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ORIGINAL ARTICLE

Neurological findings and magnetic resonance imaging in patients with low back pain in Ninevah province

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Background and objectives

Low back pain (LBP) has increasingly reported as a common musculoskeletal disorder in clinical settings carrying great impact on individual and health system. The aim of the present study was to identify the findings of the magnetic resonance imaging (MRI) and clinical neurological symptoms together with their correlation with patients overall socioeconomic status.

Methods

A total of 60 LNP patients were enrolled in the present study (25 males; 35 females). MRI were conducted for individual patients and the neurological findings were reported represented by pain, disc bulging, spinal stenosis, degenerative changes, together with demographic and geographic data.

Results

The results confirmed that age, BMI, and educational levels were confounding determinant for development of LBP and male versus female developed LBP in similar ration. Spinal canal stenosis, pain, and Spondylolisthesis were hallmark associated with LBP.

Conclusion

MRI changes associated with LBP has revealed that a high percentage of LBP could potentially carry serious undelying illness and therefore MRI should be done for all patients with LBP.

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Low back pain (LBP) is one of the most common problems that most people experience at some point in their life. In the past decade, back pain has been the main cause of disability and is still one of the most frequent health problems.[1] As in other developed nations, the lifetime prevalence of back pain was found to be more than 80% in a study of the Japanese population.[1] The long-term loss of function caused by low back pain may have a significant economic effect on the nation in terms of lost wages, medical expenses, and disability benefits.[2]

There are two distinct categories of causes of LBP: specific, after specific spinal causes (radiculopathy or spinal degenerative disease), and nonspecific, which may be determined by a thorough history and clinical examination[3]Chronic LBP considered nonspecific when no obvious cause can be detected clinically or by MRI imaging findings.[2] Patients who suffer from back pain due to radiculopathy, spinal stenosis, or discomfort from a specific location in the spine benefit the most from an MRI.[4] Diagnostic imaging is only advised for individuals with suspected disc herniation infection, fracture, or malignancy or when invasive intervention is planned in patients with low back pain.[5]

The human spine is a delicate and complex structure that can experience a variety of disorders. From disc herniation to nerve root impingement and disc degeneration, these issues can all be detected through the high-intensity zone of an MRI scan. However, it is important to note that not all individuals with lower back pain will display these problematic markers. Even when these abnormalities are present, they may not necessarily be the root cause of the pain. But here is where things become interesting: the presence or absence of these abnormal findings on an MRI can significantly impact the prognosis for those suffering from lower back pain. Despite the fact that not all cases of LBP will show these markers, it is still worth considering an MRI as part of the evaluation process. By doing so, medical professionals can gain valuable insights into the underlying issues causing the pain and develop more effective treatment plans.[6]

Lower back pain can be a real pain in the neck. But fear not, nowadays, MRI of the lumbar spine is the investigation of choice for doctors looking to diagnose the problem. And when it comes to evaluating disk morphology, MRI is the method of choice, with a sensitivity of 60-100% and specificity of 43-97% for disk herniation. T1- and T2-weighted sagittal and axial MR images are the way to go. They can visualize the vertebral endplates and intervertebral disks with stunning clarity. T2-weighted images are especially impressive, as they show excellent contrast between the outer part of the annulus (which is more fibrous tissue and therefore shows low signal) and the inner part of the annulus and nucleus pulposus (which have more water content and therefore show high signal). And here's a fun fact: in younger individuals, an area of low-intensity signal may be visible in the middle of the nucleus pulposus in a non-degenerated disk. This is actually considered a normal observation and probably represents a higher concentration of proteoglycans causing signal loss on T2-weighted images.[5,6]

This work was conducted to study the clinical presentations and the risk factors in individuals with LBP and the relationships with MRI examinations based on whether or not certain spinal abnormalities were found. Moreover, MRI results may not be sufficient to determine the cause of back pain. MRI may detect soft tissue such as discs, nerves, and muscles, which are all probable origins of LBP. No information was available in Mosul concerning MRI and neurological results in individuals with LBP, according to the city's database.

PATIENTS AND METHODS

In this cross-sectional observational study; no changes have been done to patients' ongoing medication profiles. The study was evaluated and approved by the medical research ethicalcommittee(Ninevah University, No. 10 on 24.08.2021). The study Written consent of agreement was collected from patients to participate in this study. Patients were referred by collaborative outpatient neurologistsprivate clinicsthroughout the study period, with the majority of the patients being in chronic conditions. The diagnosis was made using MRI at Mosul teaching hospital,referring from different departments in different hospitals mainly from the neurology unit as an outpatient or as admitted patients, all of them complaining of LBP that not responding to conservative treatment, MRI data were collected using MRI 1.5 Tesla Philips Achieva scanner with a standard 16 channel phased array lumbar spine coil machine. The following parameters were used: Sagital, axial T1(TR 461.0, TE 8.0), T2 (TR 2620.4, TE 100.0), and Myelogram (TR 8111.0, TE 1000.0) were done for each patient (**Figure 1**).

