The Prevalence of Pathologies Causing Low Back Pain Using Magnetic Resonance Imaging for Categorization

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Abstract

Objective: Low back pain (LBP) is one of the top ten causes of visits to hospitals. Literature review shows that 84% of people have low back pain at some stages of their lives. Therefor the present research study was conducted to find out the prevalence of pathologies causing low back pain using Magnetic Resonance Imaging.

Methods: This was a cross-sectional study conducted in a private tertiary care hospital Peshawar. The sample size was 142, calculated by Rao Soft calculator. The study was conducted during May-August 2020. Data were collected from patients coming to the radiology department for lumber scan MRI and analysed by SPSS version 22.

Results: A total of 142 patients having low back pain including 73 male and 69 females were examined. Degenerative disc diseases (82.3%) were the commonest pathologies. There were a total of 117(82.3%) cases of degenerative disc disease, 09 (6.33%) cases of the traumatic lesion, 08 (5.63%) cases of the congenital lesion, and 5 (3.5%) patients with neoplastic lesions. In this study, there were 44 cases of spinal stenosis, 68 cases of nerve compression. The commonest type of herniation was disc bulge (81.30%) and the most affected lumbar vertebral level by disc bulge was LV4/LV5.

Conclusions: This population-based study shows the prevalence of pathologies causing low back. Males were more affected as compared to females and people with Middle Ages were at increased risk of experiencing low back pain. Degenerative disc diseases (82.3%) were the commonest pathologies, followed by traumatic lesion (6.33%), congenital lesions (5.63%), and neoplastic lesions (3.52%). Future studies with long-term follow-up for determining the benefits of treatments are warranted.

Introduction

Low back pain (LBP) is one of the commonest health conditions affecting the individuals worldwide. It is a widespread problem that affects two-third adults at some stages of their lives and ranks among the top ten causes for appointment to physicians [1]. Also, it is defined as discomfort in the lower posterior trunk from the lower most rib down to the gluteal fold [2]. Moreover, 50–80% of individuals suffer at some stages of their lives [3]. The research proposes that both genders are equally affected by LBP and 30% of teenagers underwent at least a single episode of it [4]. In the United States (US), around $50 billion is spent on LBP annually and is the second-ranked cause of absentees at work [5].

Prevalence and epidemiology

LBP is not only a medical but a social and an economic problem as well. Pain limits the working activities and is the primary reason for absence from workplace discussed already. Two types of this condition are seen in patients acute and chronic. While acute LBP is defined as lumbosacral discomfort of not more than six weeks' duration. Acute LBP is mostly due to accident or other disorders such as arthritis [6]. Chronic LBP is defined as a pain that continues over three months, or longer [7]. According to a 2006 review, the total expenditures on LBP has surpassed 100 billion$ per year in the US [8]. In the US, the lifetime frequency of LBP is around 84% and that of chronic LBP is around 23% moreover it disables about 11 to 12% of the population [9]. In the UK, about 4% of people take leaves from work due to LBP, around 90 million working days are lost and 8-12 million appointments to general practitioners annually [10]. In Canada, more than 8 billion Canadian dollars are spent annually on direct treatment of LBP [11].

Anatomy of lower back

The spinal cord lies within the spinal canal and is bounded by a layer of cerebrospinal fluid (CSF), and then a thick layer of bone or cartilaginous discs. Its widest point is about 15 mm wide and around 45 cm long in an adult human [12]. The lumbar spine is the lower back that initiates beneath the last thoracic vertebrae (T12) and finishes above the sacral spine. The lumbar vertebrae are longer, denser, and block-like structure of dense bone. Anteriorly, vertebral bodies look round. The spinal cord finishes between the first and second lumbar vertebrae [13]. Different regions of the vertebral column have different vertebrae. The region is determined by particular anatomical structures present on the vertebra which is limited to that region [14].

