The relationship between exercise-induced low back pain (EILBP) and the fat infiltration rate of paraspinal muscles

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Background

Exercise-induced low back pain (EILBP)

1) Back pain is induced by standing or walking
2) Symptoms are fatigue, discomfort, and dull pain
3) Pain is typically relieved by lumbar extension
4) Asymptomatic at rest
5) No detectable neurologic deficits of the lower extremities

Nagaosa Y, et al. Orthop Surg Traumatol 1992
Takahashi I, Kikuchi S, Sato K et al. Spine 2007

← Paraspinal muscle degeneration, lumbar sagittal alignment ?

Purpose

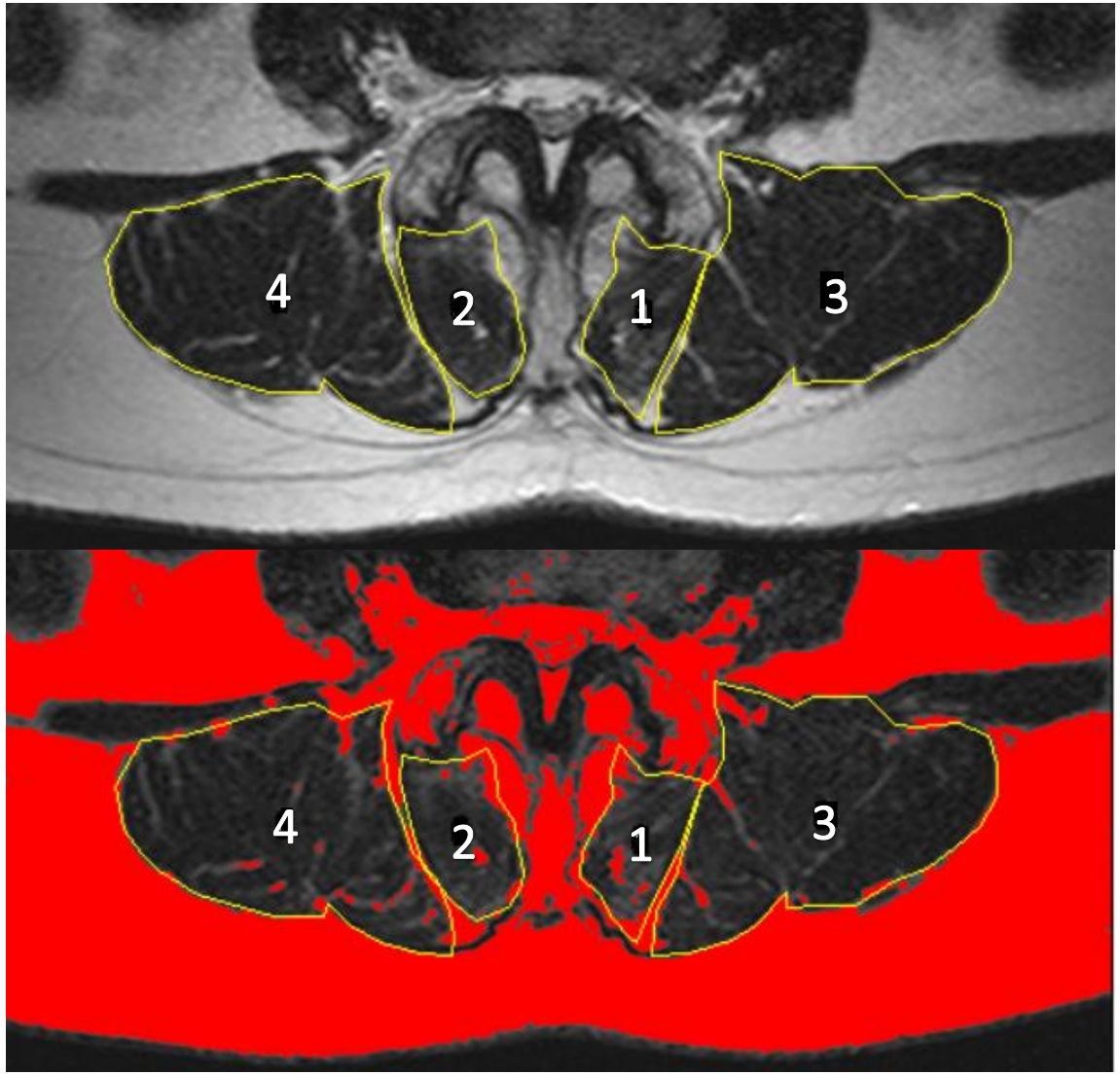
- To clarify the relationship between EILBP and degenerative changes of paraspinal muscles or spinal alignment in local residents.

