MAGNETIC RESONANCE IMAGING (MRI) PATTERNS AMONG PATIENTS WITH LOW BACK PAIN ATTENDING MRI CENTRES IN ELDORET, KENYA.

BY

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DECLARATION

DECLARATION BY THE CANDIDATE

This thesis is my original work and has not been presented for a degree in any other University. No part of this thesis may be reproduced without prior permission of the Author and/ or Moi University.

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DEDICATION

I dedicate this work to my parents, siblings, John and Kinsey.

ABBREVIATIONS AND ACRONYMS

BMI: Body Mass Index

DICOM: Digital Imaging and Communications in Medicine

IQR: Interquartile Range

IREC: Institutional Research and Ethics Committee

LBP: Low Back Pain

LDD: Lumbar Disc Degeneration

MRI: Magnetic Resonance Imaging

0.25-0.30T: 0.25- 0.30 Tesla

STATA V. 10: Data Analysis and Statistical Software Package created in 1985 by Statacorp.

DEFINITION OF TERMS

• *Low back pain:* Pain experienced in the lumbar region of the spine.

• *Acute low back pain:* Low back pain present for fewer than 4 weeks.

• *Chronic low back pain*: Low back pain present for more than 3 months.

• *Nonspecific low back pain:* Pain occurring primarily in the back with no signs of a serious underlying condition such as cancer, infection.

• *Herniated disc*: Extension of the disc in some abnormal manner beyond margin of vertebral body.

•*Disc bulge*: Diffuse extension of disc by > 2mm beyond the vertebral margin.

•*Disc protrusion*: Focal, small extension of disc beyond vertebral margin with anteroposterior< mediolateral diameter.

•*Disc extrusion*: Greater extension of focal disc material than a protrusion with the anteroposterior> than mediolateral diameter.

• *Spinal stenosis:* Narrowing of the spinal canal that may result in bony constriction of the cauda equina and the emerging nerve roots.

• *Spondylosis*: describes the presence of osteophytes arising from the bodies of the vertebrae.

• *Radiculopathy:* Dysfunction of a nerve root associated with pain, sensory impairment, weakness, or diminished deep tendon reflexes in a nerve root distribution.

• *Sciatica:* Pain radiating down the leg below the knee in the distribution of the sciatic nerve, suggesting nerve root compromise due to mechanical pressure or inflammation.

• *Neurogenic claudication:* Pain in the buttock, thigh or leg.

• *Neoplasm:* An abnormal growth of new tissue that can be benign or malignant.

•*Sedentary* (of work or a way of life) characterized by much sitting and little physical exercise

Magnetic Resonance Imaging (MRI) Patterns among Patients with Low Back Pain attending MRI Centres in Eldoret, Kenya.

ABSTRACT

Background -Low back pain (LBP) is the most prevalent musculoskeletal condition and one of the most common causes of disability. Patients presenting with LBP require diagnostic imaging to determine the cause. Plain spine x-ray examinations are readily available, but have a low yield of findings, necessitating evaluation by MRI. The aim of this study is to find out MRI patterns in LBP a practice that is well established in developing countries, but is not well documented in the developing world due to the high cost of MRI and its unavailability.

Objective: To determine the MRI patterns among patients with low back pain attending MRI centres in Eldoret, Kenya.

Setting: The Radiology and Imaging departments of the Eldoret and Mediheal Hospitals in Eldoret, Kenya.

Study Design: This was a cross-sectional study.

Subjects: Adult patients with LBP referred for lumbar spine MRI.

Methods: 185 patients with LBP, who met the inclusion criteria, underwent MRI from October 2011 to April 2012. Sampling was done using Fischer's formula and adjusted for finite population taking into account the number of MRIs done in a month. Data was analyzed using STATA version 10. Descriptive statistics were carried out for continuous variables using mean, median, standard deviation and inter-quartile range. Frequency tables were generated for categorical variables. The chi square test and Fishers' exact test were used to test for associations. A p-value < 0.05 was considered statistically significant.

Results: The median age was 47 years and mean age was 47.32 ±14 years. LBP was seen in 50.81% men and 49.19%. M: F was1: 0.97. The main presenting complaints were LBP in 65.95%, radiating LBP in 30.81% and LBP with inability to walk in 3.24%. The median duration was 1 year and the mean was 3.79±5.82 years. 79.46% had no history of trauma. Predominant occupations were 36.22% office workers, 17.30% farmer, 4.32% student, 12.97% housewife and 18.38% laborers. The patterns identified on MRI included: 80% degenerative disc disease, 23.78% lumbar spondylosis, 4.86% infections, 9.73% neoplasms and 15.68% other anomalies. 65.41% bulges and 23.24% herniations (62.79% broad based, 6.98% extrusions, 30.23% protrusions) were reported. The most common site for degenerative findings was L4/L5 followed by L5/S1. Nerve root compression was the most common complication. No association between lumbar disc degeneration (LDD) and socio-demographic factors was found.

Conclusion: MRI is useful in detecting LDD which is common in the lower lumbar regions of both sexes.

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CHAPTER ONE: INTRODUCTION

1.0 Introduction

This chapter outlines the background to the study, the problem statement, justification, research question and objectives of the study.

1.1 Background

Low back pain (LBP) is the most prevalent musculoskeletal condition and the most common cause of disability in developed nations[1]. LBP is equally a problem in the developing countries. Data on LBP in the developing countries is scanty but all the same keeps accumulating. The same can be said of Kenya where there is no statistics on the prevalence of LBP. LBP has significant economic implications as it results in disability of the working population[2, 3].

In daily medical practice, most patients presenting with LBP may require immediate diagnostic imaging when not responsive to conservative management[4]. Some of the conditions detected using diagnostic imaging include: infection, malignancy, rheumatologic diseases, neurologic disorders and referred pain from other organ systems.

Frequently ordered for LBP are plain spine x-ray examinations. Despite the low costs, there are certain drawbacks associated with plain radiographs that include: low yield of findings that alter management; poor relationship between most radiographic abnormalities and symptoms of LBP; and high doses of gonadal irradiation[5].

It is for this reason that magnetic resonance imaging (MRI) with its multiplanar capabilities and lack of ionizing radiation despite its relative costliness provides excellent anatomical details of the lumbar spine. Indications of MRI include patients with LBP either alone or with motor and sensory deficits or a suspected systemic cause of back pain such as infection or neoplasm and when referral for surgery is a possibility[4].

In developing Africa, population studies on LBP have been conducted and most of these studies show that LBP prevalence is as high as it is in the developed countries. However, according to Mijiyawa et al, the distribution of clinical patterns of LBP is not known with precision, but hospital-based studies have shown that LBP is the reason for 30 to 40 % of visits to rheumatologists in Sub -Saharan Africa[6]. Therefore, in Kenya, there is a need to identify the radiological patterns of LBP among the patients in Eldoret, Kenya with the aim of better managing LBP.

1.2 Problem statement

Low back pain is a burden to society and a major public health problem especially because it results in disability to the working population. The problem of LBP is on the rise and 11% to 84% of the population in the developed world will experience back pain at some point in their lives[7]. In Sub Saharan Africa, studies in Uganda and Togo put the LBP prevalence at 20% and 35% respectively.[6, 8] Doctors in Kenya are challenged to identify the aetiology and predisposing factors of LBP among patients. The use of MRI to detect anatomical changes (disc contour abnormalities e.g bulges, herniations) and tissue properties (disc dehydration, reactive marrow changes) involving the intervertebral discs, bone marrow, neuroforamina, spinal canal and facet joints should therefore be embraced.

1.3 Justification of the study

Low back pain is common and results in a high degree of morbidity and disability. The practice of doing MRI on patients with suspected complicated LBP in developed countries is routine and it is yet to catch up in developing countries, more so in our setup. This current study attempts to answer certain questions i.e the essentiality and predominant findings of

MRI that are significant in patients with LBP. Little is known about the determinants and radiological patterns of LBP among populations from developing areas; information mostly comes from industrialized countries. Likewise, in Kenya studies on the MRI patterns and predisposing factors of LBP are scarce. To date, no research has been conducted exploring MRI patterns and the predisposing demographic characteristics of LBP patients in Eldoret, Kenya. MRI imaging findings reported by radiologists together with clinical parameters (lumbago, neurogenic claudication, sciatica) may be potential good predictors of surgical treatment outcomes.

This study will report the MRI patterns of LBP in the general population of patients seen in Eldoret, Kenya. The diagnosis of LBP is at the core of using MRI and the findings of this study will challenge Kenyan doctors towards prioritizing an evidence based medicine diagnostic imaging approach over relieving the symptoms of LBP in patients conservatively. Hence, our decision to study the MRI patterns of LBP and to know about its significance in decision making for treatment.

1.4 Research questions

1. What are the common MRI patterns among patients with low back pain attending MRI centres in Eldoret, Kenya?

2. What are the common sites of lesions and complications in patients with low back pain attending MRI centres in Eldoret, Kenya?

3. What is the association between the socio-demographic characteristics and common MRI patterns among patients with low back pain?

1.5 Objectives of the study

1.5.1 The broad objective

To determine the MRI patterns among patients with low back pain attending MRI centres in Eldoret, Kenya.

1.5.2 Specific objectives

1. To determine the common MRI patterns among patients with low back pain attending MRI centres in Eldoret, Kenya.

2. To determine the common sites of lesions and complications in patients with low back pain attending MRI centres in Eldoret, Kenya.

3. To determine the association between the socio-demographic characteristics and common MRI patterns among patients with low back pain.

CHAPTER TWO: LITERATURE REVIEW

2.0 Overview of low back pain

The term low back pain (LBP) as defined by Andersson and used in most surveys is defined as pain limited to the region between the lower margins of the 12th rib and the gluteal folds[9]. LBP can be either specific if there is a detectable cause such as infection, cancer or compression fracture or non- specific if there is no specific cause[10,11].

LBP is further classified as acute if it has a duration of about one month or less or chronic defined by symptoms of two months or more with or without neurologic symptoms and signs[12].

This chapter discusses critically the review of some studies that describe the prevalence and radiological patterns of LBP in both developing and developed countries. The aetiology,predisposing factors, pathophysiology, differential diagnosis and diagnostic imaging of LBP are also described.

2.1 Prevalence of low back pain

Low back pain has been there since time immemorial. The oldest surviving surgical text, the Edwin Smith Papyrus from 1500 BC, gives the earliest account of LBP and includes a case of backstrain[13]. The problem of LBP in the developed world nears epidemic proportions and is on the increase with a lifetime prevalence of LBP (at least one episode of LBP in a lifetime) reported to be up to 84%[7]. Data from the developing world and particularly Africa is scanty. In Togo and Nigeria the prevalence of LBP was reported to be at par with levels recorded in industrialized countries [6, 14]. In Kenya, the prevalence of LBP in patients in a private facility was reported at 10%[15].

2.2 Etiology of low back pain

LBP is clearly an important health problem whose etiology can be indefinable or definable due to degenerative, infective or neoplastic lesions.

