CORRELATING PLAIN RADIOGRAPHIC FINDINGS WITH MAGNETIC RESONANCE IMAGING AMONG PATIENTS WITH CHRONIC LOWER BACK PAIN IN TIKUR ANBESSA SPECIALIZED HOSPITAL, ADDIS ABABA, ETHIOPIA

Submitted to Addis Ababa University College of health science department of Radiology, for partial fulfillment of the requirement for post graduate certificate in Radiology.

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ABBREVIATIONS

ACP	American College of Physicians
AP	Anteroposterior
APS	American Pain Society
AAU	Addis Ababa University
CLBP	Chronic Lower Back Pain
CT	Computed Tomography
DALY	Disability- adjusted life year
IVD	Intervertebral disc
LBP	Lower Back Pain
MRI	Magnetic Resonance Imaging
NSLBP	Non Specific Low Back Pain
OPD	Outpatient Department
SPSS	Statistical Package for social Science
TASH	TikurAnbessaSpecialized Hospital
WHO	World Health Organization
ZMH	Zewditu Memorial Hospital

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Abstract

Background

Low back pain (LBP) is one of the leading causes of activity limitation and work absence throughout the world, imposing a high economic burden on individuals, families, communities, industry, and governments.
Chronic lower back pain (CLBP) is one of the most frequently encountered patient visits in the outpatient setup like Regular clinics of general hospitals and specialty clinics of Neurology, Neurosurgery and Orthopedics departments.
These patients usually present with non specific lower back pain which makes the differential diagnosis wide, there by imaging has a big part in reaching at the diagnosis in addition to the clinical evaluation. Plain radiography and MRI are the principal imaging modalities that are used in LBP.
As to my knowledge there are only few studies done in our country on the prevalence of lower back pain and there are no published papers related to imaging of lower back pain.

Objective: To correlate the imaging findings of Lumbosacral radiograph with MRI among patients with chronic lower back pain at TASH and ZMH, Addis Ababa, Ethiopia.

Methods and materials: A cross sectional study design was applied. We collected 174 patients during the study period who presented with CLBP having both plain radiograph and MRI of the Lumbosacral region at the Neurology clinics of Tikur Anbessa Specialized Hospital and Zewditu Memorial Hospital. Data collectors administered a structured questionnaire to collect the data. The collected data was then entered and cleaned using IBM SPSS version 20 for statistical analysis. We set the significance level at $P<0.05$.

Results: A total of 174 patients who presented with CLBP having both plain radiography and MRI were included to the study. The majority were female with male to female ratio of 1:2.5. The patients age range from 19 to 84years, two third of the patients being more than 40 years of age.

The most common imaging findings were osteophytes, reduced disc height on both imaging modalities. Osteophytes (anterior and posterior) were seen in 70.7% on plain radiographs and 50.6% on MRI. Disc lesions were more prevalent on MRI 91.4% compared to 48.3% for plain radiography. MRI was found to be able to further characterize the disc lesions. The commonest disc disease on MRI was disc bulge 39.8%, disc herniation 33.1%.

Statistically significant differences in occurrence of positive imaging findings were observed between the different age groups. Osteophytes and degenerative disc diseases were more common in the older age groups.

Conclusion: Findings in this study showed that the commonest imaging findings were osteophytes and reduced disc height, which were depicted both on plain radiographs and MRI. The two imaging findings correlated well. Increasing in age was important risk factor to degenerative disease.

Recommendations: Chronic lower back pain especially in association with radiculopathy requires radiological imaging most importantly MRI.

1- Introduction

1.1 Background

Back pain is attributed to be the second cause of absence from work and resulting in loss of efficiency next to common cold than any other medical condition(1).According to different studies and reports it has been confirmed that 60% to 80% of ordinary people suffer from low backache at least once in their lifetime(2).
Chronic back pain which is also known as Lumbago, has been noted as chronic when it lasts or recurs for more than 3 months(3).
Low back pain has an impact on people of all ages, from children to the elderly, and is anexceedinglycommon excuse for medical consultations. The 2010 Global Burden of Disease Study estimated that low back pain as one of the top 10 diseases that are listed for the highest number of disability- adjusted life year (DALY) worldwide. The lifetime prevalence of non specific (common) low back pain is estimated at 60% to 70% in industrialized countries (one year prevalence 15% to 45%, adult incidence 5% per year). The prevalence rate for children and adolescents is lower than that is identified in adults but is going up. Prevalence increases between the ages of 35 and 55(4).

Low back pain (LBP) is the second most common cause of disability in US adults and a common reason for lost work days. An estimated 149 million days of work per year are lost due to LBP. The condition is also expensive with total costs predicted to be between 100–200 billion dollars annually, two-thirds of which are due to decreased earnings and productivity(5).
LBP incursbillions of dollars in medical expenditures each year and this economic burden is of particular distress inpoorer nations such as Africa. The prevalence of LBP among Africans may be comparable to the reports published in researches undertaken in developed nations. The average lifetime prevalence of LBP among the adolescents was 36% and among adults was 62%(6).
Although a good clinical history taken from patients and performing a careful physical examination are essential in reaching at a diagnosis of the causeof low back pain, Radiological imaging can be considered as the vital investigation and it is crucial for the diagnosis, pre-surgical evaluation and follow-up of patients with low back pain(7).

