

The Sensitivity of Magnetic Resonance Imaging Protocols in Detecting of Spinal Diseases

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Background: Magnetic Resonance Imaging (MRI) has employed for visualization of spinal disorders .Aim of study to systematically evaluate and compare the sensitivity of various magnetic resonance imaging (MRI) protocols in detecting a range of spinal diseases. To enhance our understanding of the diagnostic capabilities of MRI in spinal imaging and contribute to the optimization of clinical protocols for the accurate detection and characterization of spinal diseases. **Patients and Methods:** · this study included 72 patients proved with clinical and laboratory diagnosis of spinal diseases were examined during a period from December/2023 to February /2024. Patients age group between 39-52 years (38 male / 34 female) with mean age (47.64y). MRI machine was of Philips type of 1.5 T magnetic power with using Body coil during examination.

Results: 38 (52.8%) of 40 patients were male and 34(47.2%) were female. the most defect detected in the study sample were Disc lesion and spinal canal stenosis by percentage 100% and 55.6% of study sample receptively. Magnetic resonance more accurate in uses T2 weighted ability to detect disc lesion all cases while T1 weighted more accurate to detect Osseous pathology with p-value=0,001

Conclusion: the magnetic resonance scan best for detect the most causes of spinal diseases those which may be missed with other imaging . In this study we found magnetic resonance with high sensitivity in detection the causes of disc lesion ,spinal canal stenosis , disc herniation, Osseous pathology, Spinal Deformities and Spinal Instability

Keywords: magnetic resonance, disc lesion ,spinal stenosis.

1. Introduction

Spinal cord disorders is a devastating and communal neurologic disorder that has deep influences on recent society from psychosocial , physical, and socioeconomic sides [1]. Magnetic Resonance Imaging (MRI) imaging of the spinal cord disorders was limit and in directed. MRI permits better visualization of the spinal cord, discs, ligaments, others soft tissues, and vessels than Computerized tomography (CT) scans or other radiography [2] . High-resolution MRI it provides clear distinction and visualization images of individual both soft tissues and osseous ,and organs ,so that has become an essential element in the diagnostic of spinal disorders [3] . It is non-invasive, provides information around the morphology of

spinal and integrity of the intervertebral disc , vertebrae, intervertebral foramina, facet joints and ligaments on both (T1W and T2W) images, particularly sagittal plane images [4]. Aim of study to systematically evaluate and compare the sensitivity of various magnetic resonance imaging (MRI) protocols in detecting a range of spinal diseases and to enhance our understanding of the diagnostic capabilities of MRI in spinal imaging and contribute to the optimization of clinical protocols for the accurate detection and characterization of spinal diseases.

2. PATIENTS AND METHODS

This study was conducted in Al-shaheed Al-Sader Hospital and in Al-Kindi Teaching Hospital in Baghdad. The study included 72 patients with clinical diagnosis of spinal diseases . Patients ages were (39-52 years with mean age (47.64 years) , the males were 38 patients and females were 34patients, patients were referred for MR examinations, during interval of patients reviewing extended between December/2023 to February /2024. MRI system is made by Philips company and it is of magnetic field strength 1.5 tesla. cases with contraindications to MR technique such as patients with Metallic foreign Bodies ferromagnetic implants insertion ; heart pacemakers ,cases with history of claustrophobia all these were excluded from the MRI examination. Body coil was used.

Table 1: MRI Parameters

parameters	T1W Sagittal	T2W Sagittal	T1W axial	T2W axial
TR	595	3000	500	5690
TE	13	117	12	108

3. RESULT

The gender of patients were 38 (52.8%) males and females 34(47.2%). All patients with clinically diagnostic of spinal diseases were included in the study. The mean \pm SD age of study sample 47.64 ,and most of study sample had active and hard work by percentage 31% and 34.7% work in cities and the most symptoms showed in the study group were back pain by percentage 98.6 as we note the body mass index (BMI) refer to over weight of sample by mean 26.4.

Table2: The distribution of studied sample according to demographic characteristic no (72).