2.3 Socio-demographic and clinical factors associated with low back pain

Older age, female gender, low educational status, sedentary work, smoking, high body mass index (BMI), trauma and psychological factors are some factors associated with LBP[14, 15, 16,17].

2.3.1 Low back pain and age

Low back pain is mostly seen by the age of 50 years which falls within the working population[17, 18, 19].

2.3.2 Low back pain and gender

Some studies have shown no association between gender and LBP[20, 21]. However, other studies report high incidences in women[8, 15].

2.3.3 Low back pain and occupation

Occupational risk factors associated with LBP have been identified as poor or awkward postures, bending, lifting and physical strenuous work[22]. A sedentary lifestyle has largely been associated with LBP[23, 24]. LBP is also common in those involved in lifting heavy weight and doing field work[25].

2.3.4 Duration of low back pain

Patients can present with acute, sub-acute or chronic LBP[10, 26].

2.3.5 Presenting complaints in patients with low back pain

Pain, motor and sensory deficits are the most common symptoms in patients presenting with LBP[27].

2.4 Pathophysiology of low back pain

Different disc contour abnormalities like bulges or herniations, compress directly and stretch nociceptors in dura or nerve root sleeve tissues resulting in ischemia from compression of vascular structures. Inflammation and secondary edema are also likely to play a role in some cases[10].

2.5 Differential diagnosis of low back pain

The differential diagnoses include non-degenerative diseases: inflammation, infection, neoplasms, vascular diseases, congenital malformations, trauma and degenerative diseases: spondylosis, disc disease[28].

2.6 Diagnostic imaging of low back pain

Low back pain has been described as "an illness in search of a disease"[5]. Lumbar radiography may not identify all the abnormalities related to LBP symptoms and may be harmful because it exposes the gonads to ionizing radiation.

MRI has several advantages including multiplanar capabilities, superior soft tissue contrast and lack of ionizing radiation. It provides useful information that is likely to affect treatment.

Several studies have detailed the sensitivity and specificity of MRI in detecting different spine disease conditions such as neoplasms, infiltrative marrow disease, infections,spondyloarthropathies and degenerative disc disease[29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39].

Likewise, the sensitivity of MRI for diagnosing complications resulting from degenerative disc disease like stenosis and nerve root compression is high[40, 41].

2.7 MRI patterns of low back pain

Most of the studies regarding MRI patterns of LBP have been done in the developed world. However, information about studies done on the radiological patterns of LBP in developing countries is scanty. Kebede et al. in their study talks about the fact that the recommended primary imaging modality, MRI is inaccessible and expensive[42].

MRI patterns have been reported by McNally et al in 1000 patients with non-traumatic LBP without radiculopathy[43]. Results of this study showed that malignancy, infection, osteoporotic vertebral fracture, spondylitis, pars defects and cord tumours were detected in 20%. This study found 8% neoplasms but excluded benign neoplasms like verterbral hemangiomas. Younis et al study of 170 patients in Lahore mainly yielded findings of degenerative disc disease with other abnormalities like infective, inflammatory, neoplastic or congenital anomalies of the spine being excluded[44]. In India, Verma et al retrospective study of 232 patients found the incidence of lumbar disc degeneration to be most frequent[45]. This study likewise excluded spinal infections and tumours. In Cameroon Uduma et al study of 48 patients yielded 33.3% disc hernia, 37.5% spondylosis, 2.08% spondylodiscitis and one elderly patient with a metastatic bony lesion[46]. In Tanzania, Mboka et al study of 165 patients found 83% to have degenerative disc disease[47]. This study also excluded patients with inflammatory, infections, and neoplasms.

Lumbar disc degeneration (LDD) is common in patients with LBP. In Malaysia, Yong et al. in their study concluded that the most frequent finding in 91.2% of patients with LBP was intervertebral disc degeneration[26]. In Tanzania, a study of 165 patients by Mboka et al found

83% to have degenerative disc disease[47]. This study also assessed other degenerative findings such as Modic(endplate plate) changes and disc displacement. In Hong Kong, Samartzis et al study of 2599 patients yielded 1890 subjects (72.7%) with degenerative disc disease[48]. A study of 362 patients in Jamaica was dominated by degenerative disc disease in 283 (78.2%) subjects[49]. In Nigeria, Irurhe et al retrospective study of 270 patients yielded 37% disc degeneration[50].

2.8 The common disc contour abnormalities due to LDD in patients with low back pain

Different disc contour abnormalities result from LDD are referred to as either herniated or prolapsed by many physicians [51]. They can further be classified as “normal, bulge and herniation; broad based protrusion, focal protrusion and extrusion[52]. A disc bulge is a circumferential enlargement of the disk contour in a symmetric fashion in a weakened disk, the annulus is intact with disk extension outward involving >50% of disk circumference or diffuse (nonfocal, non-osseous material extending beyond the normal disc space in a circumferential manner[53, 54]. A disc herniation "is a localized/focal displacement of disk beyond the intervertebral disc space[52]. A herniated disk can be protruded, extruded or sequestrated[51]. A disc protrusion is a focal displacement disk material beyond margins of adjacent vertebral endplates involving <50% of disc circumference[52]. An extrusion is a herniated disc in which, has a small connection with the parent disc (narrow neck)[52]. Many studies have been done using this classification[44, 45, 47, 51].

The most common site for disc contour abnormalities are the lower lumbar i.e L4/L5 and L5/S1[27, 49]. Common complications of lumbar degenerative disc disease are neural compression, chemical irritation of nerves, osseous abnormalities, segmental instability, spinal stenosis and pain[26, 51].

2.9 Association of lumbar disc degeneration with socio-demographic characteristics

Some of the socio-demographic factors said to play a role in the development of lumbar disc degeneration (LDD) include older age, being female and sedentary work [16, 26]. Studies done have shown a significant correlation ($p<0.05$) between disc degeneration and age [47, 55]. The same studies did not establish any association between disc degeneration and gender[47]. Another study reported greater disc degeneration with occupational and physical loading in the upper lumbar levels ($P = 0.055 - 0.001$), whereas sedentary work was associated with lesser degeneration ($P = 0.006$)[56]. These univariate associations did not reach statistical significance in the lower lumbar region. The aetiology of lumbar disc degeneration (LDD) is multifactorial with most evidence pointing to an age-related process influenced primarily by mechanical and genetic factors[57, 58, 59].

CHAPTER THREE: METHODOLOGY

3.0 Introduction

This chapter describes and explains the rationale of the selected research setting. Description of the study site, study design, study population, sampling method, inclusion criteria, exclusion criteria and instrumentation used are also given. The data collection by use of a standardized data collection form with different variables and data analysis are also explained. This chapter ends with ethical considerations.

3.1 Study site

This study was carried out at The Eldoret Hospital and Mediheal Hospital in Eldoret East District in Kenya. The District lies between 34° 50’ and 35° 37’ East longitude and 0° 03’ South and 0° 55’ North latitude. It is located 320 Kms Northwest of Nairobi serving not only the residents of Uasin Gishu County, but also the entire North Rift, Western Province , and parts of Western Uganda and Southern Sudan. The Eldoret Hospital and Mediheal are both private multi-speciality hospitals with free standing imaging centers where the MRI scanners for the study are located. The study was conducted in the MRI departments of these hospitals.

3.2 Study design

This study was a hospital-based cross-sectional study conducted from October 2011 to April 2012.

3.3 Study population

The study included patients with LBP with or without radiculopathy who were referred for lumbar spine MRI at the radiology departments of the Eldoret and Mediheal hospitals from October 2011 to April 2012.

3.4 Sampling procedure.

All patients with LBP with or without radiculopathy referred for lumbar MRI were sampled consecutively and included in this study.

The sample size was calculated from Fisher's formula $n=Z^2P(1-P)/E^2$ where

n= sample size,

Z = (1.96)

P = prevalence = 28.2%. This was the prevalence the of degenerative disc disease based on a study by Igbidenon et al (Nigeria) [20].

95% confidence interval was used.

E = error margin 5%

Therefore $n= (1.96)^2 \times 0.28 (1 – 0.28/ (0.05)^2$ n = 310

To adjust for finite population we used the formula $n_f = \frac{n}{1+n/N}$

where N= population size. In this case it was anticipated 400 MRI will be done in seven months, n_f= sample size after adjusting for finite population, n= sample size from Fischer's formula

$n_f=310/1+310/400 =175$

We sampled an extra 5% to account for possible non-response

n=175 + 10 (5% of 175) so the sample size in this study was 185 patients.

3.5 Eligibility criteria

3.5.1 Inclusion criteria

- All patients with LBP with or without radiculopathy as the primary and only diagnosis or in association with other pre-existing conditions referred for MRI.

3.5.2 Exclusion criteria

- Contraindications to MRI (metallic implants in the lumbar spine, pacemakers).
- Prior lumbar spine surgery.
- Pregnancy.

3.6 Study flow

I participated in the recruitment of patients with LBP from the two centres in Eldoret, Kenya: Mediheal and Eldoret Hospitals. Potential patients were identified when their physicians ordered MRI scans of the lumbar spine after diagnosing LBP with or without radiculopathy. Patients targeted were referred not only by general, but also patients from surgical subspecialty physicians i.e general, orthopedic and neuro-surgeons. Diagnostic triage of these patients was actively done to make sure that all the patients met the eligibility criteria (figure 1). All the eligible patients gave written informed consent (see appendix 3). After enrollment the patients underwent a MRI of the lumbar spine. The MRI scans were conducted on systems with a field strength of 0.25-0.30T. Two evaluators (principal investigator and one radiologist) interpreted the images as part of normal work flow. In all cases of disagreement between the two observers, a third opinion was sought from another radiologist. Preliminary

reports were sent to the referring physician and the reports were then entered into the data collection form (see appendix 1) for the analysis of the study.