Plain radiography (x-ray) of Lumbosacral spine is routinely advised in patients with LBP to identify the gross morphological bony changes in vertebral body and its posterior elements but complete evaluation of the soft tissues elements e.g. intervertebral disc (IVD), nerve roots, spinal cord,ligaments and various smaller structures of spine is not possible. With unremittingimprovement in imaging technology and hardware, MRI has enhanced the identification and diagnosis is of the cause of LBP and MRI has become the favored modality for evaluation of degenerative spine diseases as it provides multi planar imaging ability, betterdepiction of intervertebral disc, nerves, ligament, para spinal muscles, epidural fat,CSFand bone marrow. Currently MRI is the most sensitive device for diseases of brain and spine and it gives an excellent window to diagnose conditions like, disc disease whether it is disc bulge, annular tear, protrusion, extrusion or sequestration and its effects on spinal canal, nerve roots, foramina, spinal cord and other adjacent structures(2, 7).

Tikur Anbessa Specialized Hospital and Zewditu Memorial Hospital receives many patients with complaints of CLBP in the outpatient clinics. Most patients will almost always be sent for radiological imaging besides other tests.
In this study the Imaging findings of Lumbosacral radiograph correlated with MRI among patients with CLBP at TASH and ZMH on patients visiting the regular outpatient departments (OPDs) of Neurology was evaluated.

1.2 Statement of the problem

Low back pain is one of the leading causes of disability. It is present in more or less the same proportions in all cultures, disturbs ones quality of life and work performance, and is the most common reason for medical consultations. Few cases of back pain are due to specific causes while large numbers of cases arenon specific. Chronic back pain is a more difficult problem, which often has strong psychological overlay, work dissatisfaction and boredom due to the long duration of pain that affects an individual(8).

CLBP is a widely prevalent problem affecting more than 25 million Americans. Roughly one third (34%) of adults aged 65-74, and adults aged 75 andover (34.9%), and there should be a reported low back pain in the last 3months(9).
The prevalence of CLBP in adults has increased more than 100% in the last decade and continues to increase significantly in the aging population.Previously, it was thought that the etiology of 80% to 90% of LBP cases was unknown has been misguided to know the cause for many decades. In most cases, LBP can be thought as a cause of a specific pain. Knowing the source of the pain is of fundamental importance in determining the management approach. Symptoms can arise from many possible anatomic sources, such as nerve roots, muscle, bones, joints, IVDs and organs within the abdominal cavity(10).

According to various studies and reports it has been confirmed that 60% to 80% of ordinary people suffer from low backache at least once in lifetime. The severity of low back pain may be brutal and may cause debilitation. Mild degenerative changes of spine are physiological and should be considered pathological only if these abnormalities are causing symptoms and clinical signs.
Many structural components of spine are responsible for low backache of degenerative causesas it has been described. The most often seen and common location of these changes is lumbar spine due to heavy mechanical stress and rotatory forces(2, 11).
Investigations additional to the clinical examination are required when a patient's signs or symptoms (red flags) raise a high point for suspicion that there is a serious pathology going on. Relevant investigations include blood tests, nerve conduction tests, imaging such as radiography, magnetic resonance imaging (MRI), computed tomography, and dual energy x-ray absorptiometry, and rarely myelography.
The red flags that are listed by American journal of neuroradiology are recent significant trauma, or milder trauma, age>50, unexplained weight loss, unexplained fever, immunosuppression, history of cancer, IV drug use, prolonged use of corticosteroids, osteoporosis, Age > 70, Focal neurologic deficit progressive or disabling symptoms, duration greater than 6 weeks(12).

The motive is to identify all or most cases of serious pathology using less of the unwanted diagnostic testing. These invasive investigations should rarely be ordered and done for patients with LBP, because serious pathology presenting as LBP is usually not common(11).

1.3 Significance of the study

Plain radiograph has been repeatedly said to be the primary imaging modality in patients presenting with this problem, followed by MRI for those having chronic symptoms or red flags or as a recommendation from a radiologist.

The purpose of the study was to generate the latest research based data on imaging findings of Lumbosacral spine on plain radiograph correlated with MRI among patients with CLBP that will be retrieved from the Regular OPD of department ofNeurologyat TASH and ZMH Addis Ababa, Ethiopia.

This study also established the how much imaging agreement there will be with the two imaging modalities in those patients.

2 Literature review

Radiological imaging is known to be the most vitalinvestigation modality and it is important particularly for the diagnosis, pre-surgical evaluation and follow-up of patients with low back pain(7). However it is said that there is a limited role of imaging in patients with non specific acute low back pain if there are no alerting clinical conditions like associated radiculopathy or spinal canal stenosis and progressive neurologic deficits, and conservative approach is better with evaluation in 4-6weeks since most acute LBP was seen to be self limiting and there was no cause identified in upto 95% of patients(13). Because non-specific LBP at present cannot be more classified, but LBP can be classified according to its duration: acute LBP (duration less than six weeks); sub-acute LBP (duration more than six weeks and less than three months); and chronic LBP (duration more than three months)(11).

In 2007, the American College of Physicians (ACP) and the American Pain Society (APS) published a joint clinical practice guideline on the diagnosis and management of LBP. The guideline gives updated evidence on appropriate diagnostic imaging in patients with LBP that should be based strongly on the clinical evaluation, specifically the history and physical examination evidences that helps to guide decision on imaging. Acute low back pain and non specific LBP should not be imaged without prior conservative therapy for a duration of six weeks(14). Depending on the ACP/APS recommendations on use ofimaging could decrease overuse. And unless there are related pathologies that urge for imaging evaluation clinicians should be limited from imaging patients that are in acute and sub acute course of LBP(15).

