Original Research Article

Comparative study of thickness of ligamentum flavum in normal and stenosis of lumbar vertebrae in south Karnataka population – Retrospective study

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Abstract

Background: Thickness of LF in normal and LSS were compared to study the variation of thickness to establish the pathological range of LF and its asymmetry indicated in CT image and associated Vertebral body size at different age and sex. **Method:** 50 controlled and 50 LSS thickness of LF was measured viewed in CT images, performed at L3, L4, L4, L5, L5, S1. Analysis was studied with't' test and P value **Results:** Cross section Area of Dural Sac of both groups mean values at L3-L4 in control was 132.5 (SD±46) and LSS group was 65.2 (SD±23) at L4-L5 control groups was 133.3 (SD±44) and LSS groups had 48.3 (SD±25). At the level of L5-S1 the control group was 136.2 (SD±46) and had 91.2 (SD±36) Moreover thickness of LF at L3-L4, L4-L5,L5-S1 had significant P value (P<0.01). In addition to thickness of LF in both sexes of normal (control) had also significant P value (P<0.01). **Conclusion:** This empirical comparative study would be a diagnostic value to rule out LSS at different ages and both sex.

Key Words: LSS=lumbar spine stenosis LF= ligamentum flavum CT= computerized Tomography, Controlled group,

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INTRODUCTION

Ligamentum Flavum (LF) wraps around the medial aspect spinal articulation and is composed more elastic than collagen fibres, hence it's yellow in colour. Its elasticity diminishes with age and there is loss of elastic fibres and a concomitant increase of collagen fibres[1]. The ligament consists of a superficial and a deep component. The superficial component inserted into superior and posterior superior edges of the caudal lamina. The deep component is inserted at a variable distance into the antero-superior surface of caudal middle of general LF begins in the middle of the cephalic lamina and is inserted into the superior surface of caudal lamina[2]. It is suggested that, LF plays on important role in vertebral disease more specifically in the spinal stenosis[3,4]. Thickening of LF can reduce the diameter of spinal canal, compressing the Dural sac and nerve roots and contributing to low back pain (LBP) and sciatica, herniation of nucleus pulposus or bone spurs5,6. Though LF thickness with age but due to degeneration of disc or diseases of vertebrae there could be due to hypertrophy of LF which causes narrowing of spinal canal and stenosis. Hence attempt was made to compare the LSS with controlled group.

MATERIAL AND METHODS

50 controlled (normal) and 50 stenotic of lumbar spines patients who were regularly visiting AIMS B G Nagar,

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Mandya (dist) have been compared to study the thickness of ligamentum Flavum in both sexes.

Inclusive Methods: The Patients having lumbar spine stenosis (L3-S1) having symptoms of low back pain, radicular referred pain, and intermittent claudication were selected for study.

Method: 50 lumbar spine stenosis aged between 40 to 60 years, the ligamentum flavum thickness were studied by using Lumbar computerized Tomography (CT) images. The same age group controlled group of 50 healthy persons were also studied compared by CT images. The thicknesses of lignutum Flavum (LF) in both groups were compared. All CT images in controlled and LSS groups were performed in the same position and techniques using the multi planar reformatting technique. Thickness of the section 1 to 3mm, 80 to 250mm. As the left and right LF thickness for each vertebral level (L3-S1) were measured at its mid-width distance in both groups. The duration of study from August- 2016 to jan-2017.

Exclusion Criteria: Patients having congenital anomalies of lumbar vertebrae, Tuberculosis and malignancy of lumbar region were excluded from the study.

Statistical Analysis: Mean values cross section Area in both groups, relative thickness of ligmentum flavum (LF) were compared in both sexes by SPSS, Software. The ratio of male and female were 1:1.

OBSERVATION AND RESULTS

Table-1 Study of mean values of cross section Area of Dural Sac in both group was at the level of L3-L4 in control group was 132.5 (SD+46) and LSS group was 65.2(SD±23) at L4-L5 control groups was 133.3 (SD±44) and LSS groups had 48.3(SD±25). At the level of L5-S1 the control group was 136.2 (SD±46) and had 91.2(SD±36)

Table 1: Mean cross section Area (CSA) of Dural SAC in both groups at different level

Mean Value	Control group (50)			LSS group (50)		
	L_3-L_4	L_4-L_5	L_5-S_1	L_3-L_4	L_4-L_5	L_5-S_1
CSA	132.5 (SD±46)	133.3 (SD±46)	136.2 (SD±46)	65.2 (SD±46)	48.3 (SD±46)	91.2 (SD±46)

Table-2 In the comparative study of thickness of ligament Flavum in both control and LSS group was, At the level of L4-L5 left in control group was 8 cm (SD±3) in LSS 11cm (SD±4), 't' test value was 4.24 and P value was highly significant ((P<0.01) In right side mean value of controls was 9 (SD±2) and LSS groups had 11.8 (SD±4) 't' test value was 4.42 and P value was highly significant (P<0.1). At the level of L4- L5 right in controls mean value was 11(SD-±3) and LSS group had 13(SD±3) 't' test value was 3.33 and P value was highly significant (P<0.01). In right side mean value was 11.5 (SD-±3) and 13.8 (SD±3) in LSS group 't' test value was -3.83 and P value was highly significant (P<0.01). At the level of L5-S1 mean value of controls left was 10.2 (SD±2)10.4 (SD±3) in LSS group, 't' test value was 0.39 P value was (P<0.01). In right side mean value was 11.5 (SD±3) controls 11.2 (SD±) in LSS group 't' test and P value P<0.05. The relative thickness formula.