AGE GROUP	25-38Y	14	19.4
	39-52Y	30	41.7
	53-66Y	23	31.9
	67-80Y	5	7
	Mean_+ SD	47.64	11.438
Gender	Male	38	52.8
	female	34	47.2
Employment statues or work	hard	23	31.9

	active	25	34.7
	passive	24	33.3
job location	in cities	49	68.1
	remote areas	19	26.4
	Rural areas	4	5.6
Symptom	Weakness and paralysis of limbs	4	5.6
	numbness	52	72.2
	Loss of sensation	42	58.3
	Changes in reflexes	39	54.2
	Loss of urinary or bowel control	1	1.4
	Uncontrolled muscle spasm	33	45.8
	Back pain	71	98.6
BMI	Healthy weight	24	33.3
	over weight	27	37.5
	Obese	20	29.5
	Mean_+ SD	26.4552	3.28224

This table show the most defect detected in the study sample were Disc lesion and spinal canal stenosis by percentage 100% and 55.6% of study sample receptively.

Table 3: show ability of MRI in detection of abnormality according to imaging finding.

TABLE SHOW ABILITY OF MRI IN DETECTION OF ABNORMALITY ACCORDING TO IMAGING FINDING		NO(72)	%
Imaging detection	Disc lesion	72	100.0
	Spinal canal stenosis	40	55.6
	Spinal Deformities	2	2.8
	Paralysis	1	1.4
	Osseous pathology	15	20.8
	SPINAL INSTABILITY	6	8.3

Table 4: Association between type of protocol and imaging finding

Imaging detection	Protocol Type		P. Value
	T1	T2	
Disc lesion	4	68	0.001
Spinal canal stenosis	3	37	
Spinal Deformities	0	2	
Paralysis	0	1	
Osseous pathology	13	2	
Spinal Instability	1	5	

Magnetic resonance more accurate in uses T2 weighted ability to detect disc lesion in all cases while T1 weighted more accurate to detect Osseous pathology with p-value=0,001 .

Table 5: Show direction and site of disc herniation.

Table show direction and site of herniation showed in sample		No	%
direction of disc herniation	turn annulus	24	33.3
	central	22	30.6
	subarticular	2	2.8
	foraminal	37	51.4
	lateral	7	9.7
	anterior	3	4.2
site of herniation(level)	L5-S1	36	50.0
	L5-L4	51	70.8
	L4-L3	38	52.8
	L2-L1	23	31.9
	L1-T12	5	6.9
	T1- C7	2	2.8
	C5-C6	11	15.3
	C4-C5	10	13.9
	C3-C4	10	13.9
	C2-C3	5	6.9
	C1-C2	2	2.8

This table show herniation have turn annulus as direction of hernia and most site of vertebra with hernia were between L4-L3 , L5-L4 and L5-s1 by percentage 52,8% , 70.8 % and 50%respectively.

Table 6: The distribution of studied sample according to type spinal stenosis and other spinal defect .

Table The distribution of studied sample according to type spinal canal stenosis and anther spinal defect		No	%
type spinal canal stenosis	developmental type	39	97.5
	Both (idiopathic and developmental)	1	2.5
Developmental spinal canal stenosis type	hypertrophied ligamenta flava	12	30.8
	hypertrophied lamina	2	5.1
	hypertrophied articular facet	10	25.6
	hypertrophied ligamenta flava and articular facet	15	38.5
grade of stenosis	simple	6	11.3
	mild	43	81.1

	severe	4	7.5
Spinal Deformities	Kyphosis	2	100
type paralysis	Monoplegia	1	100
osseous pathology	osteophytes	5	31.3
	osteoarthritis	6	37.5
	osteophytes and osteoarthritis	4	31.3
site osteophytes	anterior	5	50.0
	posterior	4	40.0
	both	1	10.0
type spinal instability	spondylolisthesis	6	100

This table show the most type of spinal canal stenosis was developmental and the most one of this type were hypertrophied ligamenta flava and articular facet by percentage 38.5% and according to grade of stenosis was mild by percentage 81.1% while the most osseous pathology we are note was osteoarthritis by percentage 37.5 %.

Statistical analysis

Analysis of data was carried out using the available statistical package of SPSS . Data were presented in simple measures of frequency, percentage, mean, standard deviation, and range (minimum-maximum values).