Appropriate investigations additional to the clinical examination are required when a patient's signs or symptoms alert that there is a serious pathology. In addition to other investigations imaging such as radiography, MRI, CT and, andrarely myelography can be required(11).
A lumbar spinal X-ray examination is usually done primarily in patients withnon specific low back pain(NSLBP) to evaluate presence of degenerative, congenital, and postural abnormalities associated with NSLBP or to exclude specific causes of LBP with several red flags(16).
The standard Anteroposterior (AP), lateral and oblique Views deliver 11 rad to the skinand one of the highest doses of any radiologic examination to the gonads. The oblique views,which contribute greatly to the dose of radiation,have been found to detect such unexpected pathological features as spondylolysis in only 5% to10% of cases. If radiography is performed the views should be onlyAnteroposterior and lateral.In cases of chronic pain the films show classic signs of degeneration,such as narrowing of the disc space, end-plate sclerosis, disc calcification andthevacuum disc phenomenon, where in gas forms in the disc as the disc degenerates. The most common surgically correctable cause of low back pain disc herniation cannot be seen on plain films(17).Therefore repeat use of lumbar spine radiograph is seen to be overused and have been said to have low diagnostic value(18).

The use of MRI instead of radiographs as the initial imaging modality has become common, especially considering that several randomized controlled trials have suggested that substituting MRI for radiography is not only safe but crucial since MRI scans detect a greater number of abnormalities including neoplasms in a primary care population. It is for these reasons that McNally E.G, Wilson D.J

and Ostlere S.J have decided to substitute radiographs with 'limited MRI' in patients with LBP of at least six weeks as a routine practice(19). On the contrary, In a Randomized controlled trial on 2003, Rapid MRIs and radiographs resulted in nearly identical outcomes for primary care patients with low back pain. Even though physicians and patients preferred therapid MRI, substituting rapid MRI for radiographic evaluations in the primary care setting may give insignificant additional benefit to patients, and it may increase the costs of care because of the increased number of spine operations that patients are likely to undergo(20).

Low back pain (LBP) has a prevalence of 84% in Africa. The commonest form of imaging is plain lumbar spine x-ray,because of ready availability and low cost(21).X-rays are helpful for evaluation of fracture, bony deformity including degenerative changes, sacroiliitis, disk and vertebral body height and assessment of bony density and architecture. X-rays are part of initial workup, if the history and physical exam suggests non mechanical cause of back pain or if red flags are present MRI does not require radiation exposure and provides better visualization of soft tissue and spinal canal(13).

Ross and Modic found 82.6% precision between MRI and surgical findings for the type and location of the disease. MRI is recognized as being accurate for detecting intervertebral disc herniation. Additionally, MRI has high accuracy in differentiating the subtype of disc herniation. The author stated that any of the subtypes of herniation, if not severe, might not cause evident reduction of the disc height in lateral lumbosacral radiograph. When decrement of posterior disc height is apparent on radiograph, the degree of herniation would have been severe enough to cause spinal stenosis and/or nerve root compression. So, when the posterior disc height is less than 6 mm in a symptomatic patient, MRI should be considered to evaluate the spinal canal and neural foramina. Plain lumbosacral radiograph is sensitive though not specific for the investigation of low back pain. Some of the radiographic features such as reduction of posterior intervertebral disc height, posterior osteophytes, spondylolisthesis, spondylolysis and end-plate changes correlated significantly with MRI findings of disc herniation, nerve root compression, and spinal stenosis(7).

There was a perfect agreement seen between radiography and MRI concerning normal findings, hypolordosis and osteophytes but there was a moderate agreement observed on disc disease on a study conducted at the University of Nairobi on 2015(22).

Coming to the prevalence of LBP in Ethiopia, On A cross-sectional study with internal comparison that was conducted throughout the period of October-December, 2015 among Nurses working in AddisAbaba Public Hospitals, the study included 395 Nurses who gave a response rate of 91.9%. The mean age was 30.6 (±8.4) years. Majority of the respondents were female (285, 72.2%)(23). On another study that was conducted on the prevalence of low back pain among teachers in Gondar Town, North Gondar, Amhara Region, Ethiopia, 2011. Of 602 teachers, 346 (57.5%) experienced low back pain (LBP) throughout their job career(24).

In East Africa, the utilizationof MRI in assessment of CLBP has been encouraged. The main drawback for MRI is the cost as well as the accessibilitycompared to that of plain radiograph which ischeap and easily available. This has been shown in a local study done in 2013 in Kenya, to examine the relationship between socio-demographic and clinical characteristics of patients with LBP. The study found that lumbar disc disease was the commonest cause of LBP which is obviously better picked on MRI and therefore recommended that public hospitals should be adequately equipped with radiological equipment especially MRI which was found to be unavailable in most hospitals(25).

3 Research questions

1. What are the plain lumbar radiographic findings in patients with Chronic Low Back Pain?

2. What are the MRI findings in the same pool of patients with Chronic Low Back Pain?

3. How do the imaging findings of conventional plain radiographs and MRI correlate with each other?

4. Objective

4.1- General Objective

- To correlatethe imaging findings of Lumbosacral spine in plain radiograph and MRI among patients with CLBP in TASH and ZMH, Addis Ababa, Ethiopia.