Causes of low back pain

Disc herniation occurs due to spinal discs' degeneration or when the disc becomes thinner. The jelly-like central part of the disc protrudes outward of the central cavity and pushed a nerve root [15]. Disc bulge is when the outer border of annulus fibrous displaces beyond the margins of the adjacent vertebral bodies[16]. Spinal stenosis is another condition responsible for back pain and involves the thinning of at least one area of the spinal column. LBP in spinal stenosis is due to pressure on a nerve [17]. While Fracture to the spine occurs in trauma including huge force with resulting low back pain but can also occur naturally

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or after relatively minor trauma [18]. Similarly, spinal infection or vertebral osteomyelitis is a serious contagious musculoskeletal disease due to vertebral bone infection in adults [15]. Osteoarthritis [19], osteoporosis [20] and malignancy is one of the major risk factors for back pain; whereas metastasis to the spine is usually from breast, prostate, lung, thyroid, and renal cancers [21]. Timely identification of these pathologies is necessary as missed or late diagnosis may have permanent serious results such as severe, long-lasting neurological compromise or may be death. Therefore, it is essential to know about the prevalence of serious pathologies as it helps in clinical decision making [22].

Diagnosis of pathologies responsible for low back pain

Since 1980, MRI has been the basic clinical procedure for the human spine [23]. MRI is the best modality of spine imaging due to its high spatial and contrast resolution and no ionizing radiation compared to other modalities. MR imaging is more sensitive and specific for spinal infection evaluation [24]. Alternative contrast mechanisms including diffusion tensor imaging (DTI) and magnetization transfer function (MTF) were developed in 1990. Through these methods, [25] tissues were examined at the microscopic level using magnetic resonance [26]. Soft tissues such as discs, nerve, and muscles can be easily identified by MRI which is the possible causes of low back pain [27].

Aims and Objective

To find the prevalence pathologies responsible for causing low back pain in patients referring to MRI department for lumbar spine MR imaging.

Methods and Materials

This cross-sectional study was conducted using 0.35T MRI unit at radiology department of Northwest General Hospital and Research Centre Peshawar. Formal approval was taken from in-charge of the related department of selected tertiary care hospital. Total of 142 patients having LBP referred for lumbar MRI scans were included and consented in this study. All eligible MRI images and reports were obtained from the participants and analysed from May-Aug 2020.

Data evaluation: The images were evaluated by the radiologist having 25 years of experience. Also the results were compared with already reported scan by another radiologist for similar examination. Interobserver agreement (k=o.82) was noted.

Inclusion Criteria: Both male and female patients with low back pain between ages 16-76 were included in this study.

Exclusion Criteria: Patients contraindicated to MRI (e.g. cardiac pacemakers, prosthetic heart Valves, ferromagnetic vascular clips, intraocular metallic foreign bodies, cochlear Implants and claustrophobia etc. were excluded from this study.

Statistical Analysis

The collected data has proceeded through SPSS Version 22.

Results

A total of 142 patients having LBP referred for lumbar MRI scans were included in this study. The MRI unit of the radiology department at NWGH and research centre is comprised of 0.35T MRI machine, 3 MRI technologists, 2 female attendants, and well-experienced radiologists. Out of 142 patients, 73 (51.4%) patients were male and the remaining 69 (48.6) were female. The age of participants ranges

from 16-76 years and was divided into three groups 16-30, 31-50, 51-76. The most affected group by Low back pain was 30-50 followed by 16-30. The least affected group by low back pain was 50-76 as shown in Table 1.

Degenerative disc diseases (82.3%) were the commonest pathologies responsible for LBP in this study, followed by the traumatic lesion (6.33%) and congenital lesions (5.63%) respectively. Patients with neoplastic lesions 5 (3.5%) were least common in this study as shown in Table 2. There were a total of 117(82.22) % cases of degenerative disc disease and was the most common cause of low back pain. Of these 65 (55.5%) were male and 52 (44.4%) were female. The most affected age group was 30-50 (45.3%) followed by 16-30 (32.5%). The least affected group by degenerative disc disease was 50-76 (22.2%) as sown in Tables 2 & 3.

There were a total of 09 (6.33%) cases of the traumatic lesion. Of these, 02 (22.22%) were female and 07 (77.77%) were male. Moreover, there were 44 cases of spinal stenosis, out of these 20 were male and 22 were female. The most affected age group between males was 31-50 and between females was 51-76. Additionally, there were 68 cases of nerve compression, of these 36 were male and 32 were female. The most affected male age group was 31-50 and that of females was 51-76 (Figure 1).

