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The Significant Relation between Low Back Pain and Magnetic Resonance Imaging Findings

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Abstract: Background: Low back pain is the most common cause of pain and disability in modern society, and costs related to disorders that cause LBP amount to billions of dollars each year. MRI is considered the gold standard in determining the etiology of low back and radicular pain. **Aim:** To identify the relation between lumbosacral MRI findings and the causes of current low back pain (If associated with radicular symptoms). **Patient and method:** A cross sectional descriptive study of 100 patients complained of non-traumatic low back pain with lumbosacral MRI were referred from Rheumatology clinic, Full history of pain was taken. Pain assessed by Numerical rating scale. Scans were read by 2 senior radiologists. **Result:** 85% of patients had disc prolapse, 2% had only Facet joint hypertrophy, 13% with normal Lumbosacral MRI. 82% of patient with radiated pain (92.7% had disc prolapse, 7.3% had normal Lumbosacral MRI). there is significant relation between MRI findings and radiation, no significant relation between pain severity and MRI findings. Mean BMI was 29. **Conclusion:** Disc bulge and herniation are the common cause of non-traumatic pain in our society, over weight is one of the major risk factors. There are other causes for low back pain that can be diagnosed by history and physical examination rather than MRI.

Keywords: MRI, low back pain, disc prolapse, pain radiation.

INTRODUCTION

Low back pain (LBP) is a common problem that most people experience at some point in their lifetime.

LBP results in socio-economic losses, health and clinical problems, not only for individuals but also for countries, because LBP causes obstacles to work or work absence and increases economic burden of treatment and compensation. (Norasteh, A. A, 2012)

The role of MRI in Diagnosis of Low back pain: Magnetic resonance imaging is considered the gold standard in determining the etiology of low back and radicular pain. It offers the best resolution of the spinal canal, spinal cord, neural foramina, nerve roots and disk spaces and allows evaluation of the entire spine. In patients with a history of previous spine surgery, contrast-enhanced MRI is recommended to differentiate between scar tissue and recurrent disk herniation. Limitations of MRI include a lengthy examination time, claustrophobia, and its effects on metallic objects. It is contraindicated in patients with pacemakers, mechanical heart valves, aneurysm clips, and intraocular foreign bodies. (Benzon, H. T. *et al*., 2014)

Modic type endplate changes represent a classification for vertebral body end- plate MRI signal, first described in 1988. (Modic, M. T. *et al*., 1988) It is widely recognized by radiologists and clinicians and is a useful shorthand for reporting MRIs of the spine.

Modic type I

o **T1:** low signal

o **T2:** high signal

o represents bone marrow oedema and inflammation

o **T1+C**: enhancement

Modic type II

o **T1:** high signal

o **T2:** iso to high signal

o represents normal red haemopoietic bone marrow conversion into yellow fatty marrow as a result of marrow ischemia.

Modic type III

- **T1:** low signal
- **T2:** low signal

represents subchondral bony sclerosis. (Rahme, R. *et al*., 2008)

Pain Assessment Scale:

Numerical Pain Rating Scale (NPRS):

The Numerical Rating Scale offers the individual in pain to rate their pain score. Statford, P, (2001) 19 concluded Numerical Pain Rating Scale as reliable, valid, and appropriate for use in clinical practice. The Numerical rating pain scale allows the health care provider to rate pain as mild moderate or severe, which can indicate a potential disability level.

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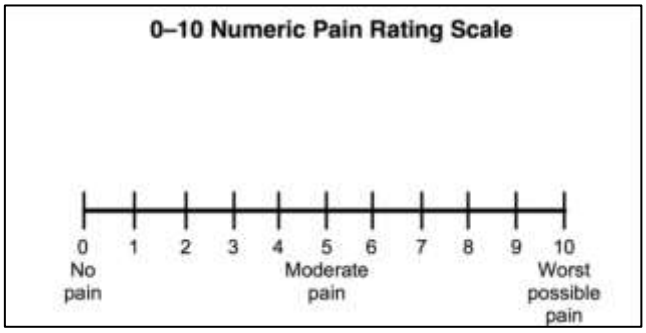
Table 1- Numerical Pain Rating Scale



PATIENTS AND METHODS

After obtaining the scientific council of Anesthesia and Intensive care unit approval, a descriptive cross-sectional study was done in the MRI unit – Baghdad teaching hospital.