Subjects

- 324 (103 men and 221 women, mean age 64)
- Volunteer
- Lumbar MRI (T1 sagittal, T2 axial)
- EILBP diagnosed by medical interview and neurological findings

Fat infiltration rate (FIR)

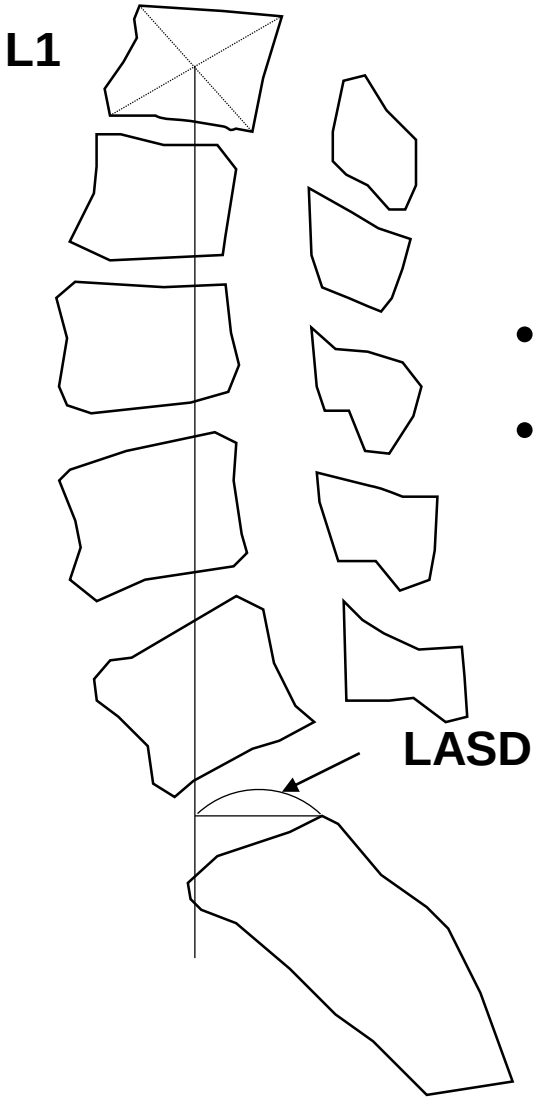
Ranson CA, et al. Eur Spine J 2006



1-2, multifidus; 3-4, erector spinae

L1 axis S1 distance (LASD)