Patients with non-specific chronic back pain were considered suitable for participation in this study.

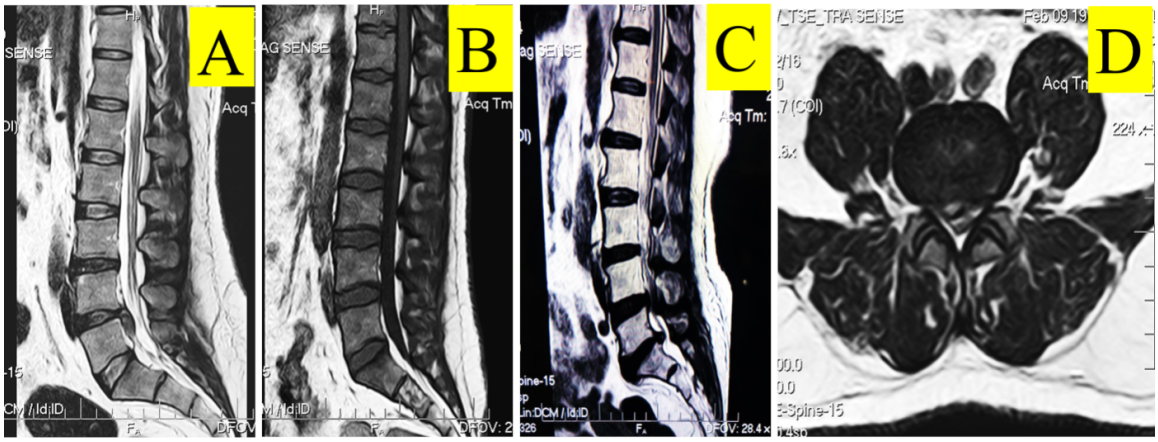

Figure 1 *A representative images for four cases presented to the clinic (A) 41 years old male presented with lower back radiating to lower limbs; T2W sagittal image showing posterior central herniation with caudal migration of L4-5 disc causing spinal canal stenosis. (B) 34 years old male patient presented with lower backache; T1W sagittal image showing normal intervertebral discs , no significant bulging, no spinal canal stenosis. (C) 56 years old male presented with lower back radiating to lower limbs; T2W sagittal image showing posterior central herniation of L5-S1 disc causing spinal canal stenosis associated with degenerative endplates changes. (D) 37 years old female patient presented with backache radiating to right lower limb; T2W axial image showing circumferential disc bulging with right paracentral disc herniation indenting right lateral recess.*

Patients were excluded if they met any of the following criteria: they were under the age of 18 years, patients had previous severe trauma, previous surgery in the spine, scoliosis, significant comorbid conditions or extensive, diffuse pain, clinical indications of polyneuropathy or polyneuropathymyofascitis, inflammation, connective tissue disorders, tumour of the spin, and osteotomy operation of the ilium were excluded. There was no local pain in the back during palpation and all patients were negative in the sacroiliac (SI) joint pain-provocation tests,including distraction, compression, sacral thrust, and pelvic torsion.

This study documented the demographic information of the participants from the outset and estimated their BMI. All patients received a thorough clinical neurological examination, which included a thorough assessment of the lower limbs to rule out the presence of radiculopathy or polyneuropathy in the legs.

The pain was assessed using descriptors, distribution, duration, severity, time course, pain-relieving posture, and current consumption of analgesics or other medications known to mitigate pain, among other things. The current pain intensity at rest and during movement, as well as the mean and maximum pain intensity during the preceding four weeks, were all recorded.

During the interview with the neurologist, indicators for that neuropathic pain were evaluated, such as accidental polyneuropathy or radiculopathy, nerve conduction tests and needle electromyography were done on the lower limbs. Other causes of polyneuropathy as vitamin B12 and folate levels deficiency, thyroid hormone levels, serum protein electrophoresis, complete blood count, serum creatinine, bilirubin and transaminases, blood glucose and glycated haemoglobin (Hb_{A1C}), serum lipid profile were routinely checked.These parameters were evaluated routinely as a part of annual check, the values were up to the normal standard ranges, hence, we didn't mention them in the present study.

RESULTS

The results of this work showed that male patients represent 42% (n=25) of the patients (age range 20-62 years, 44.8±17years; weight 92.68±22, height 172.9±6.6 and BMI 31.2±8.7), while female patients represent 58% (n=35) of the patients (age range 27-65 years, 48.9±11.4 years; weight 84.14±17.4, height 164.8±4.9 and BMI 30.99±6.4), Table 1.