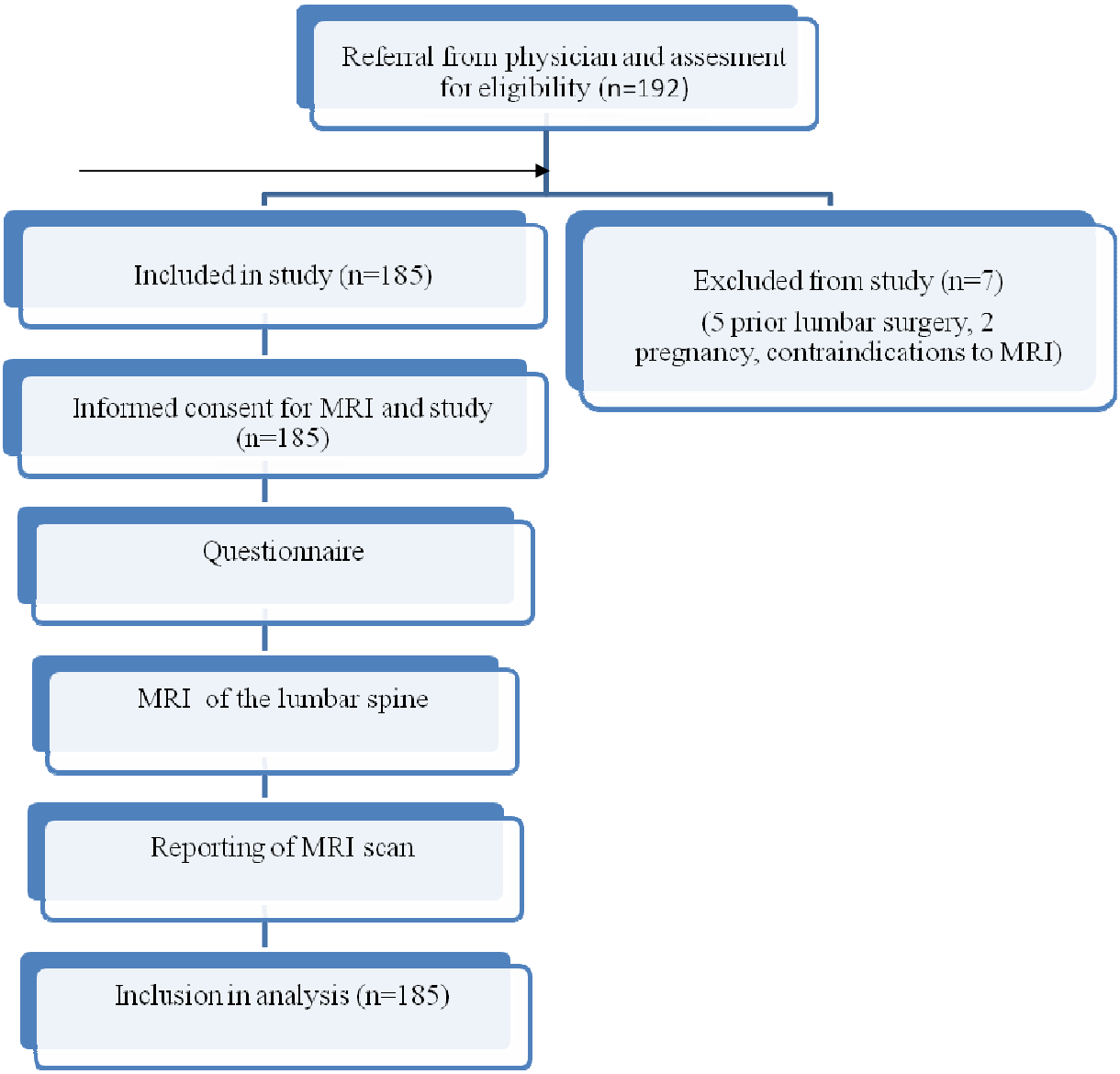

Figure 1: A study flow chart showing point of inclusion into study (indicated by arrow).

3.7 MRI imaging protocol

The MR imaging scans of patients referred with a clinical diagnosis of LBP were performed by two persons (a qualified technician and principal investigator). MR examination of the

lumbar spine at presentation was performed with a 0.25 T (GE Medical Systems) or 0.30T (Siemens) MR imager using spine phased array coils. The scans consisted of sagittal and axial T1-weighted (repetition time/echo time (TR/TE) of 400/8 ms) and T2-weighted (TR/TE of 3,000/120 ms) turbo spin echo and STIR images. Enhanced T1W images with Gadolinium pentate dimeglumine were used in cases of infections and suspected neoplastic processes. A slice thickness of 4 mm was used for both sagittal and axial images. A field of view of 350mm and 200 mm for the sagittal and axial images, respectively; and a matrix of 192 by 256 were used. The images were collected as printed laser film hard copies and also electronically and stored directly as DICOM (Digital Imaging and Communications in Medicine) files in the MR workstation.

3.8 Data collection procedures

Data collection tool included:

- A standardized data collection form with lists of imaging findings at the lumbo-sacral region which was ticked appropriately (see appendix 1).

The data collection tool was a standardized data collection form (see appendix 1) with lists of imaging findings at the lumbo-sacral region which were ticked appropriately. This was collected and kept in a cabinet under lock and key by the principal investigator. The study images were stored directly as DICOM files in the computer and compact discs. All images were deidentified and coded for patient confidentiality and also kept under lock and key by the principal investigator.

3.9 Data management and analysis

Completed standardized forms were checked for completeness and coded. The data was entered into a password protected computerized database. Data were analyzed using STATA version 10. Descriptive statistics were carried out for continuous variables using mean, median, standard deviation and inter-quartile range. While frequency listings were used for categorical variables. To assess whether there were any association between the outcome of interest and the socio demographic characteristics the chi square test was used. In cases where the cell count in any of the cells was below 5 the Fishers' exact test was used to test for any associations. In all the analysis p-value less than 0.05 was considered statistically significant. Dissemination of the study findings will be through publications and conferences.

3.10 Ethical considerations

In order to protect and respect the rights of the participants who were imaged and their imaging scans used in the study the following steps were taken:

1. Approval to conduct the study was sought from IREC.

2. Before data collection was commenced permission to conduct research was sought from the administration of the Eldoret and Mediheal hospitals respectively.

3. Informed written consent was obtained from each potential participant.

4. To ensure confidentiality and privacy of the study subjects, each imaging scan was de-identified and given a code that was used on the checklist. The code was only known by the researcher.

5. If necessary each potential participant whose imaging scan was used, was given detailed information about the study both in writing and orally and a chance to seek clarification.

CHAPTER FOUR: RESULTS

4.0 Introduction

This chapter describes the MRI patterns of LBP in the study population. The demographic characteristics, most common MRI pattern, common sites of lesions and common complications are also presented.

4.1 Description of the study population and sample

A total of 185 questionnaires were distributed to patients with LBP referred by a primary care physician for an MRI at the Eldoret Hospital and Mediheal Hospital. Of the 185 patients, 50.81% (n=94) were males and 49.19 %(n=91) females. The participants' (n=185) had a median age of 47 years and mean age of 47.32±14. LBP only 65.95% (n=122), LBP with radiculopathy 30.81% (n=57) and LBP with inability to walk 3.24% (n= 6) were the main presenting complaints. The median duration of LBP was 1 year and the mean was 3.79±5.82 years. Most of the patients 79.46% (n=147) had no history of trauma while 20.54% (n=38) had trauma. Additionally, the occupation of these patients was grouped into six: office workers 36.22% (n= 67), farmer 17.30% (n=32), student 4.32% (n=8), housewife 12.97% (n=24), laborer 18.38% (n=34) and others 10.81% (n=20) as shown in table 1 below.

Table 1: A table showing the results for the descriptive statistics (n=185)

Variable	**Frequency (%)** n=185
Gender Male Female	 94 (50.81) 91 (49.19
Age in years n Mean (std) Median (IQR)	 185 47.32 (14.00) 47 (38.5, 57)
Main presenting complaint LBP LBP radiating LBP and inability to walk	n=185 122 (65.95) 57 (30.81) 6 (3.24)
Duration of low back pain in years n Mean (std) Median (IQR)	 185 3.79 (5.82) 1 (0.33, 4)
History of trauma Yes No	n=185 38 (20.54) 147 (79.46)
Occupation Office workers Farmer Student Housewife Laborers Others(unemployed, business people, policemen)	n=185 67 (36.22) 32 (17.30) 8 (4.32) 24 (12.97) 34 (18.38) 20 (10.81)

4.2 MRI patterns of low back pain in Eldoret, Kenya

A review of 185 MRIs of patients presenting with LBP in this study established lumbar disc degeneration 80% (n=148) which was the most common pattern (Section 4.3 below).Other

significant patterns encountered include: lumbar spondylosis 23.78% (n=47), infections 4.86 % (n=9), neoplasms 9.73% (n=18) and other causes 15.68% (n=29). Figure 2 below.

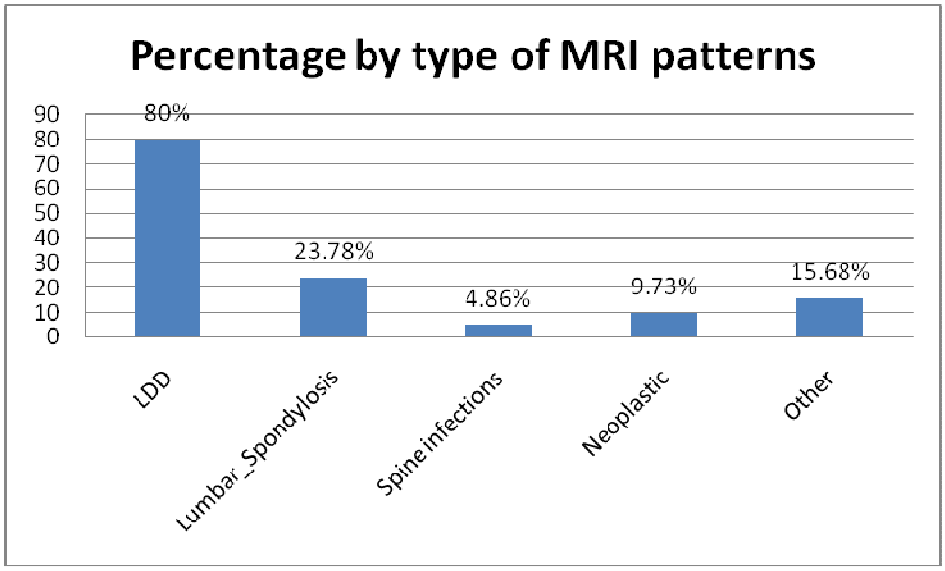

Figure 2: A bar graph showing MRI patterns of low back pain (n=185).

4.3 The most common MRI pattern in patients with low back pain

The common lumbar spine degenerative findings in patients with low back pain were endplate (modic) changes 19.2%(n=35), anterior osteophytes 25.95%(n=48), facet joint arthrosis 9.24%(n=17), ligamentum flavum hypertrophy 7.57%(n=14) and spondylolisthesis 1.63%(n=3) shown in table 2 below. Lumbar disc degeneration (LDD) was common (80%) in LBP patients studied. Table 3 below illustrates that disc dehydration which is one of the earliest features of aging and disc degeneration was present in 61.62% (n=114) patients with the most dehydrated disc seen at L4/L5 77.39% (n=89) followed by L5/S1 73.91% (n=85).

Table 2: A table showing lumbar spine degenerative findings excluding disc degeneration (n=185)

Variable	**Freq (%)**
Lumbar Spine Degenerative Findings (a patient can have multiple findings)	n=185
Endplate (modic) changes	35 (19.02)
Anterior osteophytes	48 (25.95)
Facet joint arthrosis	17 (9.24)
Ligament flavum hypertrophy	14 (7.57)
Spondylolisthesis	3 (1.63)

Table 3: A table showing disc dehydration (n=114)

Variable	**Freq (%)**
Type of LDD	n=185
Disc dehydration	114 (61.62)
Site of Lesion (a patient can have multiple sites)	n=115
L1-L2	10 (8.70)
L2-L3	26 (22.61)
L3-L4	33 (28.70)
L4-L5	89 (77.39)
L5-S1	85 (73.91)

4.3.1 The common disc contour abnormalities in patients with low back pain

Patients with degenerative disc disease had the following disk contour abnormalities. Disc bulges 65.41% (n=121) and herniations 23.24% (n=43). Herniations were further reported as

broad based herniations 62.79% (n=27), extrusions 6.98% (n=3) and protrusions 30.23% (n=13). The most common site for bulges and herniations was L4/L5 78.51% (n=95) and 60.47% (n=26) respectively. The most common complication of bulges and herniations was impingement of exiting nerve roots 47.06% (n=48) and compression of exiting nerve roots and cauda equina 70.73% (n=29) respectively as shown in table 4 and 5 overleaf.