4.2- Specific Objectives

- To know the imaging findings of Lumbosacral radiograph in patients with CLBP coming to TASH and ZMH, Addis Ababa, Ethiopia.

- To know the imaging findings of Lumbosacral MRI in patients with CLBP coming to TASH and ZMH, Addis Ababa, Ethiopia.

- To correlate imaging findings of patients having both Lumbosacral Radiograph and MRI in patients with CLBP coming to TASH and ZMH, Addis Ababa, Ethiopia.

5. Methods and Materials

5.1- Study area and period

The study was conducted at TASH and ZMH, Neurology regular OPDs Addis Ababa, Ethiopia. TASH is under college of health sciences campus of Addis Ababa University (AAU), which is one of the pioneer universities in the country. The hospitals are a tertiary level referral and teaching hospitals providing service to people from all corners of the country in its various departments such asinternal medicine, surgery,orthopedics, gynecology and obstetrics, pediatrics, radiology, neurology, radiotherapy, adult oncology, pediatric oncology /hematology, nuclear medicine, psychiatry, laboratory, orthopedics,pharmacy etc. It gives undergraduate, post graduate and several subspecialty training programs in medical and health sciences. The radiology department is equipped with high-tech radiologic devices including twox ray machines, around ten ultrasound machines, two CT scan machines and a 1.5T MRI machine.

This study was conducted from November 1st to June 30th 2019GC.

5.2- Study design

The study is institutional basedretrospective cross sectional study of patients who had Lumbosacral radiograph as well as MRI, at TASH and ZMH, visiting Neurology regular OPDs.

5.3- Source and Study population

5.3-1. Source population - All Adult patients coming with CLBP at Regular OPD of Neurology department having both Lumbosacral radiograph and MRI at TASH and ZMH.

5.3-2. Study population - All adult patients coming with CLBP at Regular OPD of Neurology department having both Lumbosacral radiograph and MRI at TASH and ZMH during the study period. Since both hospitals receive the same type of patients, no specific number was assigned to any of the centers.

5.4- Inclusion and Exclusion criteria

5.4-1. Inclusion criteria

- Adult Patients having CLBP having both Lumbosacral radiograph and MRI of all gender with available complete set of the required information.

- Patients with a history of chronic LBP greater than or equal to 3months duration who have both a plain radiograph and an MRI.

5.4-2. Exclusion criteria

The following group of patients with CLBP visiting the regular OPDs of Neurology of the hospitals during the period will beexcluded from the study.

- Patients with incomplete or unavailable medical records
- Patients with acute andsub acute Low back pain (<3months duration)
- Patients with history of acute trauma to the back.
- Patients with only plain radiography with no MRI (incomplete investigation).
- Patients who have undergone any form of lumbar surgery.
- Patients with known primary malignancy.(spine/other sites)

5.5- Sample size determination and sampling procedure

5.5-1. Sample size determination

A minimum sample size of 174 participants will be sufficient to demonstrates an agreement of k=0.7 between conventional radiography and MRI in diagnosis of chronic lower back pain. The study will be powered at 80% with 95% level of confidence. The hypothesized agreement between conventional radiography and MRI A will be based on a study conducted by P.Y Yong, NAA Alias, ILShuaib that demonstrated an agreement of 0.7. The sample size calculation assumes a lower limit of the kappa co-efficient of k=0.6 and a 50% occurrence of chronic lower back pain among clients who are served in the study sites. The table below indicates derived sample sizes based on the following[1]:

K0= Hypothesized kappa co-efficient (0.7)
kL= Lower confidence limit of the hypothesized kappa co-efficient (0.6)
π= prevalence of chronic lower back pain (50%)
n = number of raters. In this case it will be 2; conventional radiography and MRI

			Number of Raters (n)			
κ_0	κ_L	π	2	3	4	5
		0.10	559	373	301	255
0.50	0.40	0.30	264	146	112	95
		0.50	228	120	89	76
		0.10	140	94	76	64
0.60	0.40	0.30	66	37	28	24
		0.50	57	30	23	19
		0.10	463	311	247	207
0.70	0.60	0.30	205	124	99	87
		0.50	174	102	81	73
		0.10	116	78	62	52
0.80	0.60	0.30	52	31	25	22
		0.50	44	26	21	19

The sample size is based on the formula[2]:

$$n = \frac{(z_\alpha + z_\beta)^2 \cdot (E + F - G)}{[(1 - p_e)^2 \cdot \Delta\kappa]^2},$$

…….(1)

[1]Donner, Allan and Rotondi, Michael A. (2010) "Sample Size Requirements for Interval Estimation of the Kappa Statistic for Interobserver Agreement Studies with a Binary Outcome and Multiple Raters," The International Journal of Biostatistics: Vol. 6: Iss. 1, Article 31.DOI: 10.2202/15574679.1275
[2]Lee Tzeh San and CDC.On determination of sample size for the positive kappa Lee Tzeh San and CDC. On determination of sample size for the positive kappa Coefficient .Joint Statistical meetings.

