PATTERN OF SPINE DEGENERATIVE DISEASE AMONG PATIENTS REFERRED FOR LUMBAR MAGNETIC RESONANCE IMAGING AT MUHIMBILI NATIONAL HOSPITAL, DAR ES SALAAM, TANZANIA MARCH-SEPTEMBER-2010.

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Mmed(Radiology) Dissertation

Muhimbili University of Health and Allied Sciences

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By

Mboka Jacob

A Dissertation Submitted In (Partial) Fulfillment of the Requirement for the Degree of Master of Medicine (Radiology) of Muhimbili University of Health And Allied Sciences

Muhimbili University of Health and Allied Sciences

May 2011

CERTIFICATION

The undersigned certify that he has read and hereby recommend for examination of dissertation entitled "**Pattern of spine degenerative disease among patients referred for lumbar Magnetic Resonance Imaging at Muhimbili National Hospital, Dar es Salaam, Tanzania March-September-2010**" in fulfillment of the requirement for the degree of Master of Medicine (Radiology) of Muhimbili University of Health and Allied Sciences

_____

Dr R. Kazema

(Supervisor)

Date:_____

DECLARATION AND COPYRIGHT

I, Mboka Jacob, declare that this **dissertation** entitled "**Pattern of spine degenerative disease among patients referred for lumbar Magnetic Resonance Imaging at Muhimbili National Hospital, Dar es Salaam, Tanzania March-September-2010**" is my own original work and that it has not been presented and will not be presented to any other university for similar or any other degree award.

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Abstract

Background

Degenerative disease of the lumbar spine refers to a syndrome in which an intervertebral disk with adjacent spine structures are compromised. This causes low back and lower extremity pain. The syndromes encompasses the following degenerative changes: disk degeneration, Modic changes, disk displacement, nerve root compression, facet joints arthropathy, ligamentum flavum hypertrophy and spine canal stenosis. The modality of choice for imaging this syndrome is Magnetic Resonance Imaging (MRI).

Objective: Assessment of pattern of lumbar spine degenerative disease among patients with with/without radiculopathy, referred for lumbar MRI at Muhimbili National Hospital(MNH) from March-September 2010.

Methodology: This descriptive cross-sectional study involved 165 individuals selected from patients referred for lumbar MRI at MNH. A questionnaire was administered to obtain patient demographic data and clinical information. In all participants, lumbar MRI scans were performed through L1-S1 intervertebral disc spaces. Six degenerative findings were looked at: (i) disk degeneration (ii) Modic changes (iii)disk bulge (iv) disk herniation (v)central canal stenosis (vi)nerve root compression. Statistical analysis was performed using computer program Statistical Package for Social Sciences (SPSS) version; 13. Chi-square test was, used to compare between age, gender, symptomatology and MRI findings. A p-value of <0.05 was considered to indicate statistically significant difference.

Results

The mean age of participants was 50±12.5 years. Eighty percent (80%) of participants presented with LBP with radiculopathy. After lumbar MRI, 93.9% of participants had at least one degenerative finding. Disk degeneration was found in 83% of individuals, in at least one intervertebral disc level, Modic changes (28%), disc bulging (39%), disc protrusion (63%),

central canal stenosis (30%) and nerve root compression (77%) were detected. Type II Modic changes were more common than type I (22% and 6% respectively: p-value: 0.022).

Ninty eight percent of herniated disks were protrusions. Two percent of herniated disks were extrusions and the most location for disk herniation was postero-lateral seen in 75% of herniated disks. None of the participants had disk sequestration.

The degenerative imaging findings were increasing significantly with age and there was no significant sex difference. All degenerative findings were seen at lower lumbar levels (L4/L5&L5/S1) but were more common at the L4/L5. Disk herniations, central canal stenosis and nerve root compression were common in patients with radiculopathy than in patients with LBP only (p-value 0.000).

Conclusion

Majority (93.9%) of participants had at least one degenerative imaging finding. The most frequent degenerative finding was disk degeneration(83%). Posterolateral was the most common location for disk herniation. Disk herniation, canal stenosis and nerve root compression were significantly seen in patients with radiculopathy. There were no sequestered disks found in the studied patients.

Recommendations

1) MR axial images should be obtained in a contiguous manner
2) Careful evaluation of images is needed as different types of lumbar spine degenerative findings are common among patients referred for Lumbar MRI
3) There is a need of more studies to be conducted on spine degenerative disease using bigger sample sizes

Table of Contents

May 2011CERTIFICATION ii

CERTIFICATION iii

DECLARATION AND COPYRIGHT iv

Acronyms x

LIST OF TABLES AND FIGURES xi

DEDICATION xii

ACKNOWLEDGEMENTS xiii

CHAPTER ONE 1

1.0 Introduction 1

1.1 Background 1

1.2 Causes of lumbar spine degenerative disease 1

1.3 Types of spine degenerative disease 1

1.3.1 Disk degeneration 1

1.3.2 Modic changes 2

1.3.3 Disk displacement 2

1.3.4 Central spinal canal stenosis 3

1.4 Imaging 3

2.0 Literature review 9

2.1 Prevalence of disk degeneration 9

2.2 Prevalence and types of Modic changes 9

2.3 Prevalence, types and location disk displacement 10

2.4 Prevalence of spinal stenosis and nerve root compression 11

CHAPTER TWO 12

3.0 Statement of the problem 12

4.0 Rationale 13

CHAPTER THREE....14
5.0 Objectives....14
5.1 Broad Objective....14
5.1.1 Specific objectives....14
CHAPTER FOUR....15
6.0 Materials and methods....15
6.1 Study design....15
6.2 Study population and study area....15
6.3 Sampling and Sample size....15
6.3.1 Inclusion criteria....16
6.3.2 Exclusion criteria....16
6.4 Ethical issues....16
6.5 Research instruments....16
6.5.1 Questionnaires and MRI findings recording form....16
6.6 MR Imaging and evaluation....17
6.6.1 MR Imaging....17
6.7 Reliability....20
6.8 Data Management and Analysis....20
CHAPTER FIVE....21
7. Results....21
7.1 Socio-demographic....21
7.2 Frequency distribution of imaging findings....22
7.3 Distribution of degenerative imaging findings by age....23
7.4 Distribution of degenerative findings by sex....24
7.5 Distribution of degenerative image findings by disk level....25
7.6 Type of disk herniation....26

7.7 Location of disk herniation 27

7.8 Distribution of degenerative findings by patient presenting symptoms.....28

CHAPTER SIX 29

8. Discussion 29

CHAPTER SEVEN.....34

9.0 Conclusion 34

10.0 Recommendations 34

APPENDICES 40

Appendix 1(a): Informed Consent Form (English version).....40

Appendix 1 (b): Informed Consent Form (Kiswahili version).....43

Appendix 2 (a)(English version).....45

Appendix 2 (b) Kiambatanisho 4 *(Toleo la kiswahili)* 47

Appendix 3: MRI findings recording form.....49

Acronyms

CT	Computed tomography
CSF	Cerebral Spinal fluid
HNP	Herniation of nucleus pulposus
IVD	Intervertebral disc
LBP	Low back pain
MD	Doctor of Medicine
Mmed	Masters of Medicine
MRI	Magnetic resonance imaging
MNH	Muhimbili National Hospital
SE	Spin echo
SPSS	Statistical Package for Social Sciences
STIR	Short Tau Inversion Recovery
T	Tesla
T1	Longitudinal relaxation time
T2	Transverse relaxation time
TE	Echo time
TR	Repetition time

LIST OF TABLES AND FIGURES

Figure/Table number	Page
Figure 1	4
Figure 2	5
Figure 3	6
Figure 4	7
Figure 5	8
Figure 6	19
Figure 7	21
Figure 8	22
Table 1	23
Table 2	24
Table 3	25
Table 4	26
Table 5	27
Table 6	28

DEDICATION

"Mkamate sana elimu, usimwache aende zake,

mshike maana yeye ni uzima wako"

Mithali 4:13

"Take firm hold of instruction. Do not let her go.
Keep her, for she is your life"

Proverb 4:13

This work is dedicated to

my beloved husband

Dr Deogratias B. Kilasara

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First of all, I thank God, the Almight for keeping me healthy enough to be able to complete this work.