Lumbar disc degeneration

a) **Bulges**

Table 4: A table showing disc bulges (n=121)

Variable	**Freq (%)**
Bulges	121(65.41)
Site of Lesion	n=121
L1-L2	1 (0.83)
L2-L3	16 (13.22)
L3-L4	31 (25.62)
L4-L5	95 (78.51)
L5-S1	80 (66.12)
Complications	n=102
Impingement of exiting nerve root	48 (47.06)
Impingement on nerves and cauda equina	5 (4.90)
Mild thecal sac indentation	14 (13.73)
Spinal canal stenosis	3 (2.94)
Compression of exiting nerve root	32 (31.37)

b) **Herniations**

Table 5: A table showing disc herniations (n=43)

Variable	**Freq (%)**
Type of Herniation	n=43
Broad based herniations	27 (62.79)
Extrusions	3 (6.98)
Protrusions	13 (30.23)
Site of Lesion	n=43
L1-L2	3 (6.98)
L2-L3	6 (13.95)
L3-L4	7 (16.28)
L4-L5	26 (60.47)
L5-S1	19 (44.19)
Complications	n=41
Impingement of exiting nerve root	6 (14.63)
Impingement on nerves and cauda equina	3 (7.32)
Mild thecal sac indentation	1 (2.44)
Spinal canal stenosis	2 (4.88)
Compression of exiting nerve root	29 (70.73)

4.4 Association of lumbar disc degeneration with socio-demographic factors.

A logistic regression model was done to assess whether there was an association between the socio demographic characteristics and the presence of LDD. The results are shown in the table 4 below. It was observed that none of the socio demographic characteristics was

associated with LDD in the multiple logistic regression except age that tended towards significant.

Table 6: A multiple logistic regression table showing association between LDD and socio-demographic factors.

LDD	Odds ratio	p-value	[95% Confidence interval]	
Male vs Female	0.457	0.139	0.162	1.290
Age	1.036	0.061	0.998	1.076
Occupation				
Farmer vs Office worker	0.549	0.362	0.151	1.993
Housewife vs Office worker	0.308	0.096	0.077	1.232
Laborers vs Office worker	2.358	0.253	0.542	10.265
Others vs Office worker	0.404	0.172	0.110	1.482
Trauma history (Yes vs No)	0.909	0.859	0.318	2.598

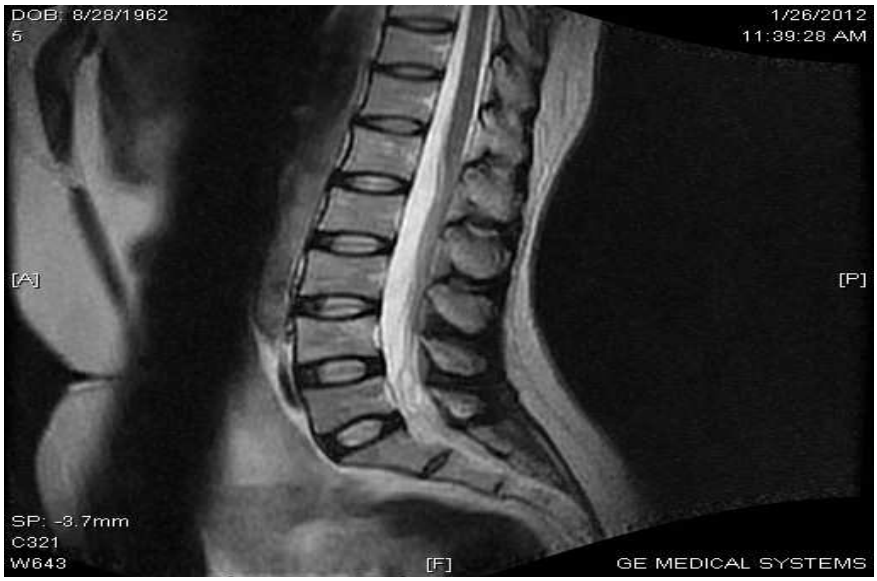

Figure 3: A sagittal T2W image showing a normal lumbar spine in a 49 year old female patient referred for MRI.

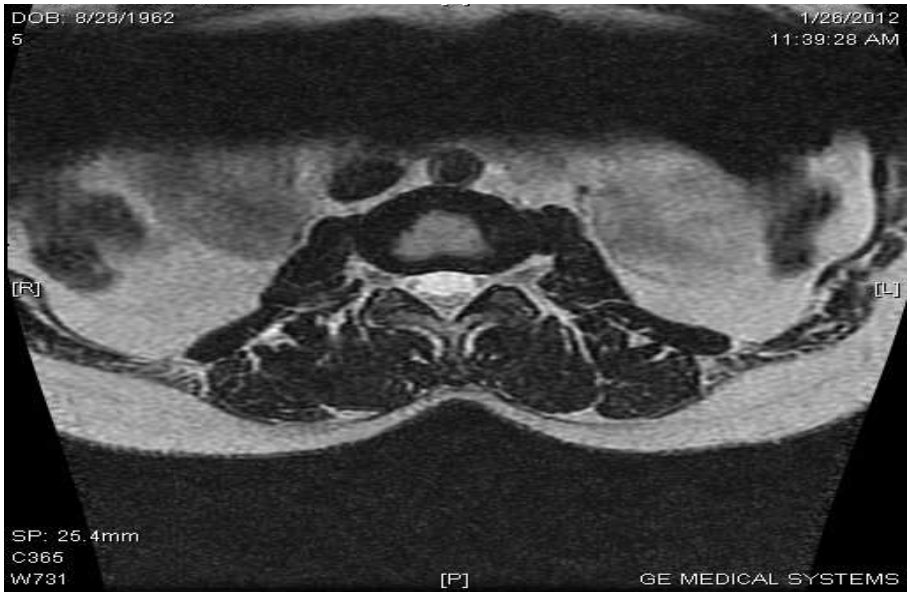

Figure 4: An image of the same patient in fig 2. An axial T2W image showing a normal lumbar intervertebral disc.

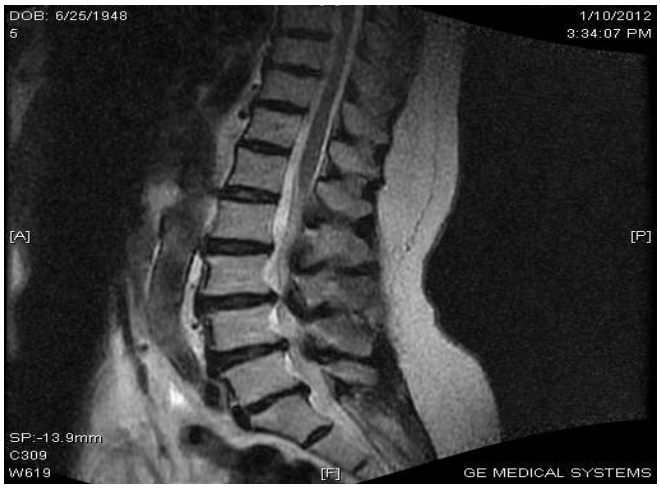

Figure 5: Lumbar spondylosis with multilevel degenerative disc disease leading to nerve roots impingement and spinal canal stenosis in a 63 year old female referred for lumber MRI. A sagittal T2W image showing all discs have low signal (low water content/desiccation), diffuse disc bulges at L2-L3, L3-L4, L4-L5 and L5-S1.

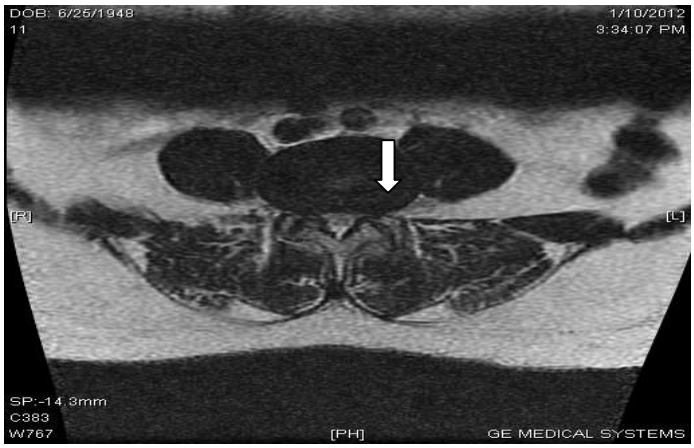

Figure 6: An image of the same patient as fig 5. Axial T2W image showing a diffuse disc bulge (down arrow) of L4-L5 that is narrowing both neural foramina and impinging on the exiting nerve roots. Note the ligamentum flavum and facet joint hypertrophy leading to spinal canal stenosis.

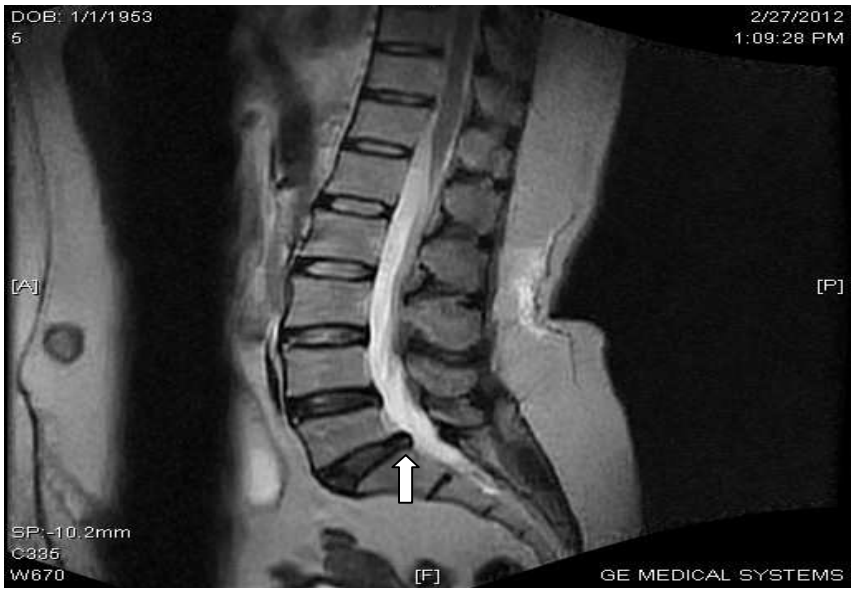

Figure 7: Degenerative disc disease at L4-5, L5-S1 in a 59 year old female patient referred for lumbar MRI. A sagittal T2W image showing a broad based posterior herniation (up arrow) of L5-S1 which is causing significant compression on cauda equina.