Kawakami M, et al. Spine 2002



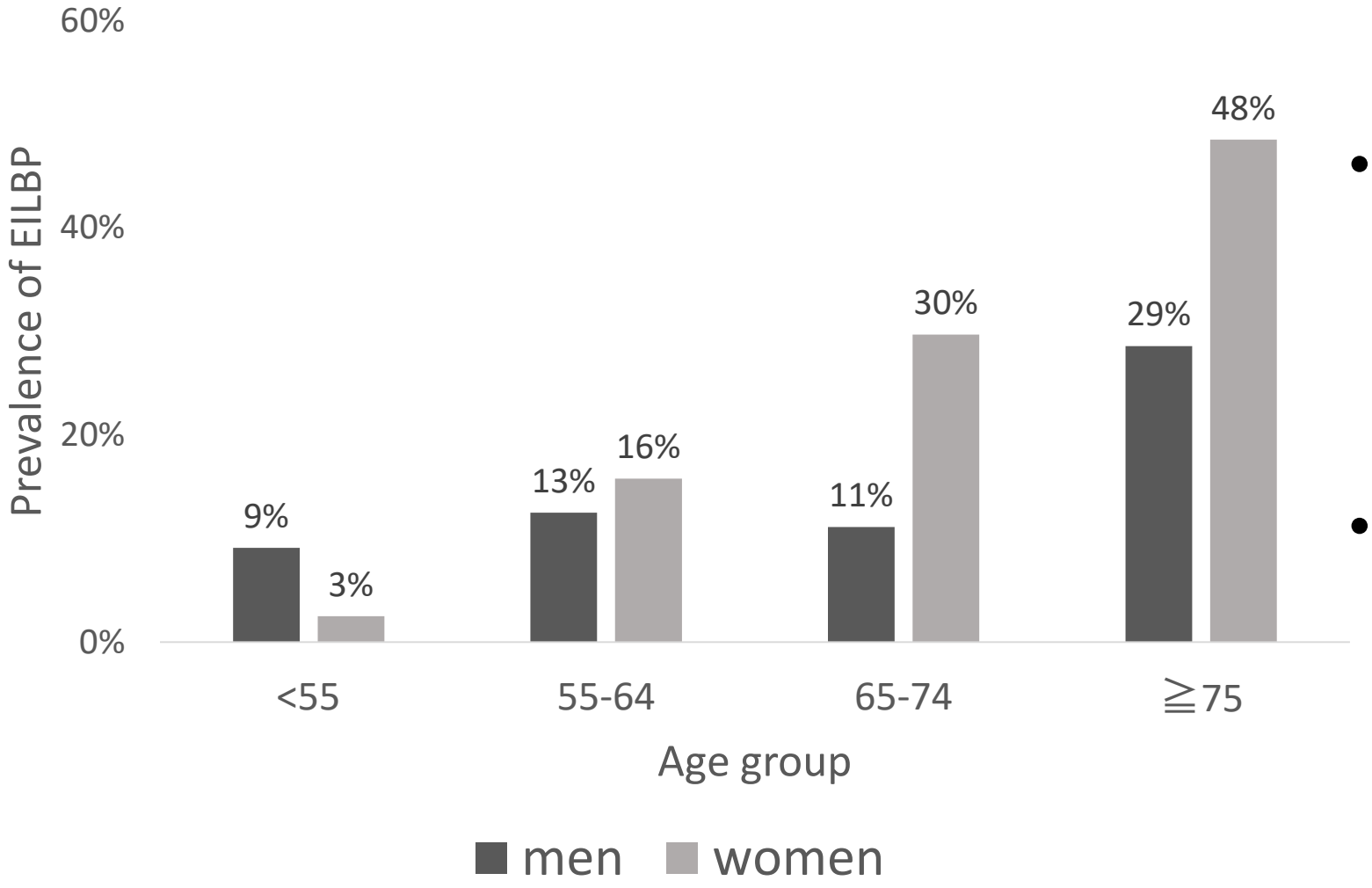
- Lateral X-ray
- Neutral standing position

Statistical analysis

- Jonckheer-Terpstra test
- Mann-Whitney U test
- Binominal logistic regression analysis
  - Adjusting for age, sex and BMI

- p-value of < 0.05 is statistically significant

Prevalence of EILBP



- The prevalence of EILBP in local residents was 21%.
- The prevalence of EILBP tended to increase with age in both sexes. ($p<0.05$)

Jonckheer-Terpstra test

Differences in FIR between EILBP and without EILBP

FIR (%)	EILBP (+)	EILBP (-)	p-value
Multifidus			
L1-2	26.2±19.8	14.0±14.5	<0.001
L2-3	22.7±18.1	12.9±13.2	<0.001
L3-4	22.8±17.7	14.2±13.1	<0.001
L4-5	28.9±18.5	17.7±14.0	<0.001
L5-S1	31.1±19.4	21.2±15.4	<0.001
Erector spinae			
L1-2	22.9±19.1	8.7±11.5	<0.001
L2-3	17.0±13.7	8.3±10.3	<0.001
L3-4	14.1±9.7	9.2±8.9	<0.001
L4-5	15.9±11.1	10.6±8.3	<0.001
L5-S1	22.9±15.3	16.0±10.8	0.001

- The subjects with EILBP had a significantly higher FIR of the multifidus and erector spinae than the subjects without EILBP.