Table 1 *Anthropometric measures of studied sample*

Parameter	Male *n=25*	Female *n=35*	*p* value
Age (Years)	44.8 ± 17	48.9 ± 11.4	0.4
Weight (Kg)	92.7 ± 22	84.1 ± 17.4	0.2
Height (cm)	172.9 ± 6.6	164.8 ± 4.9	*0.0002*
BMI(kg/m²)	31.2 ± 8.7	31.0 ± 6.4	0.9
Gender	41.7% (25)	58.3%(35)	*0.04*

Table 2 *Geographic information of the studied sample*

Parameter	Male *n=25*	Female *n=35*	*p* value	Chi-square
	Residence			
Rural	48%	54%	0.4	0.72
Urban	52%	46%		
	Education			
No formal education	12%	46%	0.0001	
Primary	36%	34%		
Secondary	40%	20%		
High education	12%	0 %		

Table 3 *Relation between gender and severe pain score*

Pain severity	Male *n=25*	Female *n=35*	*p* value	Chi-square
Mild	2(8%)	5(14%)	0.5	0.44
Moderate	12(48%)	16(46%)	0.9	0.01
Sever	11(44%)	14(40%)	0.84	0.04

Table 4 *Clinical information pertained to pain*

Parameter	Male *n=25*	Female *n=35*	*p* value	Chi-square
Post-operation history	0%	5.7%		
	Site of pain			
Right	40%	52%	0.2	2.87
Left	40%	34%		
Both side	20%	14%		
	Pain radiation			
No radiation	16%	26%	0.0001	26
Right	40%	23%		
Left	40%	26%		
Both side	4%	25%		

Table 5 *MRI finding based on gender*

Parameter	Male *n=25*	Female *n=35*	*p* value	Chi-square
MRI positive	80%	69%	0.048	3.9
MRI negative	20%	31%		

The residence distribution in the male group includes 52% (13 patients) of them living in urban areas and 48%(12 patients) living in rural areas, whereas in the female group, 54% (19 patients) of them lived in a rural area and 46 % (16 patients) lived in an urban area. A few male patients graduated; 12% (3 patients), with no formal education, 12% (3 patients), 36% (9 patients) with primary education and 40% (10 patients) with secondary education. All female patients were housewives, with no formal education 46% (16 patients), 34% (12 patients) with primary education and 20%(7 patients) with secondary education. 28% of the male patients were retired 16% were drivers, 8% were teachers and 48% are self-employers (Table 2).

According to the pain score, 8% of male patients presented with mild pain, 48% with moderate pain and 44% presented with severe pain. In females, 14.3% presented with mild pain, 45.7% with moderate pain and 40% presented with severe pain, non-significant differences existed between the groups (Table 3).

Out of 60 patients, only 5.7% (n=2) of females (no males) were reported to have past-surgical history. According to the site of pain, there were non-significant differences between males and females ($p = 0.2$). Males represented 40% on either side while 20% represented pain on both sides, while in females 52% (18 cases) had pain on the right side, 34% (12 cases) with left side pain and 14 % (five cases) had pain on both sides. According to the radiation of pain, 26% (9 cases) had no pain radiation. Other 26% of the cases (9 patients) had radiated pain in the left leg. Patients with right leg radiation pain represent 22% (eight cases) and the remaining 26% (9 cases) presented with both sides of radiation. According to the site of pain: 40% (10 cases) had pain on the left side, 40% (10 cases) with left side pain and 20 % (five cases) had pain on both sides (Table 4).

MRI of individual patients revealed that 80% of males and 69% of females were shown positive MRI results, while 20% of males and 31% of females were negatively represented in MRI (Table 5).

Patients with severe pain (12 males and 14 females) were found to suffer from other symptoms such as spinal canal stenosis and spondylitis. The presence of Spinal canal stenosis in a patient with severe pain was 10 patients (29%) female and 10 patients (40 %) male patients. The presence of spondylolisthesis in a patient with severe pain was 4 patients (26.6%) in females and 2 patients (15 %) in male patients (Table 6).

Table 6 *Correlation between severe pain and spinal canal stenosis & spondylolisthesis*

Gender	Severe pain	Spinal canal stenosis	Spondylolis thesis
Male	12	10	2
Female	14	10	4

Table 7 *Incidence of degenerative endplates changes findings*

Patients defect	Male *n=25*	Female *n=35*	*p* value	Chi-square
Degenerative changes	12(48%)	21(60%)	0.6	0.25
Disc bulging	20(80%)	23(66%)	0.6	0.24
Spinal stenosis	10(40%)	17(49%)	0.6	0.17

Degenerative endplates changes, it is found in 33 patients (55%), including 21 female patients and 12 male patients.The percentage of association between degenerative changes and L 4-5 disc bulging was 80% in male patients and 66% in females, while stenosis was 40% in male patients and 49% in female patients (Table 7).