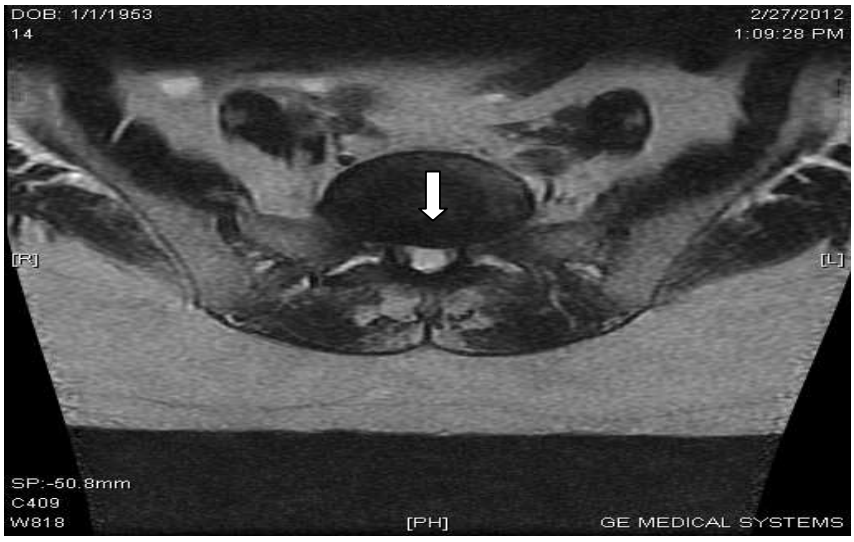

Figure 8: An image of the same patient in fig 7. An axial T2W image showing a broad based posterior herniation (down arrow) of L5-S1 which is causing bilateral neural foramina compromise and significant compression on cauda equina.

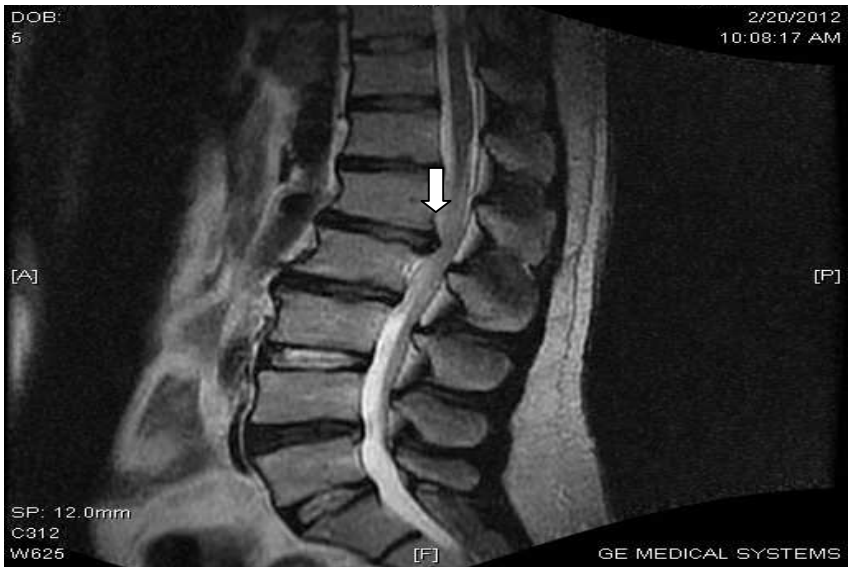

Figure 9: Lumbar spondylosis with multilevel degenerative disc disease leading to nerve roots impingement in a 42 year old male referred for lumber MRI. A sagittal T2W image showing a protrusion (down arrow) of L1-L2 which is indenting the thecal sac and impinging on cauda equina nerve roots.

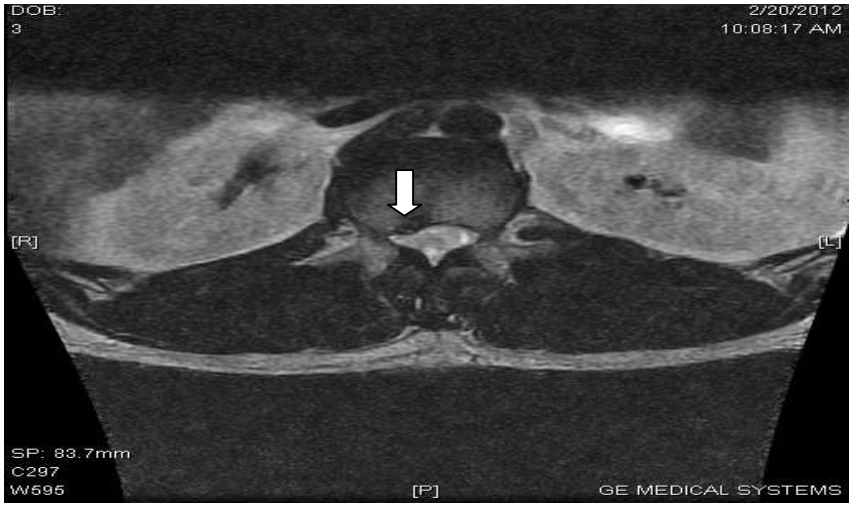

Figure 10: An image of the same patient as fig 9. An axial T2W image showing a protrusion (down arrow) of L1-L2 which is indenting the thecal sac and impinging on cauda equina nerve roots.

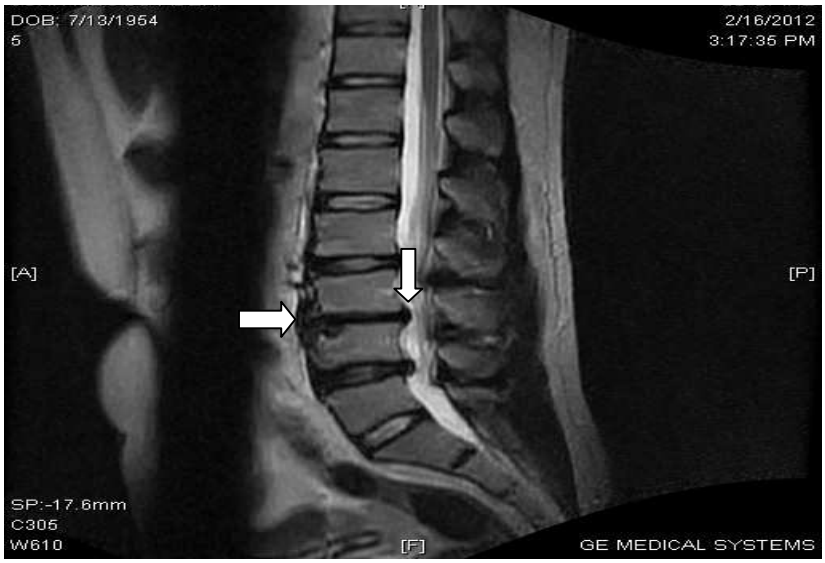

Figure 11: Degenerative disc disease at L3-4, L4-L5 in a 57 year old male patient referred for lumbar MRI. A sagittal T2W image showing an extrusion (down arrow) of L3-L4 causing significant compression on cauda equina. Schmorl's node (right arrow) noted on L4 vertebral endplate.

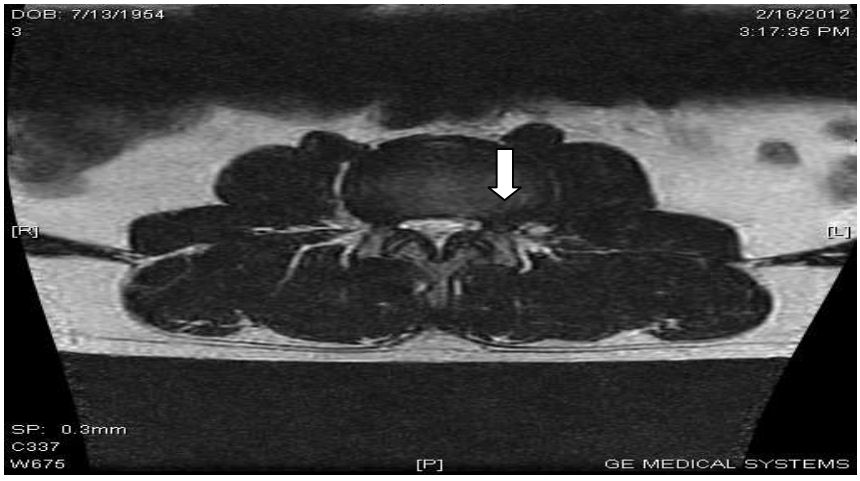

Figure12: An image of the same patient in fig 11. An axial T2W image showing an extrusion (down arrow) of L3-L4 causing significant compression on cauda equina.

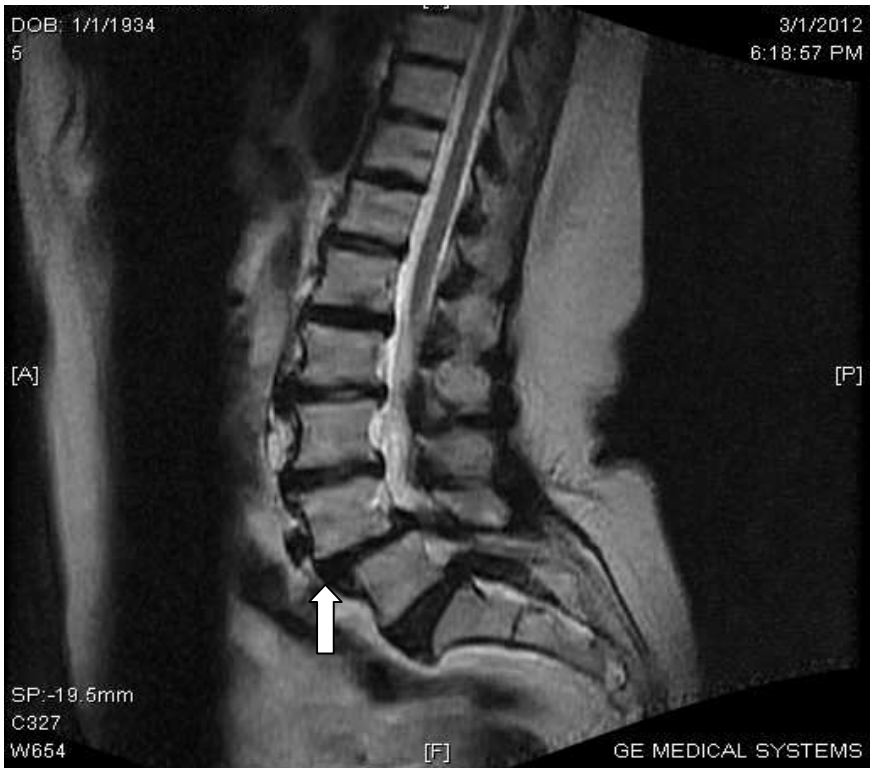

Figure 13: Lumbar spondylosis and multilevel degenerative disc disease in a 78 year old female patient referred for lumbar MRI causing compression on cauda equine. A sagittal T2W image showing disc bulges at L2-3 and L3-4, note anterior listhesis (up arrow) of L4 over L5 due to spondilolysis.

