A STUDY OF LUMBAR SPINAL CANAL BY MRI TO EVALUATE THE RISK OF SPINAL CANAL STENOSIS IN CLINICALLY SYMPTOMATIC PATIENTS

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ABSTRACT

Background

The study of lumbar spinal canal becomes important in persons with low backache and other related complaints particularly for the diagnosis of spinal canal stenosis.

Objectives

This study aims to measure the mid sagittal diameter of the lumbar spinal canal at the level of L3 and thus evaluating the risk of spinal canal stenosis.

Methods

The study was conducted on 106 kurdish patients complaining of lower backache using a 1.5 Tesla MRI scan in the imaging center of Sulaimani teaching hospital.

Results

The mean midsagittal diameter of bony spinal canal at the level of L3 was 12.32 ± 1.44 mm. About 52% of the patients had normal spinal canal diameter, while about 48% of the patients had a stenosed canal.

Conclusion

Midsagittal diameter of the spinal canal was smaller than what it was found in other populations and thus having a greater risk of spinal canal stenosis

Keywords: *Lumbar spinal canal diameter, Spinal canal stenosis, MRI*

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INTRODUCTION

Low backache is a common clinical problem. The etiology in many of these patients is narrowing of the lumbar canal. The incidence and implication of lumbar canal stenosis are gaining attention.

The values of normal midsagittal diameters are different at various levels of lumbar spinal canal in individuals of the same race and differ at identical levels in individuals of various races. A number of authors have discussed methods of measuring the spinal canal [1,2].

Spinal stenosis is defined as the narrowing of central spinal canal. This stenosis of spinal canal becomes important only when it causes interference with the normal functions of the canal contents (spinal cord/ cauda equina, meninges, vessels and etc.), leading to clinical manifestations like backache and leg pain. Measurement of diameter of the bony spinal canal represents merely one side of the equation, on the other side being the volume of nerve tissue contents within the canal and the variations that exist between individuals of the same and different racial groups and sexes. Measurement of the spinal canal diameter either through radiological studies or in cadaver spine can act only as a rough guide to the condition.

The fundamental concepts of this abnormality (spinal stenosis) were laid down by Verbiest (1955) [3] who evaluated the size of spinal canal in developmental stenosis for the first time. Epstein et al (1976) [4] gave a much clear classification of spinal stenosis as general, segmental or local.

Obliteration of subarachnoid space at the level of lesion in MRI or CT confirms the diagnosis of spinal stenosis. On CT scan, electronic measurement of the sagittal diameter of the normal bony canal are > 11.5 mm [5]. Hamanishi et al (1994) reported that 90% of patients with neurogenic claudication had a cross sectional area of spinal canal < 100 mm^2 at 2 or more levels. They considered double lesion with a cross sectional area of spinal canal below 100 mm^2 to be a critical factor for spinal stenosis symptoms. [6] In another study, Boden et al (1990) found MRI signs of stenosis in 28% of asymptomatic subjects [7].

Anatomical studies to determine the dimensions of the normal canal lay emphasis on mid sagittal diameter. It is accepted that a midsagittal diameter > 12.5 mm is normal whereas < 12 mm is considered pathological [8,9,10].

PATIENTS AND METHODS

This is a cross-sectional study which was carried out in the MRI (Magnetic Resonance Imaging) unit of the imaging center of Sulaimani Teaching Hospital. The study was carried out on 106 Kurdish patients (49 males and 57 females) complaining of lower backache, who underwent MRI examination of lumbar spine, from January 14, 2014 to May 20, 2014; their age was 15-82 years (the mean age was 44.13 ± 13.3 years) and their body weight was 55-123 kg (the mean body weight was 77.51 ± 12.18 kg).

The MRI machine used was Siemens MAGNETOM, Symphony Version Syngo MR 2004A 1.5 Tesla. The usual imaging sequence was: sagittal T2- weighted images {with a long repetition time (TR: 4000 ms), long echo time (TE: 116 ms), Fov read 310 mm and Fov phase 100%}. Distances and diameters were measured in millimeters using the software that accompanies the MRI system.

Measurements were done at the midsagittal T2-weighted image which was identified when the tip of the spinous process of L3 was seen, from the midpoint of the posterior border of the vertebral body (identified by the point of exit of the basivertebral vein) to the most anterior part of the spinous process. Statistical analysis was carried out using the SPSS for windows software program, version 21.0. A P-value < 0.05 was regarded as a standard to be considered as significant or not.