Where,

E= $E = \sum_{i=1}^{2} p_{ii} \cdot [(1 - p_e) - (p_i + p_i)(1 - p_o)]^2$. **…….(2)**

F= $$F = (1 - p_o)^2 \cdot \sum_{i=1}^{2} \sum_{j \neq i} p_{ij} \cdot (p_i + p_j)^2 .$$ ***……(3)***

$$G = [p_o \cdot (1 + p_e) - 2p_e]^2 .$$

G= **……..(4)**

n = sample size
Zα= the derivative that represents the 95% level of confidence (1.96)
Zβ=value of the standard normal distribution corresponding to the desired level ofpower of the study (0.84 for power of 80%)
Pe= is the hypothetical probability of chance agreement (applied in calculating the Cohen's kappa co-efficient)
P α= relative observed agreement among raters (applied in calculating the Cohen's kappa co-efficient)

5.5-2. **Sampling procedure:** Simple random sampling technique will be used to select the medical records of the patients with CLBP fulfilling the inclusion criteria during the study period.

5.6- Data collection instruments, techniques and data collectors

Patients will be recruited into the study when they have both MRI with prior plain radiograph and patients with absence of any of the imaging studies will be excluded from the study. Imaging findings will be filled in the data collecting sheet provided for this study.

Plain radiographs accepted for the study will include Antero posterior (AP) and lateral views, and a Lumbosacral MRI done with the standard protocol.

Loss of the normal lumbar curvature (lordosis) will be reported as muscle spasm since hypo lordosis in symptomatic patients has been associated with para- spinal muscle spasm.

The imaging findings of each of the modalities will be entered into an MS excel table and comparison will be made based on the level of pathology. Example, whether both modalities picked an abnormality at the same vertebral level or whether a certain modality missed the pathology.

Data collection will be conducted after receiving ethical clearance to conduct this study from the ethical review committee of TASH. Demographic data of participant patients such as age, gender and presenting symptom and duration will be collected from the eligible patient data.

Clinical data and final radiological diagnosis of the conventional radiography and MRI will be obtained from the patient's medical records. The Principal Investigator will collect the data on the structured data collection format and will be filled into SPSS version 20.

5.7- Data processing and analysis

The collected data was entered and cleaned using SPSS/ Statistical Package for the Social Sciences version 20 for statistical analysis.

5.8- Ethical considerations

Data collection proceeded after Ethical clearance is obtained from the ethical review committee of the department of radiology at TASH. Data collection was done by the principal investigator. On the data collection form, anonymity was assured by omitting names of patients. Information about patients will be kept confidential.

5.9- Dissemination of results

Results of the study will be submitted to the department of radiology of TASH as part of dissertation requirement for the postgraduate certificate program and will be presented on a seminar prepared by the research committeefor all staff and residents in the department. It will also be submitted for medical journals for possible publication.

6. Results

A total of 174 patients were enrolled into this study. The mean age was 48.24 years (SD= 14.676 years). Forty nine (28.2%) were male and One hundred and twenty five (71.8%) were female.

6.1- DEMOGRAPHIC CHARACTERISTICS

Figure 1: Age distribution

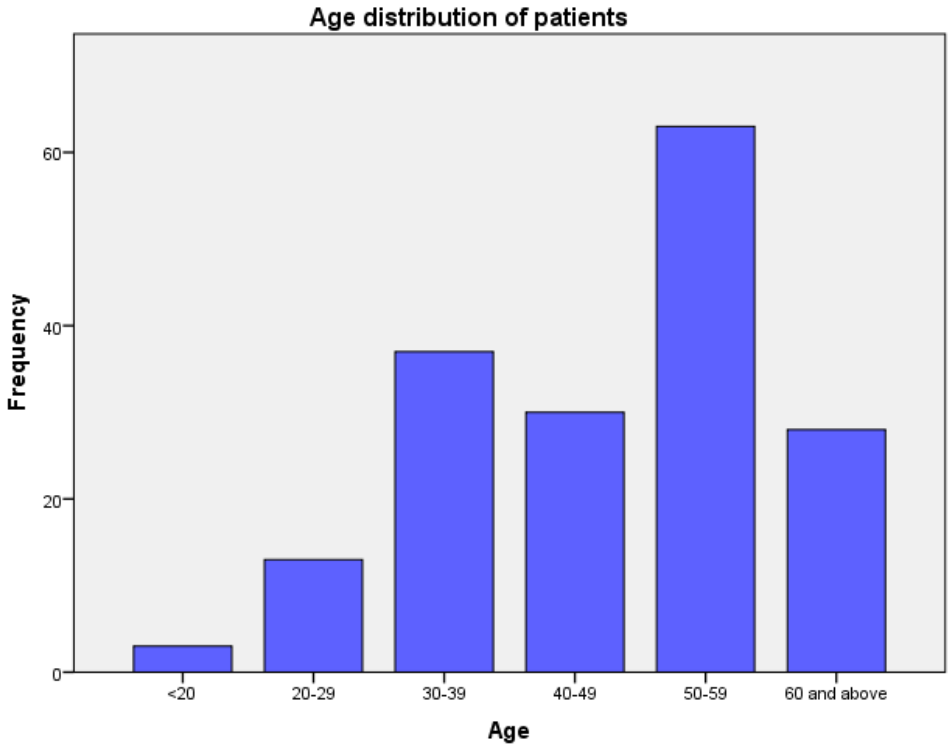
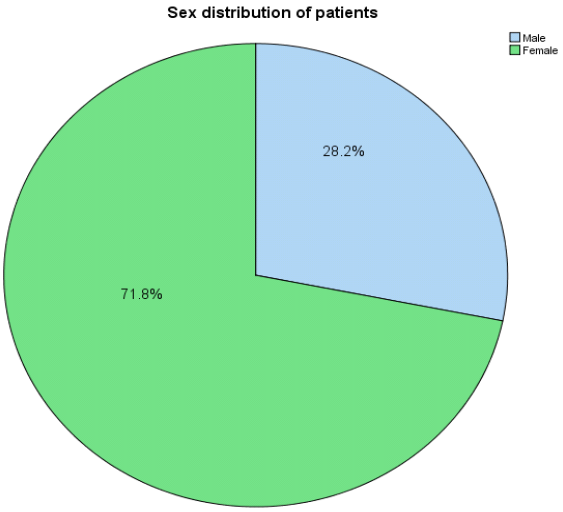