4.5 Other MRI patterns in patients with low back pain

Other less frequently encountered but still significant patterns include: lumbar spondylosis 23.78% (n=47), infections 4.86 % (n=9), neoplasms 9.73% (n=18) and other causes 15.68% (n=29). Lumbar spondylosis was common at the L4/L5 and L5/S1 level at 80.85% (n=35) respectively. A complication of lumbar spondylosis was spinal canal stenosis seen in 2 patients. The common lumbar spine infections were tuberculosis seen in 66.67% (n=6) and pyogenic infections 33.33% (n=3). The most common site was the mid lumbar vertebrae L3/L4 at 77.78% (n=7) followed by the upper lumbar vertebrae L2/L3 66.68% (n=6) and L1/l2 11.11% (n=1). The common complication of infections was spinal canal stenosis 33.34% (n=2). Metastases were the most common lumbar spine neoplastic processes seen in 7.56% (n=14) patients. Suspected prostate cancer 57.14% (n=8) was the most common primary tumour sending metastasis to the spine in men. Primary tumours of the lumbar spine were rare and were seen in 2.16% (n=4) patients. The most common primary tumour was hemangioma 75% (n=3). The most common location for the neoplasms was in the vertebral body 88.89% (n=16). Other anomalies encountered were normal MRI in 8.11% (n=15) cases, 2 cases with congenital anomalies, 2 cases with osteoporosis, 2 cases with T- spine tumours, 4 cases with ligamentum flavum hypertrophy in the T-spine and 4 cases with T-spine infections. (Figure 2 and Table 7 , 8, 9 and 10 overleaf).

Table 7: A table showing lumbar spondylosis (n=47)

Variable	**Freq (%)**
Lumbar Spondylosis	n=47
Site of Lesion	n=47
L1-L2	24 (51.06)
L2-L3	30 (63.83)
L3-L4	33 (70.21)
L4-L5	38 (80.85)
L5-S1	38 (80.85)
Complication	
Spinal canal stenosis	2

Table 8: A table showing lumbar spine infections (n=9)

Variable	**Freq (%)**
Lumbar spine infections	n=9
TB	6 (66.67)
Pyogenic infections	3 (33.33)
Site of Lesion	n=9
L1-L2	1 (11.11)
L2-L3	6 (66.67)
L3-L4	7 (77.78)
L4-L5	3 (33.33)
L5-S1	3 (33.33)
Complication	n=6
Impingement of exiting nerve root	1 (16.67)
Impinging on cauda equina	1 (16.67)
Mild thecal sac indentation	1 (16.67)
Spinal canal stenosis	2 (33.34)
Soft tissue phlegmon	1 (16.67)

Table 9: A table showing lumbar spine neoplasms (n=18)

Variable	**Freq (%)**
Location of neoplastic lesion	n=18
Extradural	2 (11.11)
Intradural extramedullary	0
Intramedullary	0
Vertebral body	16 (88.89)
Primary spinal tumour known	4
Type of tumour if known	n=4
Hemangioma	3 (75.00)
Multiple myeloma	1 (25.00)
Metastases present	14
Primary Tumour	n=14
Suspected prostate cancer	8 (57.14)
Hepatocellular carcinoma	1 (9.09)
Melanoma(foot)	1 (9.09)
Not known	4 (24.68)
Site of Lesion(multiple site lesions in each patient)	n=18
L1-L2	9 (50.00)
L2-L3	7 (38.89)
L3-L4	9 (50.00)
L4-L5	9 (50.00)
L5-S1	6 (33.33)
Complication	n=7
Spinal canal stenosis	3 (42.86)
Compression of cauda equina	4 (57.14)

Table 10: A table showing other anomalies of lumbo-sacral spine (n=29)

Variable	**Freq (%)**
Type Normal Other (T-spine lesions, osteoporosis, congenital anomalies	n=29 15 (51.72) 14 (48.28)
Site of Lesion	n=20
L1-L2	0
L2-L3	0
L3-L4	1 (5.00)
L4-L5	1 (5.00)
L5-S1	0

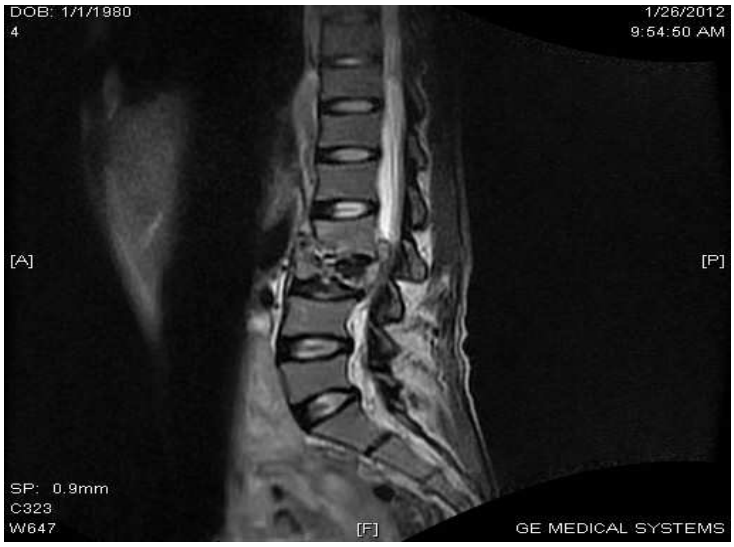

Figure 14: Tuberculosis of the spine in a 32 year old male. A sagittal T2W image showing destruction of L2 and L3 vertebral body with involvement of the L2-L3 intervertebral body.

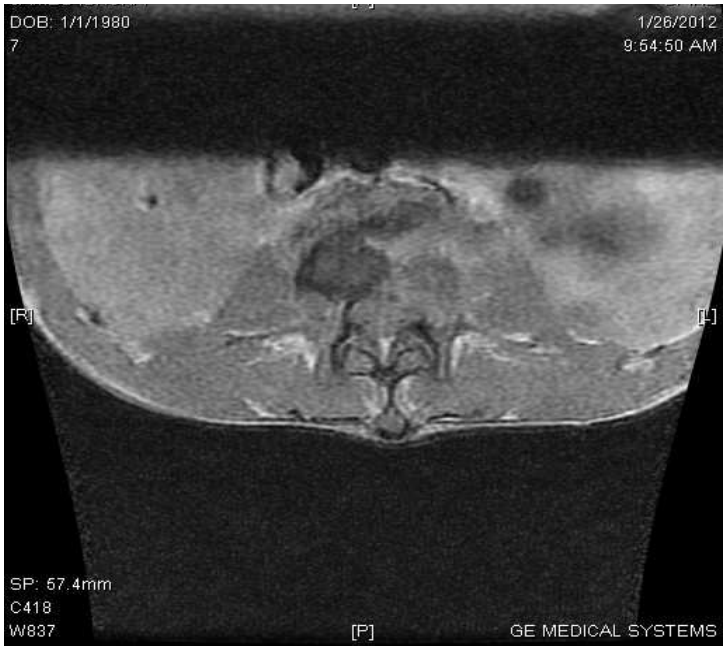

Figure 15: Images of the same patient in fig 14 above. An axial T1W+C image showing destruction of the L3 vertebral body with involvement of the pre and paravertebral soft tissues note the contrast enhancement due to inflammation.

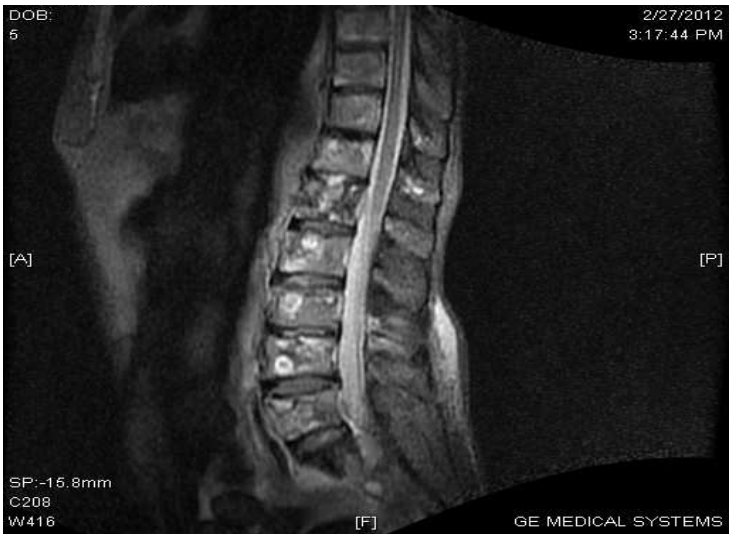

Figure 16: Metastases in a 59 year old male with a history of prostatic cancer. A sagittal T2W image showing multiple hyperintense lesions at L1, L2, L3, L4 and L5 vertebral note the destruction of L1 vertebral body and relative preservation of all the intervertebral discs.

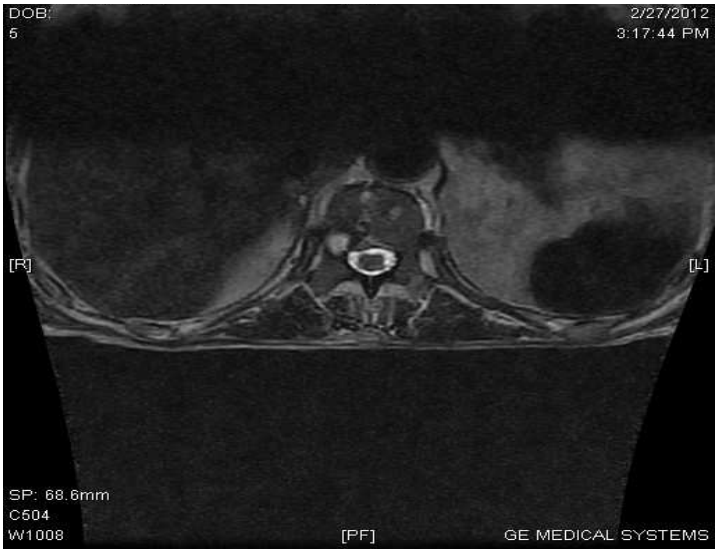

Figure 17: Images of the same patient in fig 16 above. An axial T2W image showing multiple hyperintense lesions at L2 vertebral body consistent with metastases.

CHAPTER FIVE: DISCUSSION

5.0 Introduction

The main objective of the current study was to identify the different MRI patterns of LBP in patients seen in MRI centres in Eldoret, Kenya. Furthermore, the study aimed at describing the clinical and socio-demographic characteristics, as well as determining the most common MRI pattern, site of lesions and complications in patients with LBP in Eldoret. Besides, the current study attempts to establish an association between the common pattern and socio-demographic factors. Results have shown that MRI is a useful tool in establishing different radiological diagnosis in patients with LBP. This chapter thus discusses the final findings of this study in relation to other similar studies carried out before so as to be able to come up with a significant conclusion.