4. Discussion

Spinal Magnetic resonance imaging (MRI) is the most important tool for assessing the normal and pathological states of the spinal and associated tissues. MRI examination having high depiction of the Soft tissues in relation to Computed tomography and plain radiographic [5]. Aim of study to systematically evaluate and compare the sensitivity of various magnetic resonance imaging (MRI) protocols in detecting a range of spinal diseases and to enhance our understanding of the diagnostic capabilities of MRI in spinal imaging and contribute to the optimization of clinical protocols for the accurate detection and characterization of spinal diseases.

In this study, According to the age variable, the highest percentage was between age 39-52Y by percentage 41%, Regarding the gender variable, males in our study sample were higher than females by percentage (52%, 47.2%) respectively , with a mean age of (47,64±11.438) , this result with good agreement with (Jordan J.,et al) study [6] those found highest incidence is amongst people aged (30 to 50) years ,with the male to female ratio of (2:1) the males were more frequently to be affected by spinal diseases than females. and this is similar to Bellut D., et al [7], as in that were 15 male (56 %) and 12 female (44 %) patients with a mean age of 57.4 ± 17.8 years.

The most type of spinal canal stenosis was developmental and the most one of this type were hypertrophied ligamenta flava and articular facet by percentage 38.5% and this result is similar

with Mekhail N., et al study [8] those found highest incidence lumbar canal stenosis patients with moderate-to-severe suffers from the most common type ligamentum flavum hypertrophy.

The most common symptom suffered by people with this disease were back pain, numbness by percentage 98.6% , 72.2% respectively , and many or most of them also suffer from back pain due to overweight , and this is represented in many studies that examined this problem Parker SL., et al [9].

as well Our research also indicates that Most of the study sample suffered from overweight and some of them were obese (37.5% , 29.5%), so this is lead to back injuries, this is agree with Jordan J., et al and Postacchini F., et al [6,10] as a study conducted on many patients showed the risk factors for disc herniation include weight, smoking, and certain work activities, such as repeated lifting. That has been submitted to be a risk factor for disc herniation, while evidence is inconclusive .

Many previous studies have indicated that the use of MRI devices in diagnosing back injuries, as we show in the variable of imaging detection of injury, we notice the presence of Spinal canal stenosis and disc lesion by percentage 55.6% 100% respectively . this result agreement with Bozzo A., et al and Sheehan J., [2,11] that found the Spinal MRI has become the gold standard for imaging neurological tissues including the spinal cord that use of MRI has increased significantly for imaging spinal cord injury.

The use of the T1 and T2 protocols indicates that there is a clear difference in the ability of each of its to diagnose many types of back injuries, as we notice that the value of the p-value less than 0.05 . Therefore, we notice that T2 has the ability to detect disc lesion more than T1 as indicated by many studies that were conducted in this field this result agreement with Sheehan J, Elliott J., et al and Auerbach D., et al [11,13] that found the MRI is the ideal examination for confirming disc herniation ,nerves and Spinal canal stenosis. also we notice ability of T1 more accurate to detect Osseous pathology than T2 protocol this result similar with Benneker L., et al [14] .

The current study has shown that the most susceptible to part infected with back injuries is the vertebral at the level of L4-L5, L4- L3 and L5-S1 by percentage 70.8%, 52.8%, 50% . This result with good similar with Jordan L., et al [6] that found about 95% of all herniated disc in people aged between 30 and 50 years of age, occur in the lower lumbar spine between L4-S1, while those observed in older patients typically occur above L4. Also in other study that this result with good agreement with Divi SN., et al [15] who have the non-operative group also had a common of disc hernia between L4-L5 and L5-S1, there was a higher percentage of cases at L4-5 (L4-5, 52.9%, L5-S1, 35.3%).

5. Conclusion:

The spinal magnetic resonance scan best method for detect the most causes of spinal diseases those which may be missed with other imaging . In this study we found magnetic resonance with high sensitivity in detection the causes of disc lesion ,spinal canal stenosis , disc herniation, Osseous pathology, Spinal Deformities and Spinal Instability. Magnetic resonance high significant in uses T2 weighted ability to detect disc lesion all cases while T1 weighted more accurate to detect Osseous pathology .

However, a little limitations of spinal MR are due to old patient and obesity which all diminish the image quality.

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