DISCUSSION

In the present study, more female patients were recruited from the studied sample than male patients with quite similar ages and BMI. Similarly, in a study conducted by Thapa et al, most of the patients' age was around 40 years old.[7] Additionally, Savage et al, have reported that comparing MRI of older to younger patients reportedly showed that age is an important factor in developing LBP-associated degeneration.[8] In contrast, Al-Saeed et al, conducted a study in Kuwait and they reported that even younger patients (less than 30 years) could develop LBP with associated MRI changes.[9] The results of this work showed that being overweight is associated with a greater incidence of LBP in both gender in accordance with the study conducted by Chou et al.[10]

In a study conducted on hotel workers by Wami et al, most of the patients showing back pain were females.[11] The higher rate in females could be explained in the context that females are more prone to musculoskeletal ailments.[12] Similarly in Lebanese study conducted on housewives found that up to three-quarters of the housewives suffered from LBP.[13]

Whether patients live in a rural or urban area does not make a difference in the overall distribution of back pain. These could be in part related to the fact that most rural dwellers moved to the city for work and engaged in office work with only a few farming works done in the villages mostly done by females. There are reports that most of the daily activities which are involved lifting heavy materials ultimately led to LBP.[14,15]

Educational levels seem to greatly impact the distribution of back pain in the female group. Most non-educate females have back pain than educated, however, the male group show inverse proportions with increased back pain with educational levels. These variations are perhaps related to the nature of female daily activity pertaining to household work which needs long times of sitting and standing either for cocking, knitting, sewing, and cleaning activity. In contrast, male work usually involved either office work (sitting) or non-office-based work which do involve handling and lifting heavy objects. This variation inevitably shapes the fate of body bone degeneration and subsequently neural deficits associated with LBP.[16-18] The educational levels support the notion that those with less education are more likely to suffer from incapacitating back pain than those with higher education. A higher amount of evidence supports the idea that education has an impact on the duration and/or recurrence of back pain episodes than the evidence to support the idea that education has an impact on back pain incidence.[19,20]

The severity of pain was similar between males and females and at all levels whether mild, moderate, or severe. Similarly, the site of pain whether left or right has shown no differences between males and females. However, pain is radiating either to the left or right and is more obvious in males than females.[16-18]

On MRI examination, most patients diagnosed with MRI as a positive and more positive rate were present in males than females. In addition to back pain, other symptoms coexist, such as degenerative changes, disc bulging, and spinal stenosis. Females tend to present with degenerative changes and spinal stenosis more than males, however, males are represented with disc bulging. These findings agree with the study conducted by Choi et al, who have found that most patients (80%) expressed a certain degree of degenerative changes at MRI levels ranging from disc degeneration, spinal stenosis,

endplate changes, spondylolisthesis, nerve root compression, disc contour, and others.[21]

Concerning findings on MRI imaging, most patients with positive findings were male. These findings agreed with the results obtained by Al-Shami & Hameed.[22] The importance of the link between the severity of degenerative changes discovered in imaging studies, and the presence and intensity of LBP were described by this work, especially between L4-5 with a higher incidence in males than females.[22] According to the imaging profile 20% of the male patients presented with LBP while 31.5% of females presented with LBP, ranging from normal picture to severe spinal canal stenosis, including different types of disc bulging, spondylolisthesis, and degenerative changes.

We have uncovered an intriguing correlation between the intensity of pain and the presence of spinal canal stenosis on MRI scans. This discovery is consistent with previous findings, as noted in Kasch et al, work, which also identified a clear link between the severity of pain and the occurrence of spinal canal stenosis. In other words, our results provide further evidence to support this important medical connection.[23] Degenerative endplates changes are considered a significant MRI findings in patients with chronic backache, more common in elderly people, this work results showed degenerative endplates changes seen in more than half of patients, the outcome looks similar to Jensen RK.[24] Disc bulging was found to be most common findings in patients with chronic backache , seen in most patients & was most common cause, while in Ibrahim H, disc bulging noted in 60% only.[25]Stem cells and platelet rich plasma could potentially play a great role in the treatment of arthritis and could be applied for LBP due to their anti-inflammatory activity.[26,27]

CONCLUSION

LBP associated with neurological findings presents as positive MRI results and is typically associated with spinal canal stenosis, Spondylolisthesis, and pain. Females has shown higher MRI positive cases than males.

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