5.1 Socio-demographic and clinical factors associated with low back pain

According to literature, various factors related to LBP have been mentioned, some of which are; older age, female gender, low educational status, sedentary work, smoking, high BMI and psychological factors[16]. However in the current study only age, gender, occupation, presenting complaint and duration of pain were assessed.

5.1.1 Low back pain and age.

The participants' mean age was 47.32 ± 14.00 and the median was 47 years. This is a working age in Kenya. A study done in Kenya showed that LBP occurs mostly in those with a mean age of 40.9 ± 13.2 whereas another Ethiopian study showed the mean age to be 42.4 ± 13.22; an age group that corresponds to a large component of the working population[17, 42]. These findings though slightly lower, are comparable with the current study. The glaring

difference is that none of these studies give the median ages. In USA, Britain and many other countries, LBP is a common occupational disorder, especially in adults of working age[18]. The findings of the current study have shown that LBP is predominant in the middle age group, and at the age of 50 years and above. Hence, LBP increasing with age could be likely a result of disc degeneration resulting from the normal aging process. This finding is reinforced by Quinet RJ et al. who concluded that the aetiology notwithstanding, (85-95%) of adults show evidence of DDD at autopsy by the age of 50 years[19].

5.1.2 Low back pain and gender

Males were 50.81% and 49.19 % were females with a M: F (1: 0.97). This generally indicates that the number of males though slightly higher, was almost equal and thus comparable to that of females. Different findings have been reported in two East African studies which showed that women had a higher incidence of LBP[8, 15].A study carried out in Nigeria yielded 40.9% males and 59.1% females with a M: F (1: 1.4). These findings likewise showed that more females were affected than males, a fact that can be attributed to the type of population sampled. This Nigerian study by Igbinedion et al. found that gender was not significantly associated with LBP[20]. Likewise, in the developed world, studies have shown that functional incapacity as a result of LBP and its sequelae of disc degeneration is seen in both sexes[34].

5.1.3 Low back pain and occupation

The present study reveals that majority of the patients presenting with LBP were employed. What is more, the results demonstrate that LBP was most common, up to 36.22% in those patients with a sedentary lifestyle as compared to 17.30% farmers, 12.97% housewives, 18.38% laborers and 4.32% students. Similarly, N'Gbesso et al. observed LBP lesions in subjects whose work required limited physical stress in the lumbo-sacral spine[23]. The authors

continued to say that particularly those whose sedentary lifestyle demanded variable postures and prolonged sitting are more exposed to LBP. Frymoyer et al. also support a sedentary lifestyle as an important risk factor for LBP[24]. However, Ansari et al found abnormalities in 42% manual labours, 24% sedentary workers, 26% housewives and 4% students who had prolapsed lumbar intervertebral disc [25]. This study showed that manual labour was the predominant occupation reinforcing the fact that occupations that require repetitive heavy lifting or operation of machine tools also result in LBP as reported in our study.

5.1.4 Duration of low back pain

A high number of the participants presented with chronic LBP after a very long average duration of 3.79±5.82 years. This highlighted the fact that chronic LBP was common among our patients. This finding is in agreement with a study by Yong PY et al. where 56.0% presented with chronic LBP of more than 3 months [26]. This particular study did not specify the exact duration but just generalized all the patients who had pain of greater than 3 months as having chronic LBP. These findings serve to show that patients live with LBP for a long time, such that by the time they can access medical care they have chronic LBP which could explain the high number of patients with LDD.

5.1.5 Presenting complaints in patients with low back pain

The study found that the main presenting complaints were 65.95% LBP, 30.81% LBP with radiculopathy and 3.24% LBP with inability to walk. However, Biluts et al reported 92.5% pain, 63.7% numbness and 30.5% neurologic claudication as the three most common presenting symptoms[27]. The disc displacements arising from lumbar spine degeneration directly stretch nociceptors in dura or nerve root sleeve tissue causing ischemia,

inflammation and secondary edema which cause LBP. Overall, pain, motor and sensory deficits are the most common symptoms which are also reflected in our study.

5.1.6 History of trauma and in patients with low back pain

The study found 79.46% to have no previous history of trauma whereas 20.54% had a history of trauma. These findings are comparable to those of a previous Kenyan study which found trauma in 26.2%[17]. The history of trauma in our study alludes to the fact that it is a factor in the development of LBP alongside other factors like age, occupation and genetic predisposition that also play a role in the development of LBP.

5.2 MRI patterns of low back pain

The current study shows different MRI patterns of lumbar spine disease in patients with LBP in Eldoret, Kenya. A review of 185 MRIs of patients presenting with LBP in this study established lumbar degenerative disc disease (80%) as the most common followed by lumbar spondylosis 23.78%. Other less frequently encountered but still significant patterns include: infections 4.86 %, neoplasms 9.73% and other causes 15.68% (normal, congenital anomalies, osteoporosis and T-spine lesions). The common lumbar spine infections were tuberculosis seen in 66.67% and pyogenic infections 33.33%. Metastases were the most common lumbar spine neoplastic processes with suspected prostate cancer 57.14% as most common primary tumour sending metastasis to the spine. Primary tumours of the lumbar spine were rare with the most common primary tumour being a hemangioma 75%. Other anomalies encountered were normal MRI in 8.11% (n=15) cases, 2 cases with congenital anomalies, 2 cases with osteoporosis, 2 cases with T- spine tumours, 4 cases with ligamentum flavum hypertrophy in the T-spine and 4 cases with T-spine infections. MRI patterns have been reported by McNally et al in 1000 patients with non-traumatic LBP

without radiculopathy[43]. Results of this study showed that malignancy, infection, osteoporotic vertebral fracture, spondylitis, pars defects and cord tumours were detected in 20%. This study detected neoplasms in 8% but excluded benign neoplasms like verterbral hemangiomas and did not focus on the individual prevalence of each disease pattern. Younis et al study of 170 patients in Lahore mainly yielded findings of degenerative disc disease with other abnormalities like infective, inflammatory, neoplastic or congenital anomalies of the spine being excluded[44]. In India, Verma et al retrospective study of 232 patients found the incidence of lumbar disc degeneration to be most frequent at 79.3%[45]. This study likewise excluded spinal infections and tumours. In Cameroon Uduma et al study of 48 patients yielded 33.3% disc herniations, 37.5% spondylosis, 2.08% spondylodiscitis and one elderly patient 2.08% with a metastatic bony lesion[46]. This study was almost similar in trying to address the prevalence of different disease patterns although the findings differed greatly possibly due to the small number of patients. In Tanzania, Mboka et al study of 165 patients found 83% to have degenerative disc disease[47]. This study also excluded patients with inflammatory conditions, infections, and neoplasms. Most of the findings in the studies mentioned focus only on degenerative disc disease excluding infections, neoplasms and congenital anomalies. This exclusion is part of the methodology in these studies which mostly chose to dwell on degenerative disc disease. This study serves to reinforce the fact that MRI has a high sensitivity for detection of infections and neoplasm alongside lumbar spine degenerative disease.

5.3 Lumbar degenerative disc disease in patients with low back pain

In the present study, the majority of patients with LBP had lumbar degenerative disc disease. In Malaysia, Yong et al. in their study concluded that the most frequent finding in 91.2% of patients with LBP was intervertebral disc degeneration[26]. In Tanzania, a study by Mboka et al

found 83% to have degenerative disc disease[47]. In Hong Kong, Samartzis et al study yielded 72.7% with degenerative disc disease[48]. A study by West et al in Jamaica was dominated by degenerative disc disease in 78.2% subjects[49]. These findings may be comparable to the findings in the current study. In Nigeria, a retrospective study by Irurhe et al yielded 37% disc degeneration in a retrospective study of 270 patients[50]. These results are much lower than the current study results (80%). These different global studies revealed a predominance of degenerative disc disease in both developed and developing countries. This is a fact reinforced in our study even though studies have found 35% of asymptomatic individuals to have degenerative disc disease[59].

5.3.1 The common disc contour abnormalities in patients with low back pain

Different disc contour abnormalities result from lumbar disc degeneration. Many physicians refer to any or all disc abnormalities as herniated or prolapsed disk which may not put the abnormality seen on the imaging study in proper perspective and may be misleading[51]. In this study, disc morphology was assessed and graded using a published classification scheme of "normal, bulge and herniation; broad based protrusion, focal protrusion and extrusion[52]. The findings reported 65.41% disc bulges and 23.24% herniations. Herniations were further reported as 62.79% broad based herniations, 6.98% extrusions and 30.23% protrusions. There was a substantial difference between the disc contour abnormalities reported and those reported in other studies. Ongeti et al. reported only prolapsed intervertebral discs in Kenya[17]. Biluts H. reported on 70.1% disc prolapsed, further classifying them into 18.5% bulges[27]. This study had less bulges than our study. Yong et al. in Malaysia reported 40.4% bulges, 50% protrusions and 19.4% extrusions[26]. This study reported less bulges and more protrusions and extrusions than our study.Verma et al in India reported 92% bulges, 74% protrusion and 28% extrusion[45]. This particular study had more bulges, protrusions and

extrusions than our study. Mboka et al in Tanzania reported 39% bulges, 63% herniations, 98% protrusion and 2% extrusion[47]. This Tanzanian study reported less bulges and extrusions at the same time having a high number of protrusions and herniations.In Nigeria a study by Irurhe et al. reported 3.5% bulges, 59.7% multiple disc herniation, 44.7% protrusions and extrusions 24.7%[50]. This study reported less bulges, protrusions, extrusions and more herniations than our study. Younis in Lahore reported bulges 78% and herniations 25%[44]. This particular study reported more bulges than herniations which were findings similar to our study. From these findings, bulges, herniations, protrusions and extrusions are common in patients with chronic LBP. The variance in proportions of disc contour abnormalities reported in various studies could be attributed to a problem with the definitions. Radiologists and spine surgeons need to use similar terminology so as to be able to determine clinically significant lesions.

5.3.2The most common site of lumbar disc degeneration in patients with low back pain

Traditionally, disc degeneration is common in the areas with the heaviest mechanical stresses such as the lower lumbar region. A fact verified in this study, where the findings reported that the majority of the participants, who had bulges (78.51%) and herniations (60.47%), had lesions commonly appearing at L4/L5. On the other hand lesions at L5/S1 were seen in 66.12% and 44.19% patients with bulges and herniations respectively. These findings are comparable but with a higher incidence than those found in other African studies where L4/L5 lesions were the commonest at 42.3%, 54.5% and 42% respectively[17, 27, 47]. These were then followed by L5/S1 lesions at 25.5% and 25% respectively[17,47].

5.3.3 The common complications of lumbar disc degeneration

Individuals with lumbar disc degeneration (LDD) are predisposed to the development of common potential complications such as neural compression, chemical irritation of nerves, osseous abnormalities, segmental instability, spinal stenosis and pain[48]. In this study, the most common complication of bulges and herniations were reported as impingement of exiting nerve roots 47.06% and compression of exiting nerve roots and cauda equine nerve roots 70.73% respectively. Yong et al reported 42.1% which was slightly lower, whereas Mboka et al reported 77% nerve root compression which was comparable to the findings in this study[26, 47].

