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CORRELATION BETWEEN NEUROGENIC CLAUDICATION DISTANCE AND RADIOLOGICAL PARAMETERS IN PATIENTS WITH SYMPTOMATIC LUMBAR CANAL STENOSIS. DOES IT REALLY EXIST???

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ABSTRACT Claudication distance is often considered the most invaluable symptom of lumbar canal stenosis. But apart from clinical symptoms, radiological findings are considered to be crucial not only for the diagnosis of lumbar canal stenosis but also for its management. In this study we investigate the radiological parameters for measuring the dimensions of spinal canal described in literature and establish a correlation between them and claudication distance.

KEYWORDS : Claudication distance; lumbar canal stenosis; canal diameter; lateral recess

INTRODUCTION

(1)Each lumbar vertebra is considered to be made of three functional components; vertebral body designed to bear the weight, the neural arches protecting the spinal cord and the bony processes designed to increase the efficiency of muscle action. (2)The spinal canal is enclosed between the vertebral foramen of the vertebrae. It is bounded anteriorly by the posterior longitudinal ligament and posteriorly by the ligamentum flavum. It is bordered anterolaterally and posterolaterally by the pedicle and the lamina respectively.(3)The clinical syndrome of LSS includes neurogenic claudication, radicular pain or both. Neurogenic claudication is generally defined as calf discomfort , that is aggravated by both walking and standing.

(4) Neurogenic claudication exhibits characterstics like aggravating on extension and activity and relieving on forward flexion. (5)Some patients may not exhibit the classical symptoms of radicular pain but only complain of a subjective feeling of weakness and subtle gait changes. Although a common consensus exists connecting the presence of central stenosis to claudication distance and that of lateral stenosis to radicular symptoms, variable presentations are frequently encountered for the same radiological picture.(6)Lumbar canal stenosis (LCS) is a continuum of pathology and one of the most useful definitions of LCS is that described by Verbiest in 1954 as “a disproportion in the spinal canal between the size of the neural elements and the space available.”

(7)It has also been defined as “buttock or lower extremity pain, which may occur with or without low back pain, associated with diminished space available for the neural and vascular elements in the lumbar spine” . This definition covers both the anatomic anomaly—narrowing of the spinal canal—and it's clinical manifestations— neurogenic claudication. As the term “stenosis” implies, radiologic criteria seem to be essential for the correct diagnosis of lumbar spinal stenosis .(8)The North American Spine Society states in their guidelines that imaging is the key noninvasive test for lumbar spinal stenosis, but they provide no radiologic criteria for the accurate definition of stenosis ,(9)Geneva et al reported that various criteria are used for describing lumbar spinal stenosis and that those criteria are not always clearly defined.

(10)The diagnosis of LSS involves both the presence of characteristic symptoms and the demonstration of radiographic stenosis. Some patients with significantly reduced claudication distance demonstrate a lesser degree of canal stenosis while another set of patients present with a higher degree of radiological stenosis than can be attributed to their symptoms. Thus not always does severe radiological stenosis corelate with clinically severe symptoms.

(11)Literature review suggests that an anteroposterior canal diameter of less than 12 mm is usually associated with significant canal stenosis and severely decreased claudication distance. (12)However contradictory reports also exist suggesting that not always does a direct relationship exists between the canal dimensions and claudication distance; thus emphasizing the age old question of whether lumbar spinal stenosis is a diagnosis based on symptoms than on radiological findings??

MATERIALS AND METHODS

100 patients presenting to the Out Patient Department of our tertiary health care centre with primary complaints of low back ache with claudication distance of less than or equal to of 500 meters were further investigated on the basis of following -

1. Clinical parameters – claudication distance
2. Radiological parameters – at level of maximum stenosis on MRI
1. antero-posterior diameter
2. trasnverse diameter
3. inter facetal distance
4. lateral recess angle

MRI scans of the selected patients were obtained and the site of maximum stenosis was calculated on the sagittal scans. Sagittal T2 weighted images were a good starting point . *(13)* Sagittal T1 weighted images were evaluated with particular attention to the foramen. An absence of normal fat shadow around the root is indicative of foraminal stenosis.

Axial cuts provide a good idea about the central spinal canal on T1 and T2 weighted images . The anteroposterior and transverse canal diameters were measured in their respective planes .

The interfacetal distance i.e least distance between the facetal joints at the affected level was then calculated.

(14) The lateral recess is anatomically the area bordered laterally by the pedicle posteriorly by the superior articular facet and anteriorly the posterolateral surface of the vertebral body. The lateral recesss angle is defined as the angle formed by the medial borders of the superior facet and the pedicle; it was calculated after obtaining the CT cuts of the affected area.