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CHAPTER ONE

1.0 Introduction

1.1 Background

Degenerative disease of the lumbar spine refers to a syndrome in which an intervertebral disk with adjacent spine structures are compromised, this can be due to aging process associated with pathologic[1]. Individuals with degenerative disease of the lumbar spine can be symptomatic or asymptomatic, although commonly the disease is asymptomatic[2,3,4]. The symptomatic individuals can present with back pain or radicular pain syndrome (sciatica)[5]. The possible sources of pain are mechanical compression of neural elements by disk herniation, as well as direct biochemical and inflammatory[5,6]. Thirty five percent(35%) of asymptomatic individuals may have degenerative spine findings, including: disk degeneration, Modic changes, disk bulges, facet joint arthropathy and spinal stenosis [2,3,4].

1.2 Causes of lumbar spine degenerative disease

Ageing is main factor implicated in spine degenerative disease[6]. Apart from age other factors have been implicated as causes of spine degenerative disease, these include; genetic inheritance, physical loading history, trauma and impaired nutrition [1,7]. Lumbar spine is the common area affected by degenerative changes, as it is a part of spine which is subjected to heavy mechanical stress [8].

1.3 Types of spine degenerative disease

This disease encompasses disk degeneration, Modic changes, disk displacement, facet joint arthropathy and associated complications (nerve root compression and spinal canal stenosis)[6]

1.3.1 Disk degeneration

Disk degeneration is a loss of disk signal on T2W images with/without disk height reduction[1]. The dark signal of the disk on T2W images is due to loss of water content. Initially there are biochemical changes within a disk, resulting in dehydration of disk[1.] In later stages of the

disease morphological changes such as loss of disk height, annular tears, rim lesions and osteophyte formation materialize [9]. The occurance of annular tears leads weakening of the annulus fibrosus hence disk displacement beyond the vertebral margins.

1.3.2 Modic changes

Modic changes are endplate degenerative changes due to disk degenerative disease [10]. These are signal intensity changes shown adjacent to the endplates of the degenerated intervertebral discs in magnetic resonance imaging (MRI) [1, 11]. They are assumed to be a specific phenotype of degenerative disc disease[1]. These Modic changes can be painful – especially type I changes [1]. They are common observation on MR images and are of three main forms[1]. Type I is the acute stage of disk disease, there is invasion of the cancellous spaces by fibrovascular reactive tissue[12,13]. With time, fatty replacement of red marrow occurs leading to type II Modic changes; eventually bony sclerosis of the marrow occurs and leads to type III Modic changes [12, 13].

1.3.3 Disk displacement

Disk displacement is also one of the findings in spine degenerative disease. The displaced disk can be a simple bulge, protruded, extruded or sequestration.[6]

1.3.3.1 Disk 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, nonosseous material extending beyond the normal disc space in a circumferential manner [13, 14].

1.3.3.2 Disk herniation: "is a localized/focal displacement of disk beyond the intervertebral disc space [15]. A herniated disk can be protruded, extruded or sequestrated[6].

1.3.3.3 Disk protrusion: is a focal displacement disk material beyond margins of adjacent vertebral endplates involving <50% of disk circumference [16].

1.3.3.4 Extrusion: is a herniated disc in which, has a small connection with the parent disk (narrow neck)[13].

1.3.3.5 Sequestration (free disk fragment): is a a piece of disc tissue belonging to the disc material, moving separately from and having no connection with the main disc, migrating within the spinal canal cavity [17].

1.3.4 Central spinal canal stenosis

Spinal stenosis is defined as loss of signal in epidural fat with compression of neural tissues within the canal[10,17]. Spinal stenosis is evident when there is reduction of spinal canal diameter to less than 18mm[16]. The normal size of the lumbar spinal canal is 18 to 23mm.[16]. Spinal canal stenosis commonly presents between 30 and 50 years of age[16]. Degenerative lumbar changes cause spinal stenosis. These changes include hypertrophy of the facet joints, bulging or protruded disks, hypertrophy of ligamentum flavum and degenerative osteophytes. Less common causes of central canal stenosis include bony overgrowth from Paget disease, achondroplasia, posttraumatic changes, and spondylolisthesis[18]. Presenting symptoms of canal stenosis are LBP and activity dependent lower limb symptoms (neurogenic claudication) [12, 19].

Spinal canal measurements were once considered very useful in the determination of stenosis, though currently they are no longer considered a valid indicator of disease[18]. Currently evaluation of canal stenosis is by noting whether the thecal sac is compressed or round[18]. Mild canal stenosis is present when there is reduction of sagittal diameter to less than 1/3 or there is partial effacement of epidural fat. Moderate canal stenosis occurs when there is reduction of sagittal diameter between 1/3 and 2/3 or there is moderate effacement of epidural fat. Severe canal stenosis occurs when the sagittal diameter is reduced to more than 2/3 or there is complete effacement of epidural fat [14,16].

1.4 Imaging

The role of diagnostic imaging in spine degenerative disease is to evaluate the status of the neural tissues and to affect the therapeutic decision making[20]. Imaging is only justified in patients for whom surgery is considered. The commonly used imaging modalities are plain film, CT and MRI. Plain film examination of the lumbar spine is the usual initial imaging technique[21].

Plain radiography provides only limited diagnostic information because it can not show the structural morphology of the intervertebral disk. Disk herniation cannot be seen in plain x-rays. However other degenerative joint disease findings e.g: narrowing of disk space, spurring, eburnation and vacuum sign can be clearly seen on plain radiography. These findings can be found in patients with or without disk herniation [13,21].

