Abstract

Introduction: Various medical imaging technique used in radiology to investigate the anatomy and physiology of the body in both health and disease. The main principle of magnetic resonance images (MRI) use strong magnetic field and radio waves to form an image for a certain area in the human body. The technique widely used in the hospital for medical diagnosis. In clinical practice, the MRI is employed for the assessment of lower back in the human body. Knowledge of lumbar the spine character is important for the clinical assessment of spine diseases. Materials and Methods: This study consisted Fifty nine consecutive patients gender both males and females Ages between 18‑45 years adult with no known history of lumbar spine diseases underwent lumbar spine MRI sagittal T1, T2‑weighted images. MRI machine 1.5 Tesla was used the selected sequences were Scout: axial sagittal, and coronal. Objective: The aims of this study were to establish a normal range of values for lumbar spine length (high) and classify the signal intensities by use of MRI for normal Sudanese adult with no known history of lumbar spine diseases. Result: Of this study revealed Correlation between measurement of the lumbar spine and body indices. The data were expressed as means ± standard deviation (S.D). Lumbar spine length (high) and signal intensity were analyzed as combine group (male + female) as well as the total sample. The data statistical analyses were performed using excel software programmed and statistical analyses were performed using the independent sample t-test, simple correlation (SPSS software version 20 USA) statistical significance was assumed at P < 0.05. Conclusion: The lumbar spine length (high) for Sudanese adult were found to be in the ranges of (13.8‑23.4) cm with mean = 16.9 ± 1.7 S.D. The signal intensities for lumbar spine MRI fast spin echo image (FSE) were found to be in the ranges (61‑163) pixel value for vertebrae and inter vertebral disc respectively.

Key words: Lumbar spine signal intensity, magnetic resonance images, measurement lumbar spine magnetic resonance images, normal lumbar spine length in magnetic resonance images, SI fast spin echo in lumbar spine

INTRODUCTION

The vertebral column is situated in a median line, as the posterior part of the trunk; its average length in the female column is about 61 cm in length. The male is about 71 cm of this length the cervical part measures 12.5 cm, the thoracic about 28 cm, the lumber 18 cm, and the sacrum and coccyx 12.5 cm.\(^1\)
The diagnosis of lumbar spine involves clinical investigation and imaging of the spine; a variety of imaging modalities such as X-ray, computed tomography (CT), and magnetic resonance images (MRI) are used for this purpose. Additional imaging approaches include myelography and discography, combined with either X-ray or CT.[2]

MRI is a good modality for imaging the spine and the most sensitive method for evaluating the lumbar spine. It provides high soft tissue contrast, allowing good visualization of the intervertebral disc as well as the surrounding nerves, ligaments, and muscles. In addition, it is noninvasive, does not use ionizing radiation, and is capable of multiplanar imaging.[3]

The standard MRI protocol for lumbar spine consists of sagittal T1- and T2-weighted images, supplemented by axial T1- or T2-weighted images at selected levels.[4] T1-weighted images show low signal intensity from the cerebrospinal fluid (CSF), and cortical bone and high signal intensity from the bone marrow. The T2-weighted images show high signal intensity from structures with high water content such as the (CSF) and disc's nucleus. In sagittal T2-weighted images, a normal intervertebral disc appears as a bright ellipse the nucleus surrounded by a dark ring the annulus while the end plates and ligaments also appear dark.[5]

From the length of the lumbar part of spine (LLPS), LLPS in centimeters, the latter being measured from the upper edge of the first lumbar vertebral body, to the lower edge, along the anterior surface of the spine. LLPS were 19.9 ± 1.19 cm in males and 18.6 ± 0.84 cm in females (mean ± standard deviation [S.D]).[6,7]

Relative signal intensity maybe a more sensitive measure of intervertebral disc degeneration. Also, signal intensity was lower in the middle-aged men than in the young men, indicating age-related disc degeneration. Despite the general positive association between disc narrowing and decreased relative signal intensity, disc narrowing may be have unexpectedly in relation to signal intensity and age.[8,9]

**MATERIALS AND METHODS**

This study consisted of 59 consecutive patients (males = 31, female = 28) underwent lumbar spine MRI sagittal T1-weighted, T2-weighted images of indication other than lumbar spine disease the sample includes both males and females ages between 18 and 45 years adult with no known history of lumbar spine diseases. Detailed demographic information of the population including age, gender, weight, and high, body mass index (BMI) will be record.

