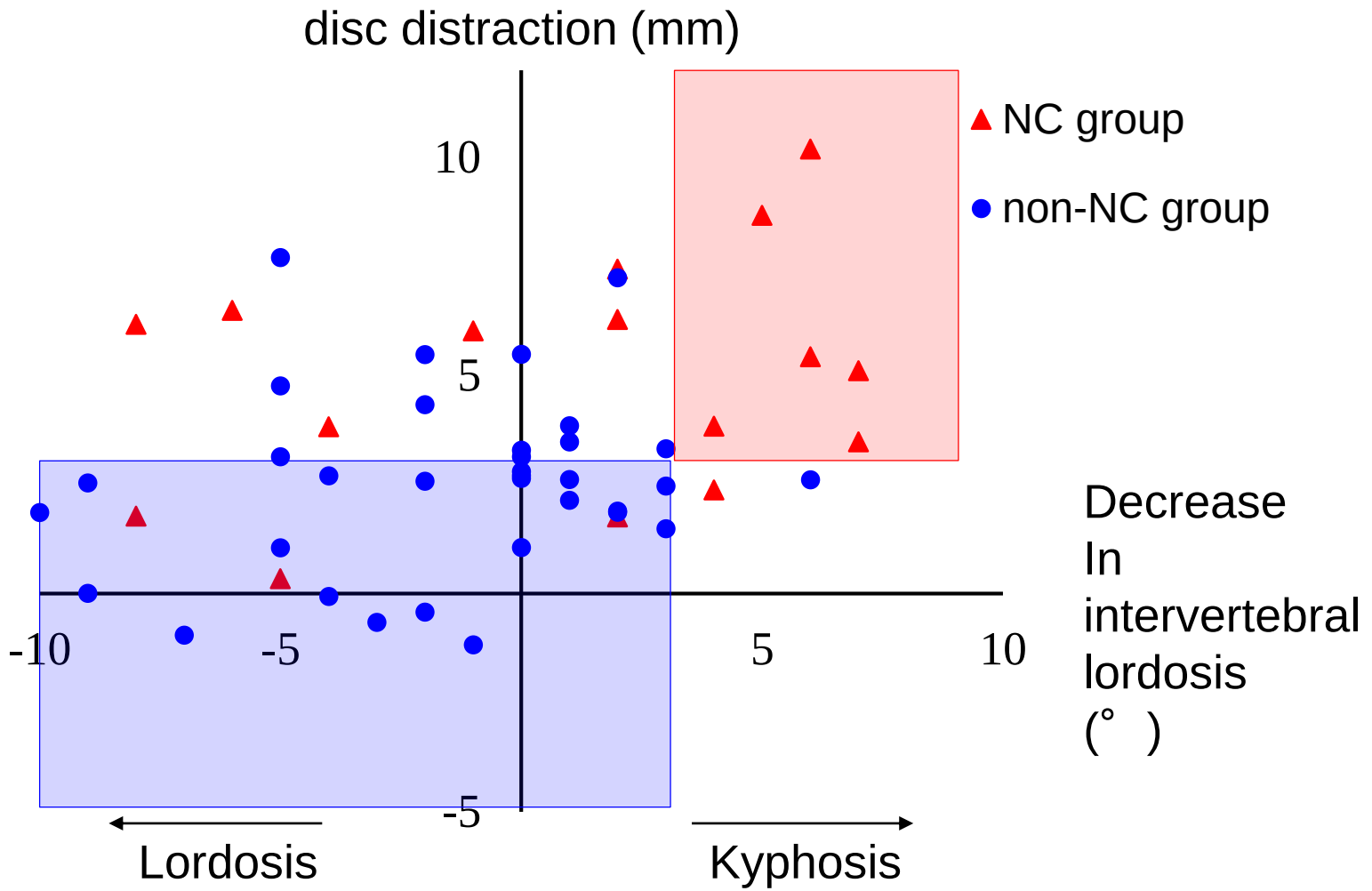


NC group	5.0mm	P<0.005
Non-NC group	2.6mm	

Dural tear

NC group	25%	P=0.12
Non-NC group	9%	

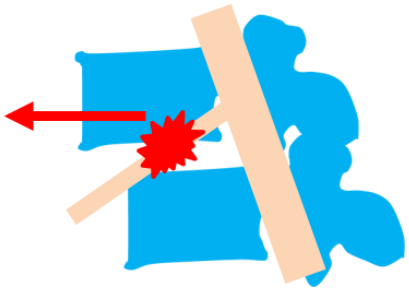
Distributions of kyphotic change and disc distraction



Neurological complications were seen in 100% of patients with both kyphotic change >3° and disc distraction >3 mm

Neurological complications are not seen in 88% of patients with both kyphotic change <3° and disc distraction <3 mm

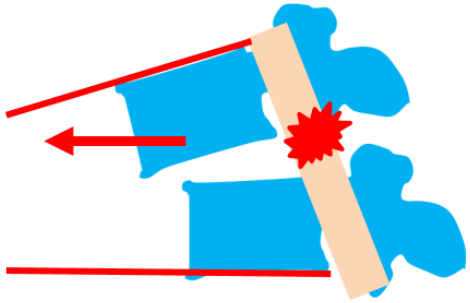
Discussion - pathoanatomic basic study



Anterior olisthesis

stretch deformation of the traversing root

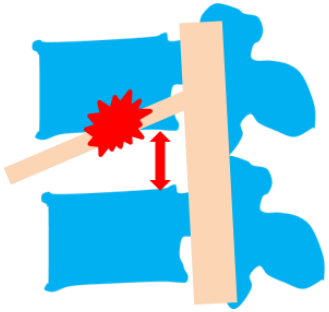
(Kitab SA, et al. *Neurosurgery* 2009)



Kyphosis+olisthesis

damaging strain to intrathecal roots

(Kitab SA, et al. *Neurosurgery* 2009)



Increasing disc height

stretch the traversing root

(Petraco DM, et al. *Spine* 1996)

These basic studies supported our results

These factors can be controlled by surgeons

Conclusions

Preoperative anterolisthesis, decrease in intervertebral lordosis, and distraction of the posterior disc height appear to be risk factors for neurological complications following revision PLIF

In revision PLIF, surgeons should achieve segmental lordosis without excessive disc height distraction

Disclosures and / or Conflict of Interest : None