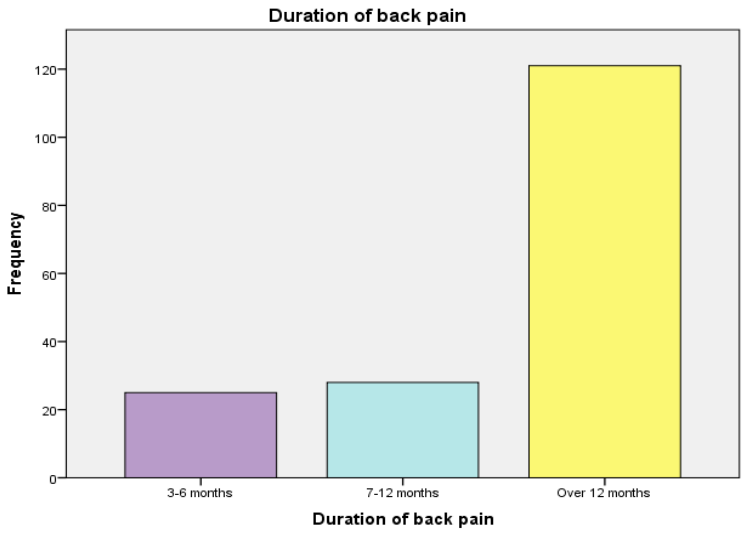
Figure 2: Gender distribution



6.2 Duration of back pain

All patients reported experiencing back pain more than 3 months. Out of 174 patients who reported their duration of back pain 53(30.5%) has experienced it for less than one year and 121(69.5%)had experienced back pain for more than one year as summarized in figure 3.

Figure 3: Duration of back pain among study participants



6.3 IMAGING FINDINGS

6.3.1 Frequencies of diagnoses on radiographs and MRI

Figure 4: Bar chart showing frequency of various findings on plain radiographs

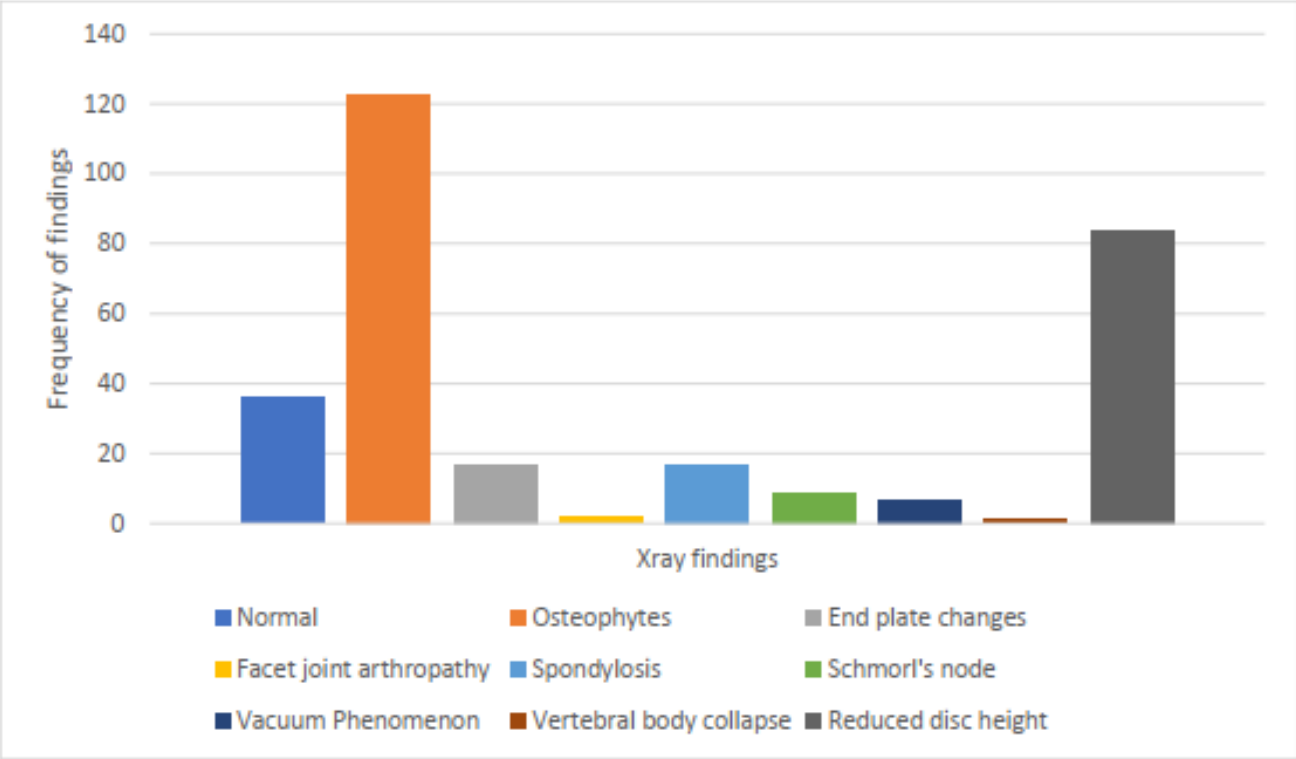
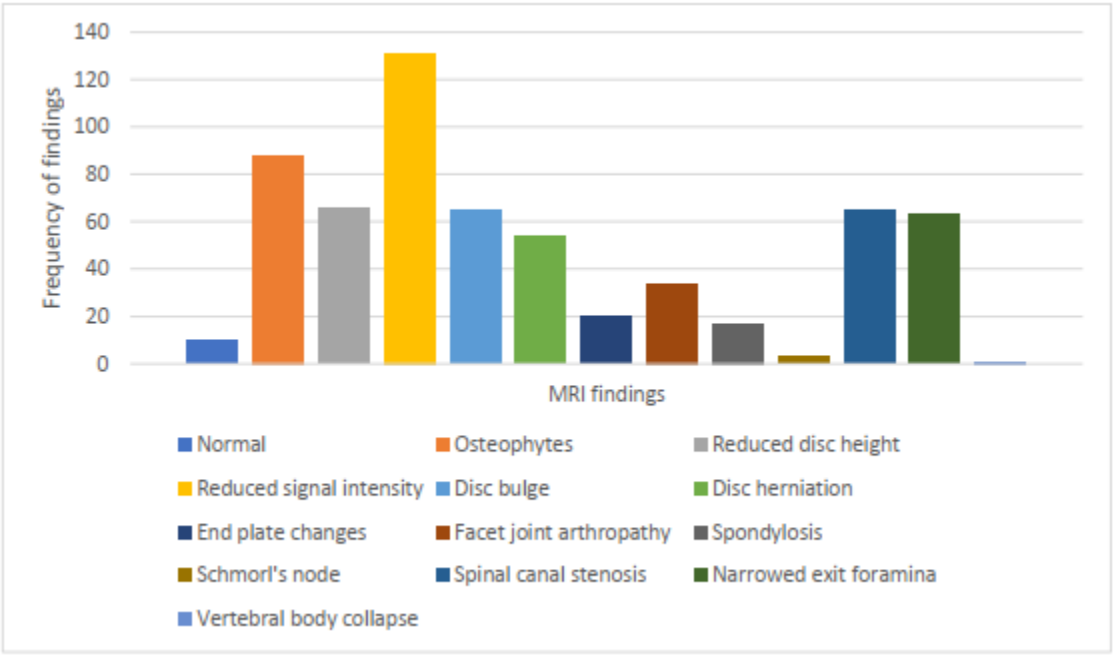