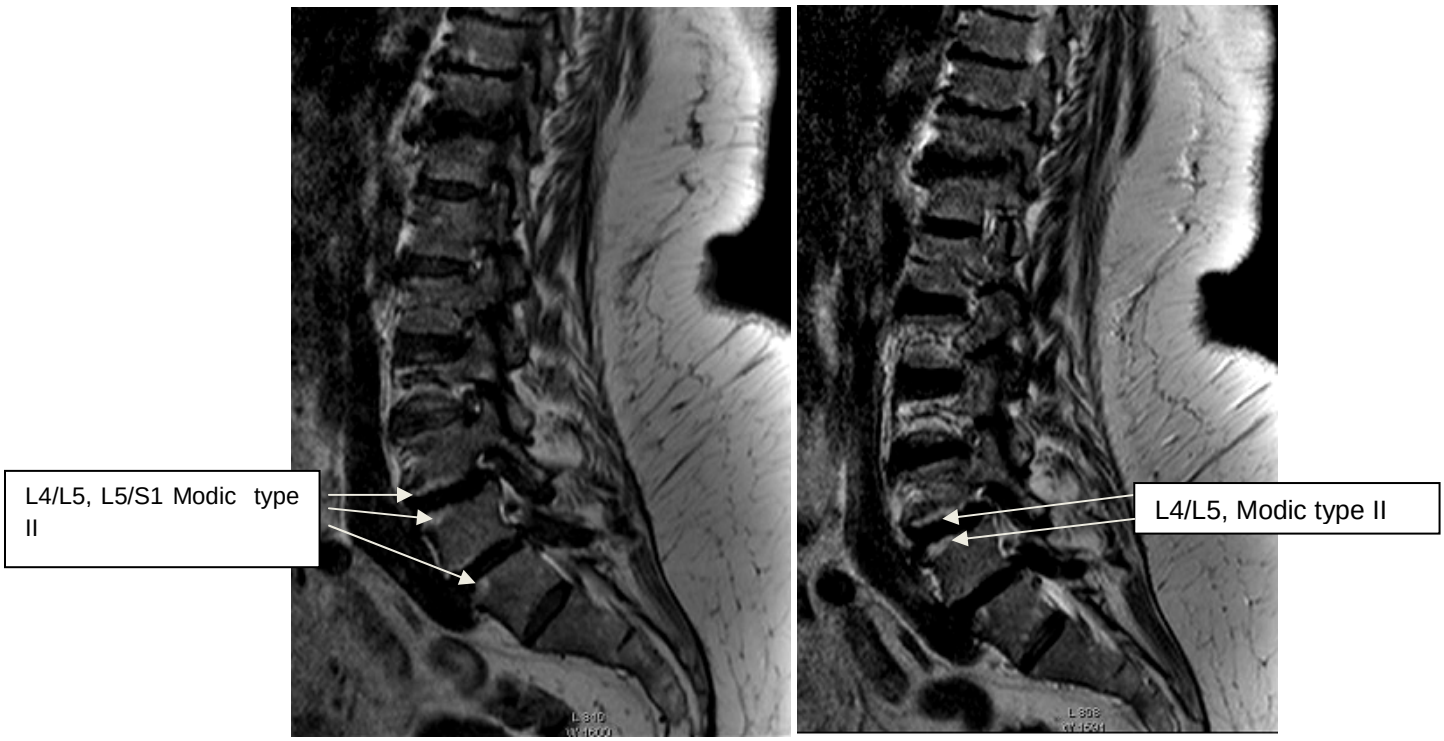


Fig 1. **A** **B**

Disk degeneration, Modic change type II, disk protrusion and exit nerve root compression in a 78 years old female reffered for Lumbar MRI at MNH. **A). Sagittal T1 weighted:** showing endplate bright signal at L4/L5 & upper anterior endplate of S1. **B). Sagittal T2 weighted:** Multilevel disk degeneration are seen (low signal of disks signifying dessication), bright signals at endplates of L4/L5 and upper endplate of S1.

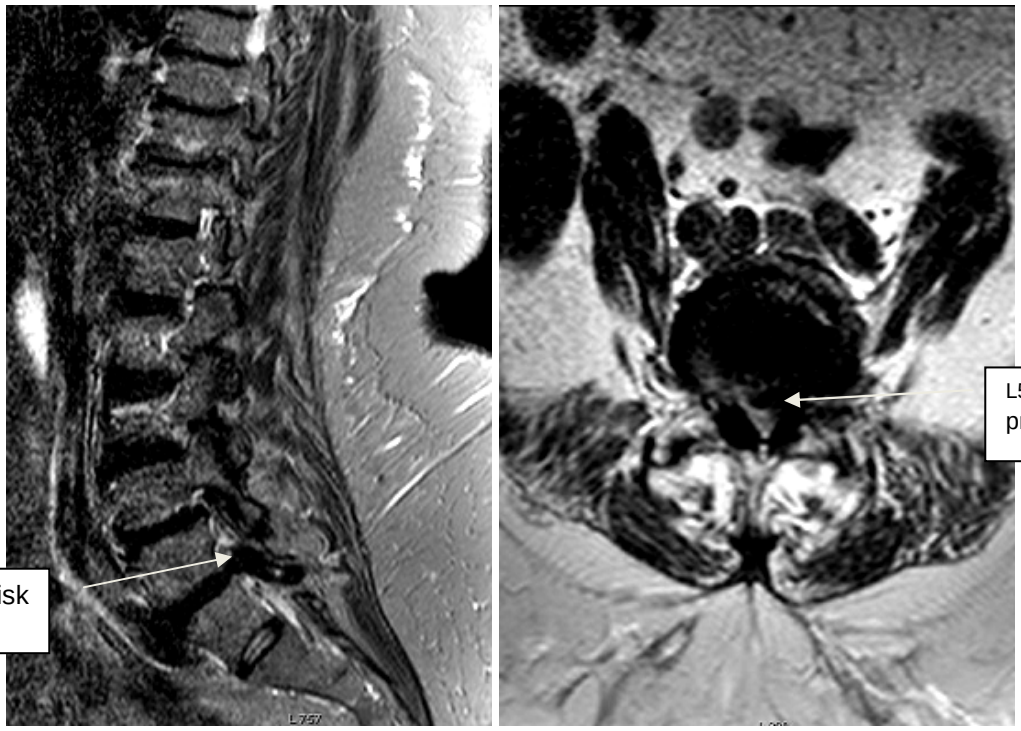


Fig 2 **A** **B**

Images of the same patient on fig 1 **:A). Sagittal STIR**; the bright endplate signal at L4/L5 and upper endplate of S1 is suppressed, this signifies that the changes were due to endplate fat degenerative changes**, (Modic type II changes)**. **B). Axial T2 weighted at L5/S1:** Central canal stenosis and bilateral exit nerve root compression due to left posterolateral disk protrusion and facet joint arthropathy and ligamentum flavum hypertrophy

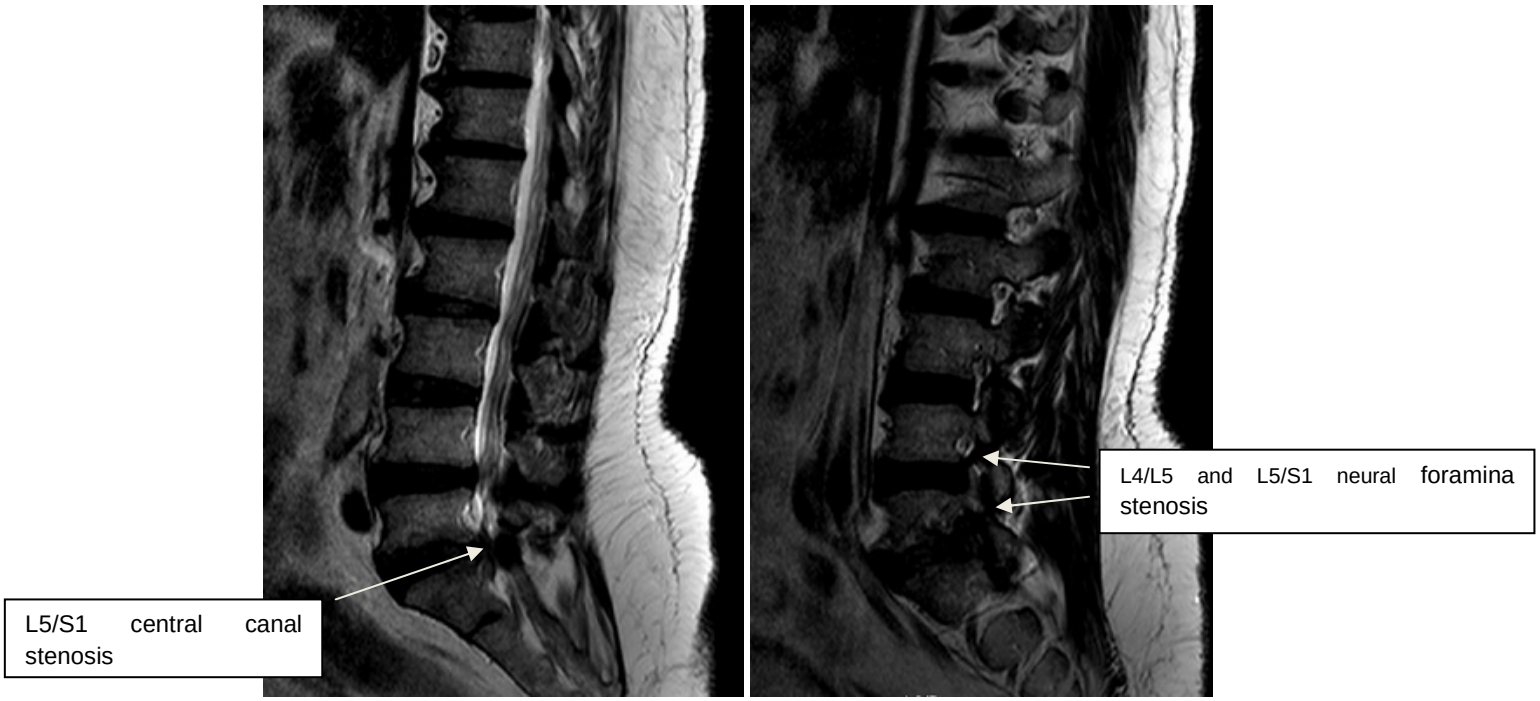


Fig 3. **A** **B**

Multilevel disk degeneration, disk bulge, central & exit neural foramina stenosis in a 69 years old male patient referred for lumbar MRI at MNH. **A)T2 weighted-mid saggital**: all disks have low signal (low water content/desiccated), disk bulge seen at L4/L5 & L5/S1, central canal stenosis is seen at L5/S1. **B)T2 weighted-parasaggital**, showing severe exit neural foramina stenosis at L4/L5 & L5/S1.