From 9th of January to 28th of February 2017 included a hundred cases, all of them complained of low back pain and were referred from rheumatology outpatient clinic for lumbosacral MRI.

Case selection was regardless of age, gender or weight and height.

Exclusion Criteria:

1. History of Severe Back Trauma 2. Congenital anomalies of the spine 3. Spinal tumor
4. History of spine surgery
5. Infection.

A full history was taken about the pain, and the severity was assessed using Numerical Pain Score and the severity of pain was classified as mild pain from 1-3, moderate pain from 4-7 and severe from 8-10, the duration of pain was considered. Pain was classified according to the radiation into radiated (to one limb or both) and non-radiated. Patients were asked for the effects of sitting, standing, walking, leaning forward and backward on the pain.

Demographic data from all the patients including the weight, height, gender and the Age of each case were taken and BMI was measured.

Patients were examined by Philips Achieva 1.5 Tesla MRI scanner 2011. in supine position and lying straight. The MRI imaging technique was performed using conventional spin echo pulse sequences. The scans were reviewed by two senior radiologists in the MRI unit for presence of disc degeneration, disc bulging, disc herniation, nerve root compression, spinal stenosis, spondylolisthesis, Modic changes, facet joint and ligamentum flavum hypertrophy.

A Questionnaire was designed by researcher and revised by the supervisor which had been adapted from multiple questionnaires of international researches to collect the data.

RESULTS

By using the SPSS V.24.0/IBM using the one sample t-student test and ANOVA it's found that

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Table 2- Mean and standard deviation in demographic data

mean and Standard deviation in demographic data

	N	Mean	Std. Deviation
Age (Years)	100	43.81	± 15.028
Weight (Kg)	100	80.91	± 16.4188
Height (Cm)	100	166.64	± 11.0678
BMI	100	29.1417	± 5.25547

About gender it's found that 50% were Male and 50% were female.

The table below describe the incidence of pain site, duration, radiation, aggravating factors of the pain and the response to the treatment.

Table 3- the incidence of pain site, duration, radiation, aggravating factors

		Count and Percentage
Pain (Site)	Midline	74
	Para-median	20
	Both	6
Pain (Duration)	Acute < 4weeks	30
	Subacute 4-12 weeks	17
	Chronic > 3 months	53
Radiation	None	18
	Single Limb	56
	Both Limb	26
Paresthesia		53
On Sitting		49
On Walking		40
On Standing		44
On Lying Down		27
On Leaning Forward		69
On Leaning Backward		43
Respond to Medical Treatment		38

Table 4- Mean and Standard deviation of Numeric Rating Scale (NRS) in the sample

Mean	Standard deviation
7.46	1.480

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Table 5- MRI findings:

	No of Patients	PERCENTAGE
Disc Degeneration	82	94.25%
Disc Bulging	82	94.25%
Thecal Sac Indentation	76	87.35%
Nerve Root Compression	71	81.60%
Facet Joint Hypertrophy	30	43.48%
Ligamentum Flavum Hypertrophy	20	22.99%
Spinal Canal Stenosis	18	20.69%
Disc Herniation	33	37.93%
Annular Tear	14	16.09%
MODIC Type Endplate Changes	9	10.34%
Spondylolisthesis	2	2.29%

By using ANNOVA test its found that there was no significant relation between pain severity and MRI findings the p-/value were more than 0.05 and as shown in tables.

Table 6- The relation between pain severity and MRI finding

The relation between pain severity and MRI Findings			
	Mean of NPRS	Std. Deviation	P-Value
Disc Degeneration	7.40	1.4303	0.409
Disc Bulging	7.34	1.451	0.087
Disc Herniation	7.36	1.389	0.330
Nerve Root Compression	7.35	1.522	0.256
Facet Joint Hypertrophy	7.77	1.591	0.176
Ligamentum Flavum Hypertrophy	7.55	1.701	0.763
Spinal Canal Stenosis	7.39	1.819	0823
Annular Tear	7.21	1.369	0.506
Spondylolisthesis	9	0	0.138

By using Chi-Square Tests. There was a significant difference between MRI findings and the radiation of pain where the P-Value was significant in (Disc degeneration, Bulging, nerve root compression and spinal canal stenosis as shown in table.