In our study, the commonest type of herniation was disc bulge (81.30%), followed by disc protrusion (16.0%) and the least common type of disc herniation was disc extrusion (2.60%). The most affected lumbar vertebral level by disc bulge was LV4/LV5; disc protrusion affects the LV5/SV1 the most as compare to other vertebral levels as shown in Table 4.

Discussion

Low back pain is not only a medical condition but also an economic problem facing worldwide. This study has provided important

Table 1: Age distribution of the participants in years.

Age distribution of the participants in years			
Age		Frequency	Percent
Valid	**30-50**	68	47.9
	16-30	46	32.4
	50-76	28	19.7
	Total	**142**	**100.0**

Table 2: Causes of Low back pain.

Causes of Low back pain		
Pathology	No of cases	Percentage
Degenerative disc disease	117	82.39%
Traumatic lesions	09	6.33%
Neoplastic lesions	05	3.52%
Congenital lesions	08	5.63%
No cause found	03	2.11 %
Total	142	100%

Table 3: Age distribution of patients with degenerative disc disease.

Age distribution of patients with degenerative disc disease					
Age		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	16-30	38	32.5	32.5	32.5
	30-50	53	45.3	45.3	77.8
	50-76	26	22.2	22.2	100.0
	Total	117	100.0	100.0	

Table 4: Shows the types of disc herniation at various lumbar levels.

Types of disc herniation at various lumbar levels						
Herniation Type	LV1/LV2	LV2/LV3	LV3/LV4	LV4/LV5	LV5/SV1	Total
Disc bulge	7	13	33	80	54	187
Disc protrusion	2	3	3	11	18	37
Disc extrusion	0	0	1	3	2	6
Total	9 (3.9%)	16 (6.9%)	37 (16.0%)	94 (40.8%)	74 (32.1%)	230

Figure 1: Sagittal MRI Image of the lumbar spine showing spinal stenosis.

information regarding the prevalence of different pathologies causing low back pain detected on MRI. The prevalence of all target conditions has been determined in both genders and various age groups. The commonest cause of low back pain is related to some form of spinal degeneration. Disc degeneration includes cell-mediated changes in composition and physical disruption. In our study, it was found that degenerative disc diseases were the commonest pathologies contributing to more than 80% causes of low back pain. People who were in the Middle Ages i.e. 30-50 of their lives were affected most by degenerative disc disorders. Other causes responsible for low back pain that were identified in our study were in the following order. Traumatic lesions, neoplastic lesions, congenital lesions, and no cause found.

Injury to the spine results in low back pain. In our study, we found that the traumatic lesion was more in males as compared to females. Congenital scoliosis and lumbarisation are the key factors that are responsible for low back pain that is due to congenital lesions. In our study, we found that the ratio of scoliosis and lumbarisation was the same. Spinal cord tumour is another main cause of LBP in our study; we found that the most affected location of the tumour in the spinal cord was Extradural followed by Intramuralextra medullary. Disc herniation has different types that affect and damage the intervertebral disc. In our study we found that the most common type of disc herniation was disc bulge followed by disc protrusion and the least common type of disc herniation was disc extrusion in our study. Our study shows that the most commonly affected vertebral level by disc bulge was LV4-LV5, the same vertebral level was affected more by disc extrusion. Unlike disc bulge and disc extrusion, disc protrusion affects the LV5-SV1 the most. Apart from the prevalence of different pathologies, our study found that the MRI was the best imaging modality for diagnosis of a spinal lesion like spinal stenosis, disc herniation, nerve root compression, and ligament flavus hypertrophy.

The diagnosis of these pathologies at an initial phase will stop the development of acute LBP to chronic LBP. As chronic LBP has the capability to limit the quality of life of a person and increase the economic burden, so the diagnosis of these pathologies at an early stage may lead to better treatment and improving their quality of life of those suffering from LBP.

Conclusion

This population-based study shows the prevalence of pathologies causing LBP. Males were more affected as compared to females and people with middle ages were at increased risk of experiencing LBP. Degenerative disc diseases were the commonest pathologies responsible in this case, followed by the traumatic lesion, congenital lesions and neoplastic lesions. The commonest type of herniation was disc bulge and the most affected lumbar vertebral level by disc bulge was LV4/LV5. Future studies with long-term follow-up for determining the benefits of treatments are required based on MRI.

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