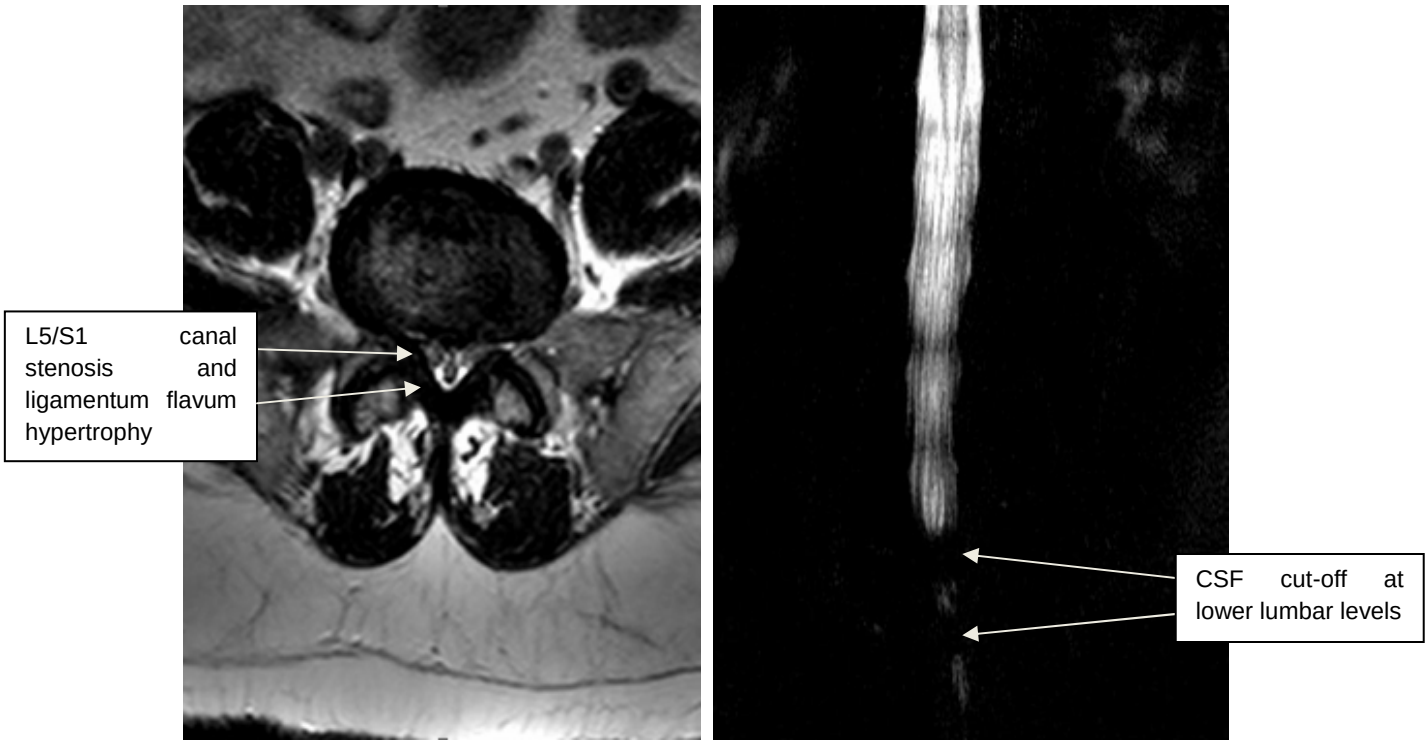


Fig 4. **A** **B**

Images of the same patient as fig 3. **A)T2 weighted-axial view**, showing severe central canal stenosis at L5/S1, note the facet joint and ligamentum flavum hypertrophy at this level **B)MR-myelogram** showing CSF blockage at lower levels due to central canal stenosis.

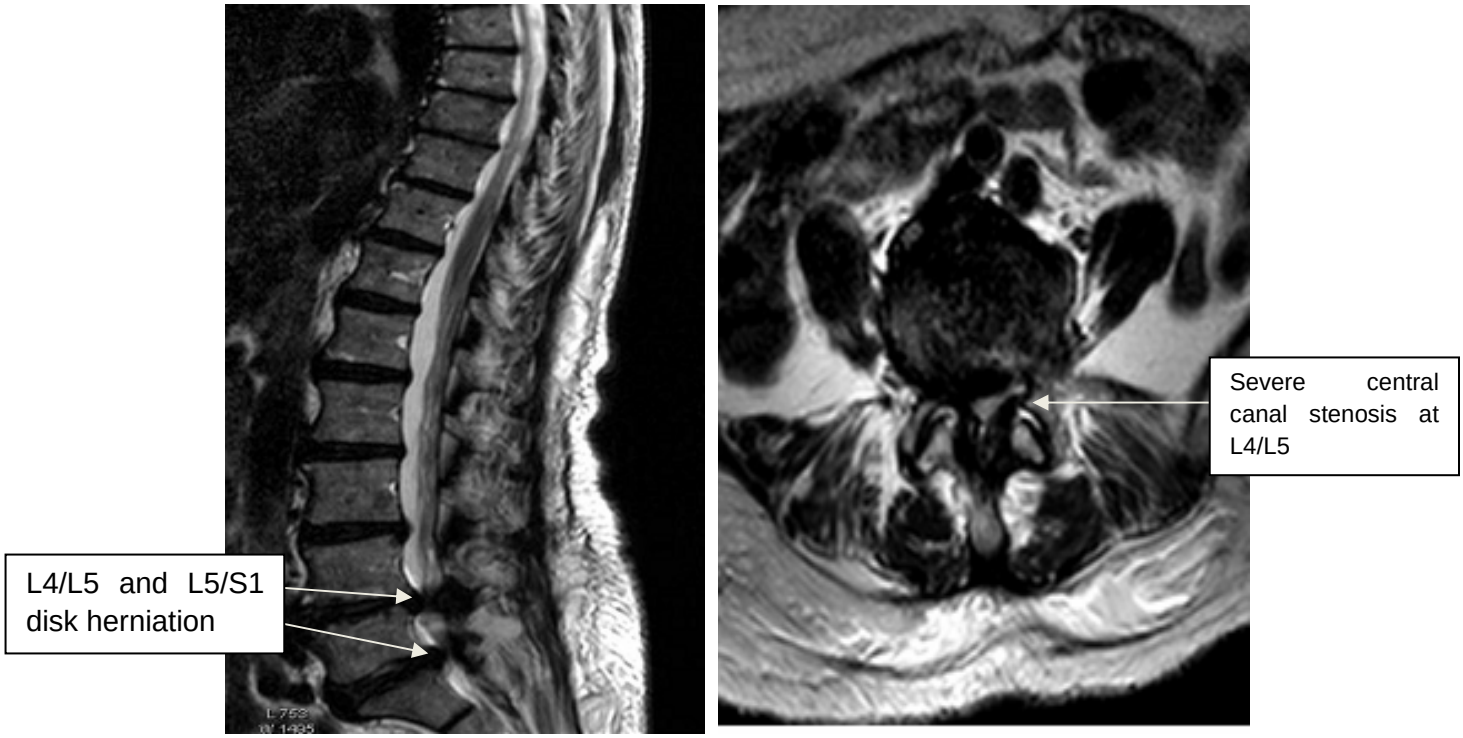


Fig 5. **A** **B**

Disk herniation and severe Central canal stenosis at L4/L5 & L5/S1 in a 80 years old female patient who was referred for lumbar MRI due to LBP and radiculopathy. **A) T2 weighted-mid-sagittal** showing multilevel disk degeneration, (note the reduction of disk space height at all levels) ,disk herniation and severe central canal stenosis at L4/L5 & L5/S1. **B) T2 weighted- axial view** showing right postero-lateral herniated disk, bilateral facet joint arthropathy, ligamentum flavum hypertrophy at L5/S1, all contributing to the central & exit neural foramina stenosis.