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Table 7- the relation between pain radiation and MRI findings

The relation between pain radiation and MRI Findings

	Radiation		P-Value
	No	Yes	
Disc Degenration	7	75	0.001
Disc Bulging	9	73	0.001
Disc Herniation	5	28	0.630
Nerve Root Compression	7	64	0.01
Facet Joint Hypertrophy	5	25	0.820
Spinal Canal Stenosis	0	18	0.028
Annular Tear	0	14	0.059
Ligamentum Flavum Hypertrophy	3	17	0..696
Spondylolisthesis	1	1	0.234

p-value < 0.05 is significant

Table 8- The relation between pain radiation and disc bulging

The relation between pain radiation and disc bulging.

		Disk Bulge				Total	P-Value
		Disc Bulge	With Thecal sac compression	Thecal sac and Nerve Root Compression	Nerve root compression		
Pain Radiation	No	0	2	9	0	11	0.008
	Yes	5	7	55	4	71	

The relation between patient complained of neurological symptoms (radiation and paresthesia) and nerve root compression.

Table 9- Paraesthesia

	Paraesthesia			
	No	Yes	Total	P- Value
Nerve Root Compression	23	41	64	0.01

64 patient with radiated low back pain had Nerve root compression: 41 of them also had paresthesia

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Table 10- The relation between patient without pain radiation and MRI Findings

		No pain radiation				Total
		Without Disc Bulging		With Disc Bulging		
		No Herniation	Only Disc Herniation	No Disc Herniation	With Disc Herniation	
Facet Joint Hypertrophy	None	7	0	3	3	13
	Yes	2	0	1	2	5
Ligamentum Flavum Hypertrophy	No	9	0	3	3	15
	Yes	0	0	1	2	3
Spinal Canal Stenosis	Non	9	0	4	5	18
	Yes	0	0	0	0	0
Annular Tear	None	9	0	4	5	18
	Yes	0	0	0	0	0
Modic type endplate changes	None	9	0	3	3	15
	MODIC type I	0	0	0	2	2
	MODIC type II	0	0	0	0	0
	MODIC Type 3	0	0	1	0	1
Spondylolisthesis	No	9	0	3	5	17
	Yes	0	0	1	0	1

18 Patients didn't have pain radiation:

- - 5 of them had Disc bulging and herniation
- - 4 of them had only Disc bulging.
- - 2 of them had facet joint hypertrophy.
- - 7 of them didn't have MRI findings.

Table 11- The relation between Disc bulge, thecal sac compression, nerve root compression, and disc herniation.

		Disc Bulge Count	Disc bulge & Thecal compression Count	Disk Bulge, Thecal & Nerve Root Compression Count	Disc Bulge & Nerve root compression Count	Total	No Disc Bulge Count	Total
Disc Herniation	No	4	7	40	1	52	15	67
	Yes	1	2	24	3	30	3	33
Total		5	9	46	4	82	18	100

85 patients had disc herniation and bulging:

- - 52 patients had only disc bulging.
- - 30 patients had disc bulging and herniation.
- - 3 patients had only disc herniation.

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Table 12- The relation between patient without disc prolapse (bulge and herniation) and other MRI findings.

Facet Joint Hypertrophy	None	13
	Yes	2
Ligamentum Flavum Hypertrophy	No	15
	Yes	0
Spinal Canal Stenosis	Non	15
	Yes	0
Annular Tear	None	15
	Yes	0
Spondylolisthesis	No	15
	Yes	0

Of 15 Patients without Disc Bulging and herniation, 2 had facet joint hypertrophy, and the other 13 patients didn't have any radiological findings.

Table 13- The gender, BMI and pain radiation for the patients without MRI findings (13 Patients).

	No	Percentage
Male	7	53.85%
Female	6	46.15%
BMI (Mean)	26.33	
Radiated Pain	6	46.15%

STATISTICAL ANALYSES

The data were analyzed using Statistical Package for Social Sciences (SPSS) version 24 / IBM. Descriptive statistics were expressed as frequency, percent and mean ± Standard deviation.

Using the descriptive statistics, one sample t-student test, Chi Square and one way ANOVA for the variables. All data were presented in tables, figures or paragraphs and all statistical analyses and procedure level of significance was set at P-Value £ 0.05 to be considered as significant difference.

DISCUSSION

In this study, we have randomly chosen 100 patients with low back pain and lumbosacral MRI scan of both genders (Males 50%, Females 50%), with mean age and SD (43.81 ± 15.028years) respectively.