Table 2: Comparative study of thickness of Ligamentum Flavum in both groups(Total No-100 SU-control group SU-LSS group)

Lumbar Level	Control group (50)	LSS group (50)	't' test value	P value
L_3-L_4 left	8 (±3)	11 (±4)	4.24	P<0.01
right	9 (±2)	11.8 (±4)	4.42	P<0.01
L_4-L_5 left	11 (±3)	13 (±3)	3.33	P<0.01
right	11.5 (±3)	13.8 (±3)	3.83	P<0.01
L_5-S_1 left	10.2 (±2)	10.4 (±3)	0.39	P<0.01
right	11.5 (±3)	11.2 (±3)	0.33	P<0.01

$$\text{Formula} = \frac{\text{LF thickness}}{\text{Vertebral body length}} \times 100$$

Table-3 Comparative study of relative thickness in both sexes of normal (controlled group)-25 male and 25 female normal (controlled) were studied. At the level of L3-L4 in males was 7.8 (SD±2) and in females 8.9 (SD±3) 't' test value was 0.55 and P value was highly significant (P<0.01). In right side mean value males, 7.9(SD±2) and female 8.9 (SD±3) 't' test value was 1.38 (P>0.01). At the level of L4-L5 of males in right side mean value 10.6 (SD±2) and in females 10.5 (SD±3) 't' test value 0.13 (P<0.01) In left side mean value of males was 10.2(SD±2) and females 10.8(SD±3)'t' test value 0.83(P<0.01). At the levels L5- S1 mean value of males right side 8.9 (SD±2) in females 9.8 (SD±3) 't' test value was 1.24 (P<0.01). In left side mean value in males was 9.2 (SD±4) in females 9.9 (SD±3) 't' test value was 0.7(P<0.01).

Table 3: Comparative study of relative thickness Ligamentum Flavum (LF) in normal (control) group of both sexes (25 male and 25 Female)

	Male (25)	Female (25)	't' test value	P Value
L_3-L_4 left	7.8(±2)	8.2 (±3)	0.55	P<0.01
right	7.9 (±1/2)	8.9 (±1/3)	1.38	P<0.01
L_4-L_5 left	10.6 (±2)	10.5 (±3)	0.13	P<0.01
right	10.2 (±2)	10.8 (±3)	0.83	P<0.01
L_5-S_1 left	8.9 (±2)	9.8 (±3)	1.24	P<0.01
right	9.2 (±3)	9.9 (±3)	0.7	P<0.01

Table-4 The present findings of thickness of ligamentum flavum (LF) in LSS group was compared with previous studies of cadavers and living subjects having herniation of disc and Low back pain studied with MRI and CT.

Table 4: Study of thickness Ligamentum flavum (LF) in previous study

Name of the Author and year	Mode of Study	Measuring Instruments	Level	LF Thickness (mm)
Spurling etal (1937)	Cadaveric study	Venire Caliper	L_3-L_4	4.3
			L_4-L_5	4.2
			L_5-S_1	2.3
Howard (1938)	Cadaveric study	Venire Caliper	Lumbar spine	2.3
Hortwitz (1939)	Cadaveric study	Venire Caliper	L_3-L_4	3.5
			L_4-L_5	3.8
			L_5-S_1	3.6
Ramsay (1966)	Cadaveric study	Venire Caliper	Lumbar spine	1.5
Herzog (1950)	Cadaveric study	Venire Caliper	L_4-L_5	4.6
			L_5-S_1	4.5
Ramani (1975)	Cadaveric study	Venire Caliper	L_4-L_5	6.13
			L_5-S_1	5.2
Young Hing (1976)	Cadaveric study	Venire Caliper	Lumbar spine	2.3
Nicholasetal (1994)	Cadaveric living	MRI	Lumbar spine	5
Fukuyama (1995)	Living (Non degenerative)	CT	L_3-L_4	2.9
			L_4-L_5	3.1
			L_5-S_1	3.4
Park eta (2000)	Living (herniated disc)	MRI	Lumbar spine	2.44
Sairyo etal (2005)	Living (low back pain)	MRI	L_3-L_4	3.25
			L_4-L_5	4.08
			L_5-S_1	2.68
Present study (2018)	Living (LSS)	CT	L_3-L_4	6.5 (mm)
			L_4-L_5	4.8 (mm)
			L_5-S_1	9.1 (mm)