2.0 Literature review

Degenerative disease of the spine is a worldwide problem. Its prevalence increases with age. It ranges from 85% to 95% among adults aged 50 to 55 years, with no sex difference[6, 22, 23]. Lumbar spine degenerative disorders including disk degeneration, modic changes, disk bulge, disk herniation, canal stenosis and nerve compression, have been extensively studied. These disorders occur frequently at L4/L5 and L5/S1[1,6]. This is due to the fact that the lower vertebrae undergo heavy mechanical stress[10].

2.1 Prevalence of disk degeneration

Disk degeneration is common in individuals who are more than 40 years of age though its prevalence increases progressively to over 90% by 50 to 55 years of age[16, 24, 25.]. The disease is not uncommon in individuals below thirty years of age and the prevalence is between 20% and 50% [3, 23, 26]. Disk degeneration in this age group can be mainly due to genetic predisposition. Other factors like repeated traumatic injuries and physical loading history do play a role. The difference in prevalence among young and aged individual is mainly due to aging process.

The most common spine levels for disk degeneration are at L4/L5 and L5/S1 [8,23]. In many studies no association has been developed between disk degeneration and LBP although Sivas et al [10] observed higher prevalence of disk degeneration among symptomatic individuals as compared to asymptomatic ones (55.5% and 33.3% respectively). Cheung et al (2009)[23] reported a significant association between lumbar disk degeneration on MRI and back pain.

2.2 Prevalence and types of Modic changes

The prevalence of Modic changes ranges from 18% to 58%. Modic changes are common in patients with LBP and strongly associated with LBP. Type I changes are more related to LBP because these changes are due to associated with invasion of the cancellous spaces by fibrovascular reactive tissue, which causes inflammation and hence pain[1, 10 ,27]. Type II Modic changes are more frequent than type I, 1.6% as compared 4% respectively[1]. In asymptomatic individuals the prevalence ranges between 12 and 13%[1].

2.3 Prevalence, types and location disk displacement

Disk displacement is also one of the findings in spine degenerative disease. The prevalence of disk herniation ranges from 60% to over 90% [20, 28, 29]. Among young adults the prevalence of disk herniation is low. This has been reported by Takatalo et al [26] to be less than 1% among individuals aged between 20 and 22 years.

Disk herniation causes compression of the nerve roots resulting in sciatica. Shobeiri et al [28] reported a prevalence of 29% and 4% among sciatica and patients with LBP respectively (p-value $p < 0.001$). L4/L5 and L5/S1 are the most common levels of disk herniation. The reported frequency at these levels is ranging from 30% to over 90% [8, 12, 16, 22, 28,]. Nineteen percent and five percent of the disk herniations occurs at L3/L4 and L1/L2 respectively [16].

Most common location for disk herniation is Posterolateral (49%)[16]. This is due to weak points along posterolateral margin of disk at lateral recess of spinal canal. Other locations include posterocentral (8%), lateral or foraminal in less than 10%[16]. Extraforaminal or anterior account for 29%. This location is commonly overlooked. Intraosseous disk herniation accounts for 14% which is also known as vertical herniation or Schmorl node [16].

Takarad et al(2008)[22] observed that nearly 93% of disk herniations occur inside the spinal canal (intraspinal), 3% are predominantly in the intervertebral foramen, and 4% are extraforaminal or occur far laterally[14]. Central herniation is not common because of the presence of strong ligament[16].

The main presentation of disk herniation is sciatica and about 95% of patients with herniation have sciatica[4]. Patient present with: stiffness in the back, pain radiating down to the thigh, calf or foot, paresthesia, weakness or reflex changes. Pain is exaggerated by coughing, sneezing, physical activity, and it is worse while sitting or straightening of a leg due to irritation of the nerve root by the herniated disk[16].

Disk bulges are other imaging findings of degenerative disease of the lumbar spine and the prevalence is about 25% among young individuals[10, 26]. The common spine level involved in disk bulges is at the L5/S1 [10, 23].

2.4 Prevalence of spinal stenosis and nerve root compression

Spinal stenosis is also one of the findings in degenerative changes and it is more common in patients with sciatica than in patients with low back pain [6] . Shobeiri et al(2009) [28] reported the prevalence of 37% among patients with sciatica and 11% among patients with LBP (p-value < 0.001).

Another finding in degenerative spine changes is nerve root compression, which is mainly caused by herniated disks. About 91% of sciatic patients have nerve root compression as compared to 36% among patients with LBP[28]. The overall prevalence of nerve root or thecal sac compression is reported to be 73% and it is more frequent at level L5/S1[29].

CHAPTER TWO

3.0 Statement of the problem

LBP is a major public health problem[3]. Eighty percent (80%) of the adult population suffers from LBP at some time in their lives [3, 10, 30,]. Around 10% of sufferers become chronically disabled[3]. Patients with this disease may also present with sciatic symptoms. The quality of life and hence productivity is reduced due to LBP and sciatica to significant proportion of population affected[3.]

The primary disorder in Lumbar Spine Degenerative Disease is disk degeneration[6]. The degenerated disk is weakened hence causing instability of the spine, which may result in modic changes, disk displacement, nerve root compression and canal stenosis[6]. This disorder is common among middle-aged individuals, who are at large the working population hence an enormous economic burden may be created in the society[3].

Before surgery, MRI is recommended in patients with severe symptoms, as it has better tissue segregation than other imaging modalities[28]. At our set-up, MRI is costly, where by few patients can afford it.

4.0 Rationale

Lumbar spine degenerative disease is a poorly researched area worldwide, and this can be far worse in developing country like Tanzania. This is due to inadequate resources for research and health care services. To date there is no any published data in Tanzania on this study area.

Since the pattern of the of lumbar spine degenerative disease has not been established, it is poorly diagnosed and hence poorly managed syndrome. This study was done in order to establish pattern of lumbar spine degenerative disease to patients referred to MNH for lumbar MRI. Previously conventional x-rays and clinical findings were mainly used to diagnose lumbar spine degenerative disease at MNH. However some of lumbar spine degenerative disease are not detected by plain x-rays. Currently, CT scan and MRI are used in the diagnosis of lumbar spine degenerative disease following plain x-rays. However, MRI is the modality of choice and better than CT scan for diagnosis of lumbar spine degenerative disease. It provides better tissue segregation. In this study only MRI was used to diagnose lumbar spine degenerative disease. Other advantages of MRI is having no known side effects or morbidity, non invasive and no radiation exposure.

The aim of this study therefore, was to establish pattern of lumbar spine degenerative disease among patients with LBP with or without radiculopathy, referred for lumbar MRI at Muhimbili National Hospital. The results of this study can be used as baseline data for comparison with other studies elsewhere, and assist in planning for further research areas on lumbar spine degenerative disease.

CHAPTER THREE

5.0 Objectives

5.1 Broad Objective

Understanding the pattern of lumbar spine degenerative disease, among patients with LBP with or without radiculopathy, referred for lumbar MRI at Muhimbili National Hospital from March-September 2010

5.1.1 Specific objectives

1. To determine proportion of individuals with lumbar spine degenerative imaging findings by age and sex, among patients with LBP with/without radiculopathy referred for lumbar MRI at MNH from March to September 2010.
2. To determine proportion of individuals with lumbar spine degenerative imaging findings by spine level, among patients with LBP with/without radiculopathy referred for lumbar MRI at MNH from March to September 2010
3. To determine frequency distribution of types of disk herniations among patients with LBP with/without radiculopathy referred for lumbar MRI at MNH from March to September 2010
4. To determine proportion of individuals with lumbar spine degenerative imaging findings by their presenting symptoms among patients with LBP with/without radiculopathy referred for lumbar MRI at MNH from March to September 2010.