The patients were classified according to pain radiation as Radiated pain 82% and non-radiated pain 18%, the mean and SD value for Pain NRS was 7.46 ± 1.480.

The aim of this descriptive study is to identify the relation between Lumbosacral MRI findings and the causes of the current low back pain (if associated with radicular findings).

Most of participants (82%) reported pain that radiated to the leg. One quarter of the participants (24%) reported having this pain within 4 weeks. In addition, 53% of the patients reported paresthesia.

87 patients had abnormal MRI findings, including 85 of them had disc prolapse (bulge and herniation), 2 of them had only facet joint hypertrophy.

85 patients with disc prolapse (52 patients had only disc bulging, 30 patients had disc bulging and herniation, and 30 patients had disc bulging and herniation).

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87% of the patients had abnormal MRI findings, including 37.93% with disc herniation, 81.60% with nerve root compression, 2.29% with spondylolisthesis (grade I & II), 20.69% with spinal stenosis, 94.25%-disc bulging, 43.48% with facet joint hypertrophy, and 22.99% with ligamentum flavum hypertrophy.

18% of patients didn't have pain radiation:
- 27.77% (5 patients) of them had Disc bulging and herniation, and this explained according to studies that reveal 50% of patients with disc bulging and herniation without radicular pain.

A study by Jensen, *et al*., 1994, found that Over 50% of non-radicular pain had Disc Bulges.

Another study by Boos, *et al*., 1995, found At least 75% of non-radiated pain individuals had Disc Herniation.

- **22.22% (4 patients) of them had only Disc bulging**. And this may be due to mild disc bulges and not cause nerve root compression.

A study by Ract, *et al*., 2015, it is common to find only minimal disc changes in imaging examinations in patients disabled by low back pain.

- **11.11% (2 patients) of them had facet joint hypertrophy.**

A study by Allegri, 2016, Patients usually complain of LBP with or without somatic referral to the legs.

- **38.88% (7 patients) of them had negative MRI findings with non- radiated LBP.** And this may be because MRI doesn't reveal all the causes of radiated low back pain, like sacroiliac joint dysfunction and facet joint hypertrophy or muscle spasm.

13 Patients with normal lumbosacral MRI findings (13%) were 53.85% Male, had a slightly higher BMI 26 (risk factor of the back pain) and 46.15% (6 of 13 patients) reported pain radiation (and this is may be other causes rather than disc prolapse like piriformis syndrome or face joint hypertrophy), 10 of them (76.9%) had pain on sitting. Which is one of the signs of facet joint hypertrophy (that is diagnosed better by CT).

Shepper, *et al*., 2016, found Patients with low back pain and normal MRI findings was 6%.

The abnormal findings on MRI were disc degeneration present in 82% patients, disc bulging and herniation observed in 85% & nerve root compression found in 71% patients.

While the study conducted by Wani, *et al*., 2014, found disc degeneration present in 59.3% patients, disc herniation observed 56.25% and nerve root compression 56.25% patients.

Another study conducted by McNee, *et al*., 2011, found abnormal MRI findings with disc degeneration present in 32% patients, disc herniation present in 39% & nerve root compression present in 46% patients.[12]

Also, in this study we found there is no significant relation between the severity of pain and the MRI findings, and this finding of our study supported by O'Connell, *et al*., 2011.

CONCLUSIONS

- The study revealed that disc bulges and herniation are the common causes of non-traumatic low back pain in Baghdad Teaching hospital.
- Over weight is the major risk factor of non-traumatic low back pain in Baghdad Teaching hospital.
- Patients with disc prolapse (bulges and herniation) not always had pain radiation, and

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disc prolapse is not the only cause of pain radiation.

- There are other causes for Low back pain that can be diagnosed depending on clinical presentation and physical examination rather than MRI (13% of cases had low back pain with negative MRI findings).
- There is no association between the severity of pain and MRI findings.
- 46.15% of patients (6 of 13) with normal lumbosacral MRI findings had radiated back pain.

RECOMMENDATIONS

- To prepare organize uniform form report of MRI that help in conduction Thesis.
- More details about the case in the referral paper
- More social education regarding decreasing weight.
- More attention about history and examination to pick up other causes of LBP and radiation about prone disc prolapse.

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