5.4 Association of lumbar disc degeneration with socio-demographic factors

Attempts were made in this study to identify if there is a relationship between lumbar degenerative disc disease and socio-demographic factors. It was observed that none of the socio demographic characteristics was associated with LDD in the multiple logistic regression except age that tended towards significant. Studies done have shown a significant correlation ($p<0.05$) between disc degeneration and age [47, 55]. The same studies did not establish any association between disc degeneration and gender[47]. Another study reported greater disc degeneration with occupational and physical loading in the upper lumbar levels ($P = 0.055 - 0.001$), whereas sedentary work was associated with lesser degeneration ($P = 0.006$)[56]. These univariate associations did not reach statistical significance in the lower lumbar region. The aetiology of LDD is multifactorial with most evidence pointing to an age-related process influenced primarily by mechanical and genetic factors[57]. Findings in this current study reinforce findings reported in studies in the developed world about the substantial role of genetics in the development of LDD as opposed to the minor effects of particular environmental factors like job type[58, 59].

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS.

6.0 Introduction

This chapter outlines the conclusion from the study and gives some recommendations.

6.1 Conclusion

- Lumbar disc degeneration (LDD) is the most common pattern which results in disc contour abnormalities like bulges and herniations. This is common at the L4/L5 followed by L5/S1 region and causes impingement and compression of exiting nerve roots.
- Lumbar spondylosis is the second most common pattern. It is common in the L4/L5 and L5/S1 region and causes spinal canal stenosis.
- The common lumbar spine infections are tuberculosis followed by pyogenic infections in the mid lumbar region at L3/L4 resulting in spinal canal stenosis.
- Primary tumours of the lumbar spine are rare. Metastases are the most common lumbar spine neoplastic process seen.
- There is no association between lumbar degenerative disc disease and socio-demographic characteristics.

It is expected that with the aid of diagnostic imaging modalities such as MRI the primary care physicians will be able to make a more directed referral to an appropriate specialist for timely intervention. This will improve the quality of healthcare services and management of the patient.

6.2 Limitations of the study

- The population was a highly selected cohort of patients who could afford MRI excluding many poor patients who may have had the other patterns.

6.3 Strengths of the study

- MRI is an important diagnostic imaging tool for patients with LBP.

6.4 Recommendations

1. MRI should be done in patients with LBP. This routinely done on patients with suspected complicated LBP in developed countries and the practice should also follow suit in our setup.

2. Public hospitals in the country should be equipped with adequate radiological equipment which includes a MRI machine. Equipping hospitals with MRI scans and subsidizing the cost of MRI scanning can improve diagnosis and management of patient with LBP, thus reducing disability in these patients.

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APPENDIX 1
DATA COLLECTION FORM

DATE ……. **CODE** ☐

SECTION A :

1. Kindly answer all questions in the spaces provided
2. Do not indicate the name anywhere on the form
3. It is absolutely important that all questions have a response

1. Gender a. Female ☐ b. Male ☐

2. DOB……..**Age** ……

3. Main Presenting Complaint……

4. Duration of Low Back Pain……....

5. History of Trauma Yes ☐ ☐

6. Occupation……
…

SECTION B (For official use only, tick appropriately)

8. MRI Findings

Morphology of lumbar vertebral bodies: Normal ☐ Abnormal ☐

Vertebral curvature: Normal ☐ Loss of lordosis ☐ Scoliosis ☐

Vertebral body height: Normal ☐ Reduced ☐

Vertebral collapse: Present ☐ Absent ☐

Verterbral spondylolisthesis: Present ☐ Absent ☐

Verterbral pseudospondylolisthesis: Present ☐ Absent ☐

Destructive process: Present ☐ Absent ☐

Infiltrative process:	Present	☐	Absent	☐
Osteophytes:	Present	☐	Absent	☐
Endplates changes:	Present	☐	Absent	☐
Prevertebral soft tissue:	Normal	☐	Abnormal	☐
Paravertebral soft tissue:	Normal	☐	Abnormal	☐
Paravertebral masses:	Present	☐	Absent	☐
Facetal joint arthrosis:	Present	☐	Absent	☐
Osteopenia:	Present	☐	Absent	☐
Ligamentum flavum hypertrophy:	Present	☐	Absent	☐
Anterior longitudinal ligaments:	Normal	☐	Abnormal	☐
Posterior longitudinal ligaments:	Normal	☐	Abnormal	☐
Bony spinal canal:	Normal	☐	Abnormal	☐
Lateral recesses:	Normal	☐	Abnormal	☐
Neural foramina:	Normal	☐	Abnormal	☐
Disc morphology:	Normal	☐	Abnormal	☐
Disc displacement:	Present	☐	Absent	☐
Disc bulge:	Present	☐	Absent	☐
Disc herniation:	Present	☐	Absent	☐
Disc extrusion:	Present	☐	Absent	☐
Disc protrusion:	Present	☐	Absent	☐
Annular tear:	Present	☐	Absent	☐
Schmorl’s nodes:	Present	☐	Absent	☐
Disc dehydration:	Present	☐	Absent	☐
Conus medullaris:	Normal	☐	Abnormal	☐

Cauda Equina:	Normal	☐	Abnormal	☐
Muscle spasms:	Present	☐	Absent	☐
Marrow signal intensity:	Normal	☐	Increased	☐
Gadolinium enhancement:	Present	☐	Absent	☐

9. MRI DIAGNOSIS

A. Lumbar Degenerative Disc Disease

a. Bulge

i) Type of bulge……

ii)Site of lesion

L1-L2 ☐

L2-L3 ☐

L3-L4 ☐

L4-L5 ☐

L5-S1 ☐

Other (Specify)……...

iii) Complication……..

b. Herniation

i)Type of herniation…….

ii) Site of lesion

L1-L2 ☐

L2-L3 ☐

L3-L4 ☐

L4-L5 ☐

L5-S1 ☐

Other (Specify)……

iii) Complication…….

c. Other type of LDD……

i) Site of lesion

L1-L2 ☐

L2-L3 ☐

L3-L4 ☐

L4-L5 ☐

L5-S1 ☐

Other (Specify)……..

ii) Complication…….

B. Lumbar Spondylosis

i) Site of lesion

L1 ☐

L2 ☐

L3 ☐

L4 ☐

L5-S1 ☐

Other (Specify)…….

ii) Complication……

C. Lumbar Spine Infections

i)Type of Infection……

ii) Site of lesion

L1 ☐

L2 ☐

L3 ☐

L4 ☐

L5-S1 ☐

Other (Specify)…….

iii) Complication……

D. Lumbar Spine Neoplastic Disease

i) Location of lesion Extradural ☐

Intradural extramedullary ☐

Intramedullary ☐

Other (Specify)…….

ii (a)Primary Spinal Tumour Known ☐ Not known ☐

(b)If primary tumour known specify…….

iii) a)Metastases Present ☐ Absent ☐

b) If primary tumour known specify……....

iv) Site of lesion

L1 ☐

L2 ☐

L3 ☐

L4 ☐

L5-S1 ☐

Other (Specify)…….

v) Complication…….

E. Other (Specify)…….

APPENDIX 2

CONSENT FORM: ENGLISH

Magnetic Resonance Imaging (MRI) Patterns among Patients with Low Back Pain attending MRI centres in Eldoret, Kenya.

Investigator – Dr Juliette Adhiambo Orege, P.O .Box 4606-30100 ELDORET, KENYA.

I……. ……

of P.O. Box …….....

Telephone……

Hereby give informed consent to participate in this study at the Eldoret Hospital/Mediheal. The study has been explained to me clearly by Dr. Juliette A.Orege / her assistant).

I have understood that to participate in this study, I shall volunteer history of illness and undergo radiologic imaging .I am aware that I can withdraw from this study any time without prejudice to my right of treatment at Eldoret Hospital/Mediheal now or in the future. I have been assured that no injury shall be inflicted on me from my participation in this study directly or indirectly and that all information shall be managed and treated with confidence.

Signature of participant/ Guardian…….

Date……

Witness: Name…… Sign ……

Date……

IDHINI YAKO: KISWAHILI

Uchunguzi wa Chanzo cha Wagonjwa Kuumwa na Mgongo Kutumia Mtambo ya MRI Mjini Eldoret, Kenya.

Mchunguzaji mkuu – Daktari Juliette Adhiambo Orege,S.L.P. 4606-30100 ELDORET, KENYA.

Mimi……. wa S.L.P. …….....

Nambari ya simu…….

Natoa idhini kuhusika katika uchunguzi huu unaoendelea katika hospitali ya Eldoret/Mediheal. Nimeelewa na kupewa maagizo na mchunguzaji mkuu Daktari Juliette A. Orege / msaidizi wake. Nakubali kuhojiwa kuhusu ugonjwa na kupelezwa kutumia mbinu ya XRAY aina ya MRI. Ninafahamu kuwa naweza kujiuzulu wakati wowote bila kunyimwa matibabu katika hospitali ya Eldoret/ Mediheal. Nimehakikishiwa kuwa hakuna madhara yoyote kwangu wakati wa uchunguzi na ya kuwa stakabadhi zote zitalindwa kwa njia ya siri.

Sahihi ya mhusika/ mlinzi……

Tarehe……

Shahidi: Jina…… Sahihi ……

Tarehe……

APPENDIX 3 IREC APPROVAL

INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)

MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471//2/3

MOI UNIVERSITY
SCHOOL OF MEDICINE
P.O. BOX 4606
ELDORET
Tel: 33471/2/3

Reference: IREC/2011/ 42
Approval Number: 000643

8th, June, 2011

Dr. Juliette A. Orege
Moi University School of Medicine,
P. O. Box 4606,
ELDORET- KENYA.

Dear. Dr. Orege.

RE: FORMAL APPROVAL

The Institutional Research and Ethics Committee have reviewed your research proposal titled:

"MRI Patterns of Low Back Pain in Eldoret Kenya"

Your proposal has been granted a Formal Approval Number: **FAN: IREC 000643** on 8 June, 2011. You are therefore permitted to begin your investigations.

Note that this approval is for 1 year; it will thus expire on 7th June, 2012. If it is necessary to continue with this research beyond the expiry date, a request for continuation should be made in writing to IREC Secretariat two months prior to the expiry date.

You are required to submit progress report(s) regularly as dictated by your proposal. Furthermore, you must notify the Committee of any proposal change (s) or amendment (s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. The Committee expects to receive a final report at the end of the study.

Yours Sincerely,

09/06/2011

DR. W. ARUASA
AG. CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

INSTITUTIONAL RESEARCH & ETHICS COMMITTEE
APPROVED
08 JUN 2011
P.O. Box 4606 ELDORET

cc:
	Director	-	MTRH
	Dean	-	SOM
	Dean	-	SPH
	Dean	-	SOM