CHAPTER FOUR

6.0 Materials and methods

6.1 Study design

This is a hospital based cross-sectional descriptive study conducted from March to September 2010.

6.2 Study population and study area

Study population included all patients above 20 years of age with LBP with/without radiculopathy who were referred for lumbar spine MRI at Radiology department, MNH from March to September 2010.

MNH is largest referral and teaching hospital in Tanzania located in Dar es Salaam city. It is the only public/government hospital with MRI facility. It receives referred patients from all referral hospitals, as well as patients from various hospitals in Dar Es Salaam and its surrounding regions.

6.3 Sampling and Sample size

All consented patients with LBP with/without radiculopathy referred for lumbar MRI were consecutively included in the study.

A total of 180 individuals had lumbar MRI sacn from March to September 2010, but only 165 whom fulfilled the study criterion were studied. The sample size was calculated from the formula $n=Z^2P(1-P)/E^2$ where

n= sample size,

Z = (1.96)

P = prevalence = 11%. This was the prevalence the of degenerative spinal canal stenosis among patient with LBP [28].

95% confidence interval was used.

E = error margin 5%

Therefore $n = \frac{(1.96)^2 \times 0.11 (1 - 0.11)}{(0.05)^2}$

n = 150 + 15 (10% 0f 150) , so the sample size in this study was 165 patients.

6.3.1 Inclusion criteria

Patient above 20 years of age (165), with history of low back pain with/without radiculopathy, plus lumbar spine degenerative imaging findings were studied.

6.3.2 Exclusion criteria

Fifteen patients were excluded from the study. Four had history of former lumbar spine surgery, three had vertebral trauma, two had spine tumor and six had spine infection.

6.4 Ethical issues

Ethical clearance to conduct the study was obtained from Muhimbili University ethical committee. Permission to conduct the study at MNH Radiology department was obtained from MNH authority. Written informed consent was used to study participants. Information recorded in the questionnaire and clinical forms were used only for the study and not otherwise.

6.5 Research instruments

6.5.1 Questionnaires and MRI findings recording form.

Self-administered questionnaires (appendix 2) were used to collect socio demographic information such as age, sex and clinical history. In addition MRI findings were recorded in a special designed form (appendix 3).

6.6 MR Imaging and evaluation

6.6.1 MR Imaging

Imaging was performed by a trained Radiographer. Lumbar spine MRI was done using 1.5 T-scanner, (Phillips, Achiever, Best, Eindhoven, Netherlands). 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. The slice thickness of 4 mm was used for both sagittal and axial images. The interslice gap of 0.4 mm used with 332 × 240 matrix and a field of view of 300 mm were used for sagittal images, and 224 × 168 matrix and a field of view of 200 mm for axial images. Skip technique was used on axial scans whereby intervertebral spaces only were included.

The variables assessed on MR imaging were: Disk degeneration, Modic change, Disk bulge, Disk herniation, Central canal stenosis and Nerve root compression.

i) **Disk degeneration**: which was graded as per criterion used by Dominic et al (2001) [31]. Grade 1-2 disc degeneration were considered normal while grade 3-5 were accepted as a presence of degeneration.

Classification of Disk Degeneration on Sagittal T2-weighted MR Images (Dominic et al (2001)[31]

Grade	Differentiation of nucleus from annulus fibrosus	Signal intensity of Nucleus Pulposus	Disk Height
1	Yes	Homogeneously hyperintense	Normal
2	Yes	Hyperintense with horizontal dark band	Normal
3	Blurred	Slightly decreased, minor irregularities	Slightly decreased
4	Lost	Moderately decreased, hypointense zones	Moderately decreased

5	Lost	Hypointense, with or without horizontal hyperintense band	collapsed

ii) **Modic changes:** were evaluated in accordance with the system described by Modic [10], as follows;

- **Modic change type I:** low signal intensity on T1-weighted images and high signal intensity on T2-weighted and STIR images when compared with normal fatty bone marrow,
- **Modic change type II**: high signal intensity with both T1W, T2W and low signal on STIR images
- **Modic change type III**: low signal intensity on T1W and T2W images.

iii) **Disk bulge.** Evaluated as presence or absence of disk bulge.

iv) **Disk herniation** (protrusion, extrusion sequestration). Evaluated as presence or absence of disk herniation.

v) **Central Spinal canal stenosis**,

In this study severity of canal stenosis was graded as per Borenstein et al 2001 [14]. Mild canal stenosis was evaluated by the presence flattening of the ventral thecal sac. Moderate canal stenosis , evaluated by triangularization of spinal canal with loss of posterior epidural fat pad. Severe canal stenosis, evaluated by compression of the canal with loss of epidural fat in all planes. Only those with anatomically significant stenosis were diagnosed as patient with canal stenosis, and these were those who had moderate and severe canal stenosis.

Grading criterion for Spinal canal stenosis by Borenstien et al (2001) [29]

Normal	Round shape of spinal canal
Mild	Flattening of the ventral thecal sac

Moderate	Triangularization of the spinal canal with loss of the posterior epidural fat pad
Severe	Compression of the canal with loss of epidural fat in all planes

iv) Nerve root compression

Nerve root compression at any location (i.e. thecal sac, lateral recess or foramen), was just noted as presence or absence of nerve root compression.

Radiographic laser films were used for recording patients MR images as a hard copy. However, most of the patients digital information were preserved in the MRI workstation and special designed forms were used for recording degenerative imaging findings.

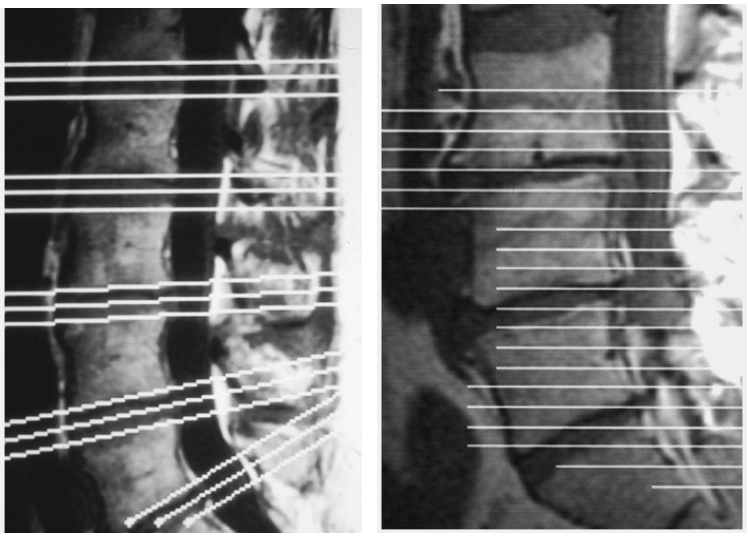


Fig 6. **A** **B**

A: Skip Areas. MR scout film has cursors placed through the disk spaces. This allows large gaps or skip areas that can result in missed free fragments of disks(this technique was used at MNH, it is considered inadequate Technique). **B:** Proper MR Technique. This MR scout, with cursors placed contiguously from the body of L3 to S1, allows complete coverage of the lower lumbar spine in the axial.

6.6.2 MR Image Evaluation

Interpretation of the MR images was performed by two evaluators (Principal investigator and one Radiologist) . Initially, all images were screened for evidence of neoplastic, inflammatory infectious disorders or surgical scars and if any, the patient was excluded from the study. Images were examined for any presence of disk degeneration, Modic changes, disk bulge, disk herniation, canal stenosis and nerve root compression. Then each spinal level was examined separately for each. Almost all patients had more than one (multiple) findings, hence at each spine level each finding was examined separately, so that at each level and finding n was equal to N (165). In all cases of disagreement between the two observers, a third opinion was sought from another radiologist. The clinical condition of the subjects was compared with the imaging findings.