DISCUSSION

In the present study of thickness of LF in LSS and normal groups mean value of cross section area of Dural sac (CSA) mean value of control group at the level L3-L4 was132.5 (SD±46) and LSS group was 65.2(SD±23)at L4-L5 control groups was 133.3 (SD±44) and LSS groups had 48.3 (SD±25) At the level of L5-S1 the control group was 136.2 (SD±46) and had 91.2 (SD±36) (Table-1) But more thickness of LF was observed in LSS group than controlled groups in all three levels i.e. LF at L3-L4, L4-L5,L5-S1 due to hypertrophy of LF in LSS group (Table-2). Moreover in the normal group thickness LF was more in females then males (Table-3) these finding of present study more or less in agreement with previous studies[7,8,9] Thickness of LF was also observed in after the age forty in both genders[10]. Hence it can be hypothesized that, lumbar stenosis associated with LBP, radicular pain, sciatica was mainly observed elderly people rather than young adults. Significant changes in LF thickness were observed in L3-L4 and L4- L5. It could be due to hyper mobility of these two segment as compared to L5-S1 which is stabilized by the ilio-lumbar ligament and the large transverse processes of L5 vertebra. In addition to this articular facets of S1 are more coronally oriented to act to decrease the shearing stress in that segment11. LF being a connective tissue that runs or connect from

second cervical vertebra to first sacral vertebra[12]. Its functions effects the intrinsic stability of the vertebral spine, controls inter verebral movement and maintains a smooth surface for Dural sac. It was also reported that vertebral segmental instability affects the patho-physiology of LF13. Hence degeneration of inter vertebra disc may cause hypertrophy or thickness of LF 14. Hence it is difficult to designate hypertrophy or thickness of LF.

SUMMARY AND CONCLUSION

The present comparative study of thickness of LF in LSS with control groups will be quite useful to Radiologist, Neurosurgeon, Neuro-physician to treat such patients efficiently. But this study demands further patho-physiological, nutritional, Kinesiological, genetic study, because this study suggests that the thickness of LF has no any correlation with height of body of vertebrae and exact pathogenesis of thickness of LF is still un-clear. This research paper was approved by Ethical committee of Adichumchangiri Institute of Medical sciences B G Nagar-517448. Nagamangala (Tq) Mandya (dist) Karnataka.

REFERENCES

1. Kosoka, H Sairya K — Patho mechanism of loss of elastics and hypertrophy of umber ligament Flavum in elderly patients with lumbar spinal canal stenosis. Spine,2007,32(25)2805-11
2. Olszewski AD, yaszemski MJ- The anatomy of the human lumbar ligamentum flavum. New observation and their surgical importance. Spine 1996,2(20)2307-12
3. Yoshida M, Shima, K- Hypertrophied Ligamentum flavum in lumbar spinal canal senosis pathogenesis and morphological and immune histo chemical observation. Spine 1992, 17(11), 3553-60
4. Grainier N , Kressel H Y- Normal and degenerative posterior spinal structure MR imaging Radiology 1987,165(2) 517-25
5. Safak A A, Is M, sevinc, 0- The thickness of the ligamentum fluvum in relation to age and gender. Clin Anat. 2010, 23(1) 79-83
6. Park J B Chang H- Quantitative analysis of transforming growth facter beta-1 in ligamentum Ovum of lumbar spinal stenosis and disc herniation. Spine 2001,26(21),492-5
7. Towne E B, Reichert FL — Compression of lumbo sacral roots of the spinal cord by thickness ligamentum flavum. Ann. Surg. 1931,94, 327-36
8. Okuda T, Baba I- Pathology of ligamentum flavum in degenerative lumbar spine. Spine.2004,29, 1689-97
9. Schonstroom NS, Hanson T- pressure changes following construction of the caudal equine an experimental study in situ. Spine .1988,13,385-8
10. Sairyok Biyani A, Goel V- Patho-mechnism of ligamenutum flavum hypertrophy a muti disciplinary investigation based on clinical, biomechanical histological and biological assessment. Spine, 2005,30,2649- 56
11. Masharawi Y, Rothschild B- Fact orientation in the thoraco lumbar spine three dimensional anatomic and bio-mechanical analysis. Spine 2004,16,1755-63
12. Abbas J, Hamoud. K- Ligamentum flavum thickness in normal and stenotic lumbar spines. Spine-2010,35(12)1225-30
13. Bark JB, Lee J K- Hypertrophy of ligmentum flavum in lumbar spinal stenosis associated with increased protinase inhibitor concentration. Bone joint surg. 2005,87 (12) 2750-7
14. Sakamaki T, Sairyoik — Measurement of ligmentum Flavum thickening at lumbar spine, using MRI, Arch orthop. Trauma surg. 2009,129(10) 1415-9 .

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