MRI machine 1.5 Tesla was used at Doctors hospital, the selected sequences were Scout: Axial sagittal, and coronal. Sequence 1 and 2 were coronal and axial T2-weighted: TSE, TR = 3000-4000, TE = 90–140, respiratory triggering TR = 1900-2300, TE = 100, Flip angle 90°(degree) STIR: TR = 2200, TE = 60, TI = 100 HASTE, breath hold; TR = 11.9, TE = 95, Slice thickness 4–6 mm. Slice gap: (0.8-1.2 mm), phase encoding gradient: LR, FOV: 380–400 mm, sequence 3 was axial T1-weighted, GRE (FFE) [Figure 1].

The researcher’s measures length of vertebrae and intervertebral disc in MRI by use computer program (RadiAnt DICOM Viewer). Interactive data language (IDL) Version 6.1 use to extract pixel value from same MRI (Signal intensity). In the signal intensity analysis open the T1-fast spin echo (FSE) MRI in IDL program and extract pixel value from vertebrae and intervertebral disc. Finally Microsoft Office Excel Worksheet was used to predict the high (length) of lumbar spine in (cm). Length of lumbar spine from MR image = [Σ length of five lumbar vertebrae + Σ length of five intervertebral disc].

**RESULT AND DISCUSSION**

This study adept analytic cross-sectional design focuses on measure the length of lumbar spine and analysis the signal intensity of vertebrae, and intervertebral disc in MRI this study science in Khartoum state Doctors Clinic hospital period from September 2014 to February 2015. The demographic information for the total sample was recorded as shown in Table 1.

The data are collected for 59 patients showed the measurement and signal intensity of lumbar spine correlated with patient’s age, weight, length, and BMI.

**Figure 1:** (a) Lumbar spine magnetic resonance images T1-fast spine echo image, (b) lumbar spine magnetic resonance images T2-fast spine echo image
The data statistical analyses were performed using the independent sample \( t \)-test and linear regression for variables (SPSS software version 20, IBM® SPSS® Statistics, USA). Statistical significance was assumed at \( P \leq 0.05 \) where the result as shown in the following Tables 2-4.

The mean and standard deviation of length of lumbar spine (which measured individually) was 16.93 ± 1.68 cm, these result compared with Dimeglio and Bonnel,\(^{[10]}\) were found the measurement of lumbar spine 16 cm which was similar to our study.

Also study show statistically significant, between lumbar spine length and patient height [Figure 2]. These results compare with Yanase \textit{et al.}\(^{[11]}\) the findings suggest that the increased length of the lumbar spine with patient height.\(^{[12]}\)

Table 1: Statistical descriptive total sample

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Table 2: Linear regression (stepwise method) entered variables

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<td>Model 1</td>
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<td>Variables Entered:</td>
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<td>Variables Removed:</td>
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<td>Method: Stepwise (Criteria: Probability-off-to-enter ( \leq ) .050, Probability-of-to-remove ( \geq ) .100).</td>
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Table 3: Linear regression (stepwise method) excluded variables

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Table 4: Compare means independent sample (\( t \)-test)

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CONCLUSION

- The lumbar spine length (high) is clinically relevant and use frequently as the basis for making a clinical
decision. Serial measurements also can provide information regarding disease progression or stability:

- Aims of this study were to establish normal lumbar spine length (high) and values of signal intensity of Sudanese adults using MRI as well as to determine the relations between lumbar spine measurement and Sudanese body indices.

- Correlation between measurement of the lumbar spine and body Indies were calculated. The lumbar spine length (high) of Sudanese adults were found to be in the ranges of (13.8–23.4) with mean = 16.9 ± 1.7 SD.

- Relation between body height and lumbar spine length which can be represented by an equation and used as an easy reference in clinical practice: Lumbar spine length (cm) = (0.074 × pt high + 3.359)  

- The signal intensity profiles can provide useful information about the microstructures of the structures the interest can speed the process of diagnosis. There for the main objective of this study was to use signal intensity technique in order to identify the pathological lumbar spine from the normal one.

### Financial support and sponsorship
Nil.

### Conflicts of interest
There are no conflicts of interest.

### REFERENCES

5. Reif E, Moeller T. MRI Parameters and Positioning, Thieme; 2014.