6.7 Reliability

Intra examiner consistency on degenerative imaging findings was based on imaging findings from 17 randomly selected participants (approximately 10% of all participants). Measures of each degenerative finding was compared to and reported using Kappa statistics. Results of intra-examiner reproducibility for different variables ranged from 0.8 to 1.

6.8 Data Management and Analysis

Data analysis was done using SPSS version 13 [32]. Data quality check was done by running frequencies daily. Data transformation by recoding, counting and cross tabulation was performed and obtained information was processed using Pearson chi-square and Fisher's exact test to compare MRI findings and patient demographic and presenting symptoms. Fisher's exact test was used on cells with values less than 5. P-value of 0.05 was considered to indicate statistically significant difference.

CHAPTER FIVE

7. Results

7.1 Socio-demographic

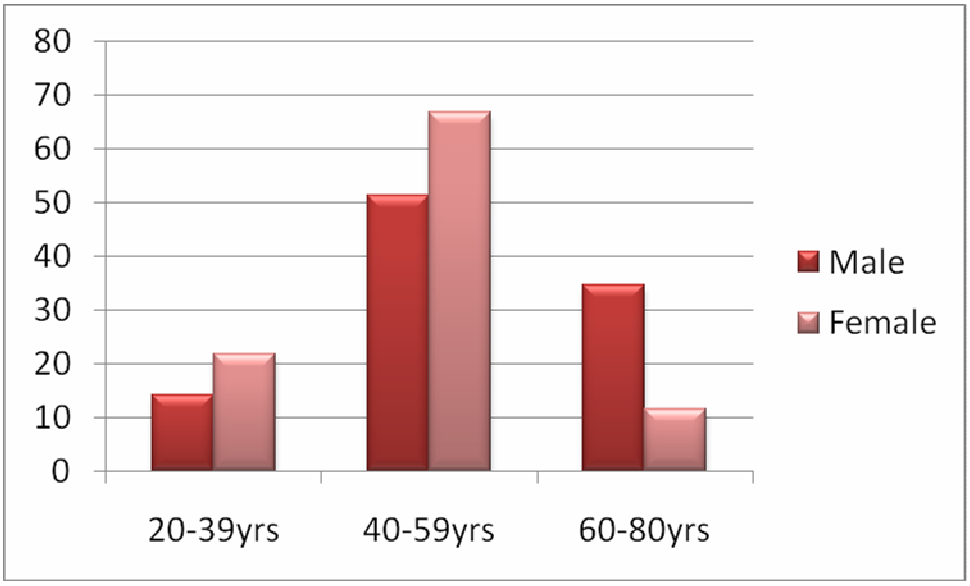


Fig 7. Percentage distribution of participants by age and sex

The study included 165 patients, the age range was from 20 to 80 years (mean; 50±12.5 years) whereby eighty-seven (53%) of them were females (figure 5).

7.2 Frequency distribution of imaging findings

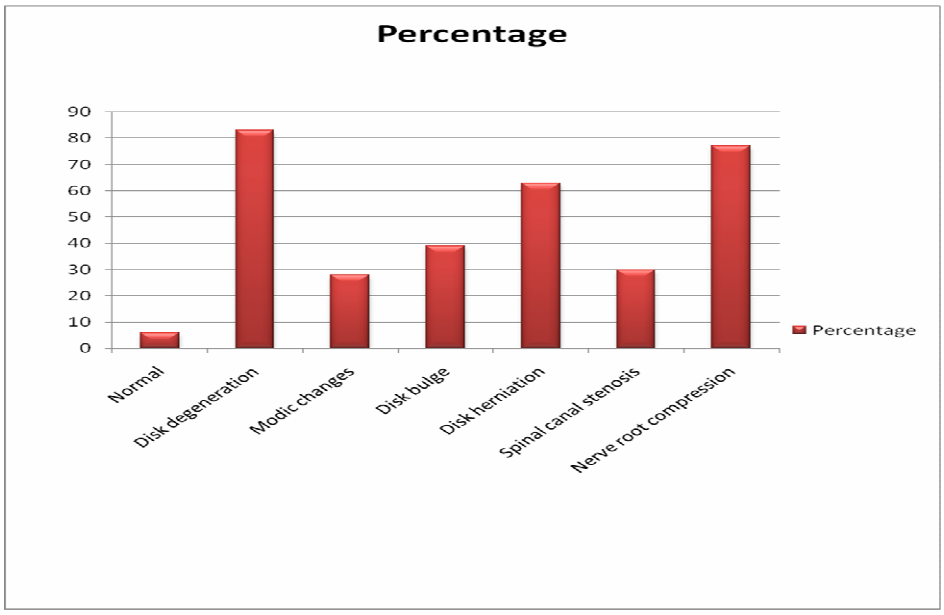


Fig 8. Frequency distribution of MR imaging degenerative findings (n=165)

On lumbar MRI, overall prevalence of lumbar degenerative findings was 94%, disk degeneration (sign of reduced disk signal intensity) being the most frequent finding seen in 137(83%) patients, followed by nerve root compression 127 (77%), disk herniation 104 (63%), disk bulge 64(39%) and central canal stenosis 50 (30%). The least common finding was Modic changes which was seen in 47 patients (28%) (figure 6). Minority of participants (6.1%) had normal lumbar MRI findings.

7.3 Distribution of degenerative imaging findings by age

Table1. Distribution of patients with degenerative imaging findings by age of (N=165) (percentages in parenthesis)

Findings	20-39yrs (n=30)	40-59yrs (n=98)	60-80years (n=37)	Total (N=165)	*P value*
Disk degeneration	13(43.3)	87(88.8)	37(100.0)	137(83.0)	.000
Modic changes	2(6.7)	31(31.6)	14(37.8)	47(28.5)	.011
Type I Modic changes	1(3.3)	6(6.1)	3(8.1)	10(6.1)	.022
Type II Modic changes	1(3.3)	25(25.5)	11(29.7)	37(22.4)	
Disk bulge	12(40.0)	40(40.8)	12(32.4)	64(38.8)	.664
Disk Herniation	14(46.7)	63(64.3)	27(73.0)	104(63.0)	.079
Canal Stenosis	2(6.7)	30(30.6)	18(48.6)	50(30.3)	.001
Nerve root compression	17(56.7)	77(78.6)	33(89.2)	127(77.0)	.002

The prevalence of lumbar degenerative findings was increasing with age. All patients aged 60 to 80 years had degenerated disks, whereby in 20 to 39 years and 40 to 59 years of age, prevalence was 43% and 89% respectively. This was also true for Modic changes, central canal stenosis and nerve root compression, (P-values; 0.011, 0.001, 0.002 respectively). Type II Modic changes were more common than type I with prevalence of 22% and 6% respectively (p-value: 0.022) (table 1).

For disk bulge, herniation the prevalence varied with age but the differences were not statistically significant (p- value > 0.05) (table 1)

7.4 Distribution of degenerative findings by sex

Table 2. Percentage distribution of degenerative imaging findings by sex (% in parenthesis)

Findings	Sex			
	Male (n=78)	Female(n=87)	Total(N=165)	*P- value*
Disk degeneration	67(85.9)	70(80.5)	137(83.0)	.353
Modic changes	26(33.3)	21(24.1)	47(28.5)	.191
Type I Modic changes	7(9.0)	3(3.4)	10(6.1)	.246
Type II Modic changes	19(24.4)	18(20.7)	37(22.4)	
Disk bulge	27(34.6)	37(42.5)	64(38.8)	.298
Disk herniation	54(69.2)	50(57.5)	104(63.0)	.118
Canal stenosis	24(30.8)	26(29.9)	50(30.3)	.902
Nerve root compression	63(80.8)	64(73.6)	127(77.0)	.272

Prevalence of various degenerative imaging findings were more common among males, only disk bulges were common among females, though the differences were not statistically significant (p-value $\geq$0.05) (table 2).