Figure 5: Bar chart showing frequency of various findings on MRI



6.4 PLAIN RADIOGRAPHIC AND MRI FINDINGS WITH AGE CORRELATION

Most of the patients were found to have disc disease, anterior/posterior osteophytes on both plain radiography and MRI. On plain radiography disc disease was seen as reduced intervertebral disc height and on MRI disc disease was seen as reduced signal intensity on T2 (desiccation), reduced disc height, disc herniation and disc bulge. These findings affected a single vertebral level or multiple sites.
The findings are summarized in the tables below.

i) Reduced disc height

Table 1: Age vs reduced disc height – Radiograph

		Reduced disc height on Xray		Total
		Yes	No	
Age category	20-29	2	0	2
	30-39	8	20	28
	40-49	18	5	23
	50-59	34	23	57
	60 and above	22	6	28
Total		84	54	138

This table shows patients above 50 years of age had higher occurrences of reduceddisc heights.

Table 2: Age vs reduced disc height – MRI

		Reduced disc height on MRI		Total
		Yes	No	
Age category	<20	0	1	1
	20-29	0	6	6
	30-39	8	27	35
	40-49	3	27	30
	50-59	33	30	63
	60 and above	22	6	28
Total		66	97	163

This table shows patients above 50 years of age had higher occurrences of reduced disc heights.

ii) Osteophytes

Table 3: Age vs osteophytes – Radiograph

		Osteophytes on XRAY		Total
		Yes	No	
Age category	20-29	0	2	2
	30-39	26	2	28
	40-49	21	2	23
	50-59	54	3	57
	60 and above	22	6	28
Total		123	15	138

This table shows patients between 50-59 years of age had higher occurrences of osteophytes.

Table 4: Age vs osteophytes –MRI

		Osteophytes on MRI		Total
		Yes	No	
Age category	<20	0	1	1
	20-29	0	7	7
	30-39	9	26	35
	40-49	20	10	30
	50-59	43	20	63
	60 and above	16	12	28
Total		88	76	164

This table shows patient between 40-60years of age had higher occurrence of osteophytes.

iii) Table 5: Age vs Disc dessication- MRI

		Decreased signal intensity of IV disc on MRI		Total
		Yes	No	
Age category	<20	0	1	1

	20-29	0	6	6
	30-39	26	9	35
	40-49	28	2	30
	50-59	49	14	63
	60 and above	28	0	28
Total		131	32	163

This table shows higher occurrence of degenerative desciccation with the majority between 50-59years.