RESULTS

The overall mean midsagittal diameter of bony spinal canal at the level of L3 was 12.32 ± 1.44 mm (SD) in the total sample of the patients. It was 12.42 ± 1.37 mm (SD) in the female patients and 12.19 ± 1.51 mm (SD) in the male patients (Table 1).

There was no significant difference between male and female measurements of the midsagittal diameter of the spinal canal at the level of L3 vertebra (P value = 0.412).

About 49 % of the male patients and 47 % of the female patients were found to have a stenosed canal; whereas about 51 % of the male patients and 53 % of the female patients were found to have a normal spinal canal diameter despite having lower backache (Table 2).

Table 1. Measurements of the bony spinal canal in mm (millimeter).

	MSD (midsagittal diameter) at the level of L3			
	Mean	**Std. Deviation (SD)**	**Minimum**	**Maximum**
Total	12.32	1.44	9.0	16.0
Female	12.42	1.37	10.0	16.0
Male	12.19	1.51	9.0	15.0

Table 2. Percentage of patients with stenosed or normal canal.

	Absolute stenosis (Diameter<10 mm)	**Relative stenosis (Diameter 10-12 mm)**	**Normal diameter (Diameter>12 mm)**
Male patients	4 %	45%	51 %
Female Patients	----	47 %	53 %
Total patients	2 %	46 %	52%

DISCUSSION

Spinal canal stenosis becomes important only when it results in interference with the normal functions of the contents of the canal resulting in low backache and other related complains.

Measurement of antero-posterior diameter of the spinal canal with varying cut off levels are the most often applied criteria for central stenosis. To our knowledge no structured and systematic review collecting radiological criteria applied for defining lumbar spinal stenosis has been published to date.

The importance of the radiographic measurement of the spinal canal was first emphasized in 1934 by Elsberg and Dyke [11] who established the normal range of interpedicular distance in the thoracic and lumbar spine. These early works concerning the large spinal canal stimulated interest in the small canal. Though Sarpyener [12] is credited with first recognizing the clinical importance of lumbar spinal canal stenosis, Verbiest [3] was first to assess stenosis quantitatively. He classified stenosis as relative when the sagittal diameter is 12 mm and absolute when the diameter is 10 mm or less.

Most authors accepted that a midsagittal diameter > 12.5 mm is normal, whereas < 12 mm is considered as spinal canal stenosis [8,9,10].

In this study, we measured the midsagittal diameter of the lumbar spinal canal at the level of L3 vertebra (Table 1), as it is usually taken as the standard level in the diagnosis of spinal canal stenosis.

About 48% of the patients were found to have a narrow spinal canal; whereas about 52 % of the patients were found to have a normal spinal canal diameter despite having lower backache. However about 4% (2 out of 49) of the male patients were found to have absolute spinal canal stenosis (canal diameter < 10 mm) (Table 2).

In a study done by Ahmad et al (2011) [13], they found that about 11.6 % of the cases have stenosis at the level of L3 and about 4.6 % of the cases have generalized stenosis (stenosis at all vertebral levels) [13].

Morphometric studies of the lumbar vertebral canal have reported age, gender and racial differences in the diameter of the lumbar spinal canal [8,14,15] .

In order to correlate the size of the vertebral canal in this study with those of other studies, the mean midsagittal diameters obtained in the present study were compared with other studies (Table 3). It was found that the mean midsagittal diameters of the lumbar spinal canal in this study were smaller than those reported by Malas *et al* [16], Shukri [17], Jahangir *et al* [18], Tong *et al* [19] and Ahmad *et al* [13].

Many factors may play role in such a difference such as racial, social and environmental factors and therefore, our population may have a greater risk for getting spinal canal stenosis.

However, further studies are suggested to be conducted on larger sample of patients to get more reliable results.

Table 3. Comparison between mean bony spinal canal measurements at the level of L3 from the present study and other studies performed by MRI in symptomatic patients.

Study	Malas et al (1997)	Shukri (2002)	Jahangir et al (2003)	Tong et al (2006)	Ahmad et al (2011)	This study (2014)
Midsagittal diameter	13.42 ± 1.65	13.98	16.2 ± 1.4	13.13 ± 2.92 mm	13.5 ± 0.5	12.32 ± 1.44 mm

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