Mann-Whitney U test

Factors related to EILBP in logistic regression analysis at each disc level

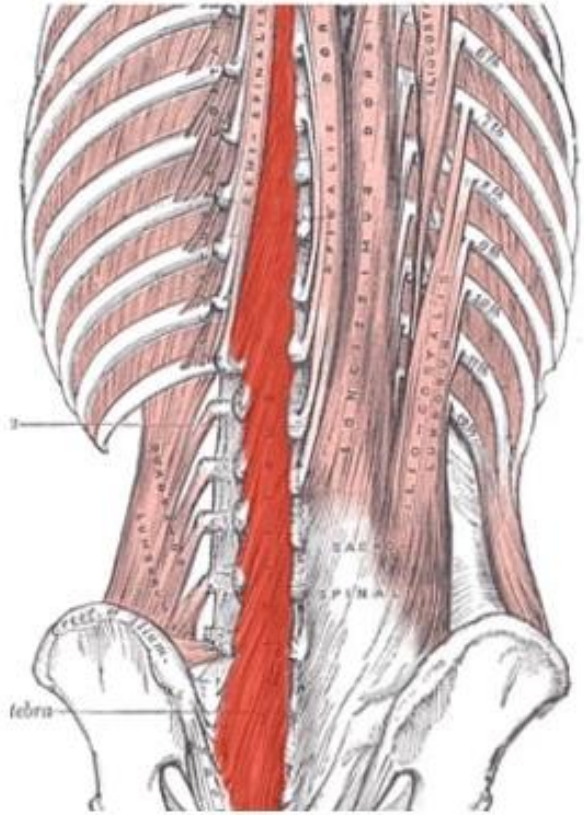
	Multifidus FIR			Erector spinae FIR			LASD		
	OR	95%CI		OR	95%CI		OR	95%CI	
L1-2	1.008	0.981	1.036	**1.041***	1.011	1.072	0.993	0.971	1.016
L2-3	1.014	0.985	1.044	1.028	0.997	1.060	0.991	0.969	1.013
L3-4	1.002	0.971	1.035	1.029	0.989	1.071	0.990	0.969	1.012
L4-5	1.017	0.992	1.042	1.034	0.996	1.072	0.990	0.969	1.012
L5-S1	1.002	0.976	1.030	**1.047***	1.012	1.083	0.986	0.965	1.008

FIR: fat infiltration rate, LASD: L1 axis S1 distance, *p<0.05

- EILBP was associated with FIR of the erector spinae at L1-2 and L5-S1.
- There was no significant association with EILBP and the LASD.

Anatomical feature

	Local system	**Global system**
Muscle	Multifidus	Erector spinae
Attachment	Lumbar spine	Thorax and pelvis
Action	Regulation such as lumbar lordotic curvature and intervertebral stability	Maintaining balance with the external loads on the trunk



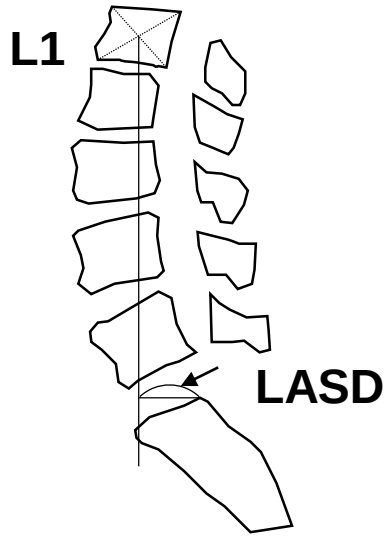
Bergmark A. Acta Orthop Scand 2017
Bogduk N. Clinical and Radiological Anatomy of the Lumbar spine. 2012

Lumbar sagittal alignment

- The C7 plumb line, which is thought to reflect the axis of loading, passes most frequently through the L1 vertebral body in a group of patients with LBP and most frequently through the L1-2 intervertebral disc in healthy volunteers.