Table 6: Age vs Disc herniation- MRI

Count				
		Disc herniation on MRI		Total
		Yes	No	
Age category	<20	0	1	1
	20-29	0	2	2
	30-39	11	24	35
	40-49	18	12	30
	50-59	5	59	64
	60 and above	20	11	31
Total		54	109	163

This table shows patients 40-49 shows higher occurrences of disc herniations.

Table 7: Age vs Disc bulge – MRI

Count				
		Disc buldge on MRI		Total
		Yes	No	
Age category	<20	1	0	1
	20-29	6	0	6
	30-39	5	30	35
	40-49	8	22	30
	50-59	39	24	63
	60 and above	6	22	28
Total		65	98	163

This table shows highest occurrence of disc bulge at 50-59 years.

6.5 AGREEMENT BETWEEN PLAIN RADIOGRAPHS AND MRI

FINDINGS

The extent of final agreement in the final diagnosis based on the conventional radiography and MRI readings was determined using the Cohen's Kappa analysis and the strength of agreement was demonstrated by the kappa co-efficient. The kappa co-efficint (k) was transtted as shown in box 1:

Table 8: AGREEMENT BETWEEN PLAIN RADIOGRAPH AND MRI

	Agreement	Kappa co-efficient (standard error)	p-value	Rating
Normal		0.479(0.088)	0.000	Moderate agreement
Osteophytes		0.753(0.072)	0.000	Substantial agreement
Disc disease		0.523(0.040)	0.013	Moderate agreement
Reduced disc height		0.742(0.055)	0.000	Substantial agreement
End plate change		0.844(0.068)	0.000	Substantial agreement
Facet joint arthropathy		0.086(0.057)	0.013	Slight agreement
Spondylosis		1.000(0.000)	0.000	Almost perfect agreement
Schmorl's node		0.162(0.154)	0.012	Slight agreement
Vertebral body collapse		1.000(0.000)	0.000	Almost perfect agreement

Box 1: Interpretation of kappa co-efficient (k)
≤0=poor agreement
0.01–0.20=slight agreement
0.21–0.40=fair agreement
0.41–0.60=moderate agreement
0.61–0.80 =substantial agreement
0.81–1=almost perfect agreement.

7. DISCUSSION

The main objective of this study was to correlate the imaging findings of patients with chronic lower back pain obtained using plain radiographs and MRI.

The mean age for presentation of LBP was 48.2years (+/-14.6years). This is similar to a number of studies(25, 26) Damian Hoy and Christopher Bain in their study showed with the highest prevalence of low back pain among female individuals and those aged 40–80years. Similar findings were also seen in a Nigerian study the mean age was 54.5±12.5 years, with one-third(32%) of patients in the age range of 50-59 years(27).
Possible reason to the age group in this study is that likely most individuals in this age group might be undergoing age related degenerative changes ensuing in the incident of lower back pain.

Low back pain was seen to be more common in this study. Females accounted for 71.8% as compared to the males who accounted for 28.2%. The study of Damian Hoy also showed similar findings of female predominance(26). Different results were seen in study by N.K Irurhe(27) which showed LBP to be more common in males(65.5%) rather than females (34.4%).

The Kappa statistic was used to evaluate the agreement between MRI and the plain radiographs. There was moderate agreement between findings of disc disease on both modalities (k=0.523,p=0.013). This shows that MRI picked more disc lesions as compared to plain radiographs which could only show reduced disc heights. The findings confirm that plain radiographs may be sensitive in detection of disc disease but are very non specific with regards to the type of disease and the severity. A study by P.Y. Yong et al(7)also observed no significant relationship between reduced disc heights on radiographs and disc disease (herniation) on MRI. This therefore means that when reduced intervertebral height was observed on a plain radiograph in a symptomatic patient, then MRI was recommended to evaluate the state of the spinal canal and the neural exit foramen.

The presence of osteophytes had a substantial agreement in both modalities (Table 8). Despite this plain radiographs still picked a higher number of osteophhytes 123(70.6%of patients) compared to MRI 88(50.5%)of patients. This could be the limited ability of MRI to bony structures(28) as opposed to plain radiography.

No malignancy/tumor was reported in all the images evaluated.

CONCLUSION

- Lumbar osteophytosis and degenerative disc desiccation are the commonest imaging findings in patients with Chronic Low Back Pain.

Lumbosacral MRI is superior in evaluating and detecting disc pathologies better than lumbosacral radiograph.

- Increasing Age is important risk factors to chronic low back pain.

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APPENDICES

Annex- 1 Patient information data collection sheet

Patient presenting with Chronic lower back pain (>=3months) having both lumbosacral radiograph and MRI examinations

Form number	**MRN**	**Age**	**Sex**	**Duration of symptoms**	**Additional symptoms (if any)**
001					

Annex-2 Imaging findings data collection sheet

Tick where appropriate (Please indicate vertebral level .eg disc disease at L2)

Imaging findings	**Plain radiograph (date of examination…. /….20….)**	**MRI (date of examination:…../…..20…..)**
Normal		
Osteophytes		
Disc disease		
End plate changes		
Facet joint arthropathy		
Spondylolysis		
Schmorl's node		
Vacuum phenomenon		
Spinal canal stenosis		
Narrowed exit foramina		
Paravertebral mass		
Vertebral body collapse		
Others		

KEY: Codes for findings with more than one characteristic

Disc disease:

Reduced disc height- D01

Abnormal signal intensity-D02
High Intensity Zone-D03
Disc bulge-D04
Disc herniation-D05
Disc prolapse-D06
End plate changes: End plate sclerosis- E1