The following relationships were examined -

1. claudication distance vs a-p diameter
2. claudication distance vs transverse diameter
3. claudication distance vs interfacetal distance
4. claudication distance vs lateral recess angle
5. mean a-p diameter (<12mm) vs mean claudication distance
6. mean a-p diameter (>12mm) vs mean claudication distance

RESULTS

Z test of means is applied to find the significance of difference between Male & female

Variable	Sex	n - Sample size	Mean	Std. Deviation	T	Sig. (2-tailed)	Significance
Claudication Distance	Male	40	282.50	155.48	-0.26	0.80	Not significant
	Female	60	290.83	162.47			
Trans diameter (mm)	Male	40	15.12	1.74	0.93	0.36	Not significant
	Female	60	14.79	1.72			
Intra Facet Distance	Male	40	10.03	2.53	0.60	0.55	Not significant
	Female	60	9.73	2.31			
Lat Recess Angle	Male	40	45.50	11.32	1.25	0.22	Not significant
	Female	60	42.70	10.51			
A-P Diameter (mm)	Male	40	13.77	3.28	0.96	0.34	Not significant
	Female	60	13.10	3.47			

Mean a-p diameter (<12mm) vs mean claudication distance

	A-P Diameter (mm)	Claudication Dist
Mean	9.91	305.26
N	38	38
Std. Deviation	1.86	143.22

Mean a-p diameter (>12mm) vs mean claudication distance

	Claudication Dist	A-P Diameter (mm)
Mean	276.61	15.49
N	62	62
Std. Deviation	168.09	2.14

DISCUSSSION

(15)Stenosis is defined as narrowing or constriction of a passage or a canal. The pathophysiology of lumbar canal stenosis is best described by the Kirkaldy WiIlis concept . Reduced disc space leads to overloading of facetal joints due to the resultant instability. The eventual facetal hypertrophy leads to translation amongst vertebral segments causing the stage of degenerative spondylolisthesis. The end result is a stage of ligament hypertrophy causing spinal stenosis. Lumbar canal stenosis is thus a chronic rather than an acute condition.

(16) The most common stenotic conditions are acquired; stenosis due to degenerative conditions includes herniation of disc, osteophyte formation and buckling of a hypertrophied ligamentum flavum.

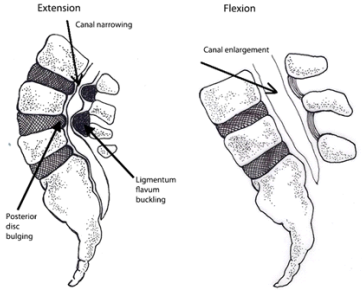

Fig 1. Buckling of ligamentum flavum on extension

Apart from the less frequent congenital narrowing of spinal canal the three structures that contribute to the narrowing of spinal canal are ligamentum flavum, facet joints and disc space. The hypertrophied ligamentum flavum infolds from posterior aspect and is the major lesion seen. Further encroachment occurs when facet subluxation of a degenerative spondylolisthesis contributes facet bony masses to narrow the space available to the cauda equina. Superior capsular hypertrophy especially in a degenerative case can protrude into the lateral recess producing radicular symptoms.

(17)The biochemical cascade of spinal stenosis can be summarized as follows; the canal constriction or encroachment mechanically affects the cauda equina nerve fibers and the free flow of cerebrospinal fluid. The noxious by-products of the metabolism built up in the area and are not removed due to venous engorgement. There is also some evidence to suggest that ectopic nerve impulses are generated in the area resulting in cramping and paraesthetic symptoms of spinal stenosis.

In this study we investigated 100 patients presenting with the chief complaint of neurogenic claudication and evaluated them on the basis of before mentioned radiological parameters. Evaluation of all the parameters with claudication distance led to the conclusion that a true correlation did not exist . The anteroposterior diameter did not proportionately decrease with a reduced claudication distance. The transverse diameter of the canal as well as the lateral recess angle did not show a significant association with claudication distance.

The lack of relation between clinical and radiological can be explained to an extent. The imaging studies are conducted in supine position while the symptoms of canal stenosis are precipitated in standing or walking position. In these positions there may be dynamic structural changes in the spine leading to the symptoms. During activity there is constant accumulation of by- products of metabolism leading to the symptoms. Rest leads to drainage of these by-products from the affected area alleviating the symptoms. This further emphasizes the need for dynamic imaging as opposed to that of static tests currently performed widely.

CONCLUSION

The inconsistency between claudication distance and radiological parameters suggests that MRI should be used only as a tool for identifying the disease process and not as a screening test to confirm the presence of the disease. The diagnosis remains largely a clinical one thus reiterating the fact that lumbar stenosis is a condition primarily defined by symptoms than by radiological signs.

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