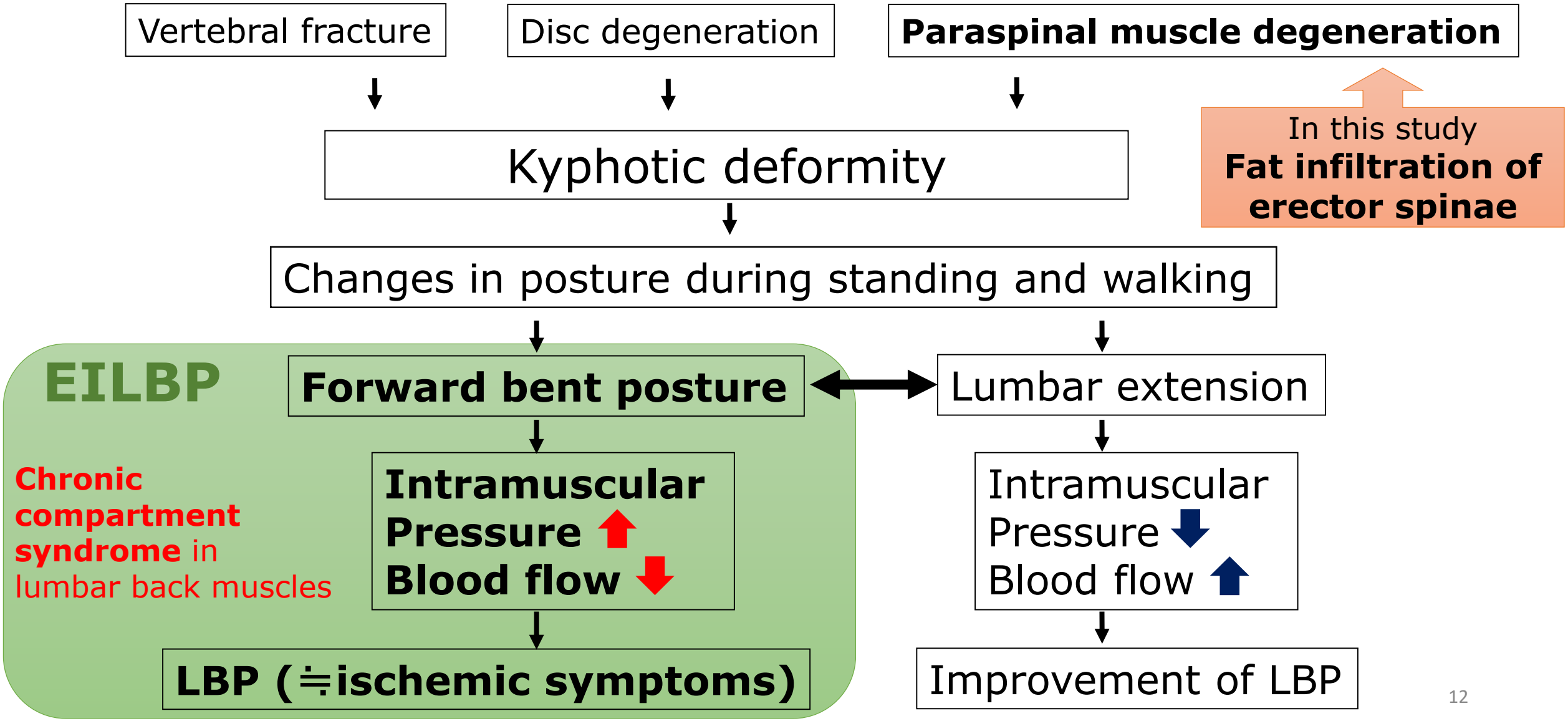
Jackson RP, et al. Spine 1994

- L1 axis S1 distance (LASD) is also thought to reflect the axis of loading.



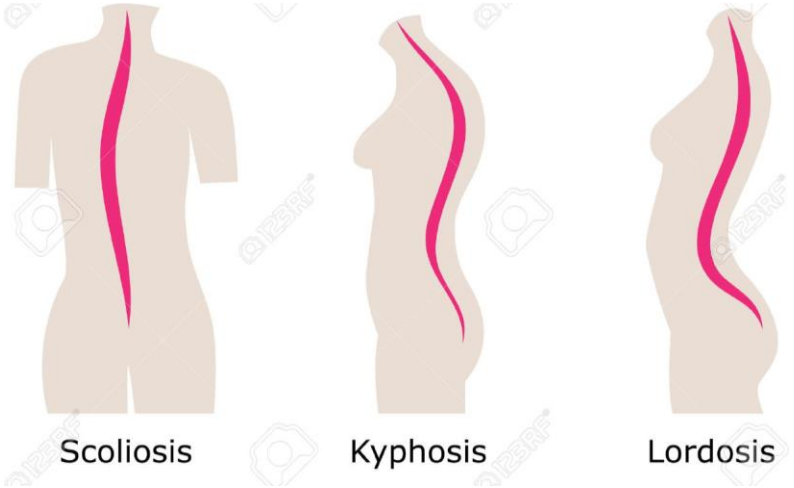
Mechanisms of EILBP

Konno S, et al. Spine 1994
Takahashi I, et al. Spine 2007
Styf J, et al. Spine 1987



Limitations

- The lack of measurement of global spinal alignment
- A cross-sectional study



Conclusion

- Fat infiltration rate of the erector spinae, especially in L1-2 and L5-S1, is associated with EILBP.
- There was no significant association with EILBP and the L1 axis S1 distance, which is the index of lumbar alignment.

Annual Meeting of the EUROSPINE

Name of first author: Masataka Nakamura

I have no COI
with regard to our presentation.