7.5 Distribution of degenerative image findings by disk level

Table 3. Percentage distribution of degenerative imaging findings by disk level (n=165, at each disk level and for each degenerative imaging finding) (percentage in parenthesis)

Spine level	Degenerative imaging findings						
	DD	MODC	DB	DH	CST	NRCOMP	Total
L1/L2	24 (14.5)	3(1.8)	1(0.6)	3(1.8)	1(0.6)	5(3)	37(4)
L2/L3	43(26.11)	7 (4.2)	4(2.4)	13(7.9)	2(1.2)	16(9.7)	85(9)
L3/L4	57(34.5)	9(5.5)	15(9.1)	29(17.6)	14(8.5)	38(23)	162(17)
L4/L5	109(66.1)	22(13.3)	38(23)	78(47.3)	41(24.8)	107(64.8)	395(42)
L5/S1	87(52.7)	14(8.5)	26(15.8)	51(30.9)	15(9.1)	71(43)	264(28)

Key for abbreviations

DD Disk Degeneration

MODC Modic Change

DB Disk Bulge

DH Disk Herniation

CST Canal Stenosis

NRCOMP Nerve Root Compression

Most of the degenerative findings were seen at lower lumbar levels i.e L4/L5 and L5/S1, 42% and 28% respectively. At L4/L5 the prevalence of disk degeneration, Modic changes, disk bulge, disk herniation, central canal stenosis and nerve root compression were 109(66%), 22(13%), 38(23%), 78(47%), 41(25%) and 107(65%) respectively, whereby these findings at L1/L2 were; 24(14%), 3(2%), 1(1), 3(2%), 1(1%) and 5(3%) respectively (table 3)

7.6 Type of disk herniation

Table 4. Percentage distribution of type of disk herniation (n=177: total number of herniated disks, percentage in parenthesis)

Disk level	Type of disk herniation		
	Protrusion	Extrusion	Total
L1/L2	3(1.72)	0(0.00)	3(1.69)
L2/L3	13(7.47)	0(0.00)	13(7.34)
L3/L4	30(17.24)	0(0.00)	30(16.95)
L4/L5	78(44.83)	1(33.33)	79(44.63)
L5/S1	50(28.74)	2(66.67)	52(29.38)
Total	174(100)	3(100)	177(100)

Ninety eight percent of all herniated disks were protrusion. Only 3 (2%) disks were extrusions (table 4).

7.7 Location of disk herniation

Table5. Percentage distribution of the location of herniated (percentage in parenthesis)

Disk level	Location of disk herniation			Total
	Posterolateral	Postcentral	Foraminal	
L1/L2	2(67)	1(33)	0(0.00)	3(100)
L2/L3	10(77)	3(23)	0(0.00)	13(100)
L3/L4	21(70)	9(30)	0(0.00)	30(100)
L4/L5	58(73)	19(24)	2(3)	79(100)
L5/S1	41(79)	10(19)	1(2)	52(100)
Total	132(75)	42(24)	3(2)	177(100)

The most common location for disk herniation was postero-lateral seen in 132(75%) disks, followed by posterocentral and foraminal 42(24%) and 3(2%) respectively, so the intraspinal disk herniation (postcentral and posterolateral) were the most common, seen in 174(98%) herniated disks (table 5).

7.8 Distribution of degenerative findings by patient presenting symptoms

Table 6. Percentage distribution of degenerative imaging findings by patient presenting symptoms (% in parenthesis)

Findings	Symptoms		
	LBP with Radiculopathy(n=132)	LBP only (n=33)	P. value
Disk degeneration	111(84)	26(79)	0.468
Modic changes	43(33)	4(12)	0.020
Disk bulge	50(38)	14(42)	0.632
Disk herniation	100(76)	4(12)	0.000
Canal stenosis	50(38)	0(0)	0.000
Nerve root compression	118(89)	9(27)	0.000

Prevalence of disk degeneration, modic changes and disk bulge did not significantly vary with patient presenting symptoms. Disk herniations, central canal stenosis and nerve root compression were common in patients with radiculopathy than in patients with LBP only. The prevalence was 100(76%), 50(38%), 118(89%) respectively for patient with radiculopathy and 4(12%), 0(0%), 9(27%) respectively for patient with LBP only (p-value 0.000). None of the patient with low back pain only had canal stenosis (table 6).

CHAPTER SIX

8. Discussion

The role of diagnostic imaging is to provide accurate anatomic information and to affect the management decision making[6]. This cross-sectional hospital based study used MRI to diagnose spine degenerative changes as it has better tissue segregation and it can show degenerative changes at an early stage as compared to other imaging techniques (such as CT scan) [20]. Other advantages of MRI include having no known side effects or morbidity, no radiation exposure and is non-invasive [10, 20, 28]. Despite its high sensitivity, degenerative changes are observed on many MRI scans in asymptomatic subjects, thus questioning its specificity [10]. That's why MRI is only beneficial to patients with chronic disease and those who are being planned for spine surgery.

All recruited patients underwent MRI of the lumbar spine and both saggital and axial views of all images were interpreted to locate the degenerative findings. Degenerative changes were observed in majority 155 (94%) of patients examined. Most of these degenerative findings were seen at L4/L5 (42%) and L5/S1 (28%). Though a degenerative change of the disk begins early in life and is partly a consequence of aging, the actual cause is not known but many factors (autoimmune, genetic, re-absorption and biochemical) have been implicated in accelerating the process. Since lumbar spine is subjected to heavy mechanical stress, it is a common area affected by degenerative changes[19] this could partly explain such observation in this study group. The mean age of this study group is 50±12.5 years , could be another explanation, as degenerative changes is common in individuals above 40 years of age and its prevalence increases progressively to over 90% by 50 to 55 years of age [16, 24, 25].

Disk degeneration was the most frequent finding observed in 137(83%) patients in this study. The prevalence was observed to increase with age (60 to 80 years of age was 100%, whereby in 40 to 59 and 20 to 39 years of age was 89% and 43% respectively). The difference observed between the age groups was significant (p-value 0.000) and compares well to the

findings of other previous studies [16, 23, 24, 25]. The prevalence of disk degeneration to young individuals (20 to 39 years) could probably be explained as a results of genetic predisposition; though, other factors like repeated traumatic injuries and physical loading history can play a role in causing disk degeneration [3, 16, 23, 26]. The difference in prevalence among young and aged individual could be contributed by aging process. Disk degeneration was slightly more frequent among males 67 (85.9%) as compared to females 70(80.5%), though the variation observed was not statistically significant. This is similar to the findings reported by Takarad et al (2008) [22].

Proportion of degenerated disks (reduction in disk signal intensity) progressively increases the lower the spine level, and that most common spine levels were L4/L5 and L5/S1[8, 23, 26,] , is similar to what was observed in this study. At L1/L2 level, 85 % of the disks had normal signal intensity, which then progressively decreased to 47% at L4/L5 level, this finding is similar to previous report by Ong et al (2003) [8].

The observation that disk degeneration was not associated with LBP, is similar to the findings from previous report by Sivas et al (2009)[9], however, Cheung et al (2009)[23] reported a significant association of lumbar disk degeneration on MRI with back pain.

The prevalence of Modic changes (28%), was higher compared to 23% found by Kuisma et al (2009)[1], and lower than prevalence of 43% found by Jensen et al (1994) [5].

Modic changes in this study increased with age, 6.7%, 31.6% and 37.8% in the age group of 20 to 39 years, 40 to 59 years and 60 to 80 years respectively and this finding was statistically significant (p-value 0.011), and this is similar to the findings by Kuisma et al (2009)[1]. This variation can be due to normal aging process in older individuals. In young individuals Modic changes are not uncommon, this was observed by Takatalo et al (2009)[26] and Sivas et al (2009)[10] to be 1.4% and 3.7% respectively in patients below 30 years. The slight higher prevalence of 6.7% was observed in 20 to 39 years age group in this study, this could be due to inclusion of patient with 31-39 years in this age group. Type II Modic changes were more common than type I with prevalence of 22% and 6% respectively (p-value: 0.022), this is similar to what was found by Kuisma et al (2009) [1].

In this study, it was observed that Modic changes progressively increased the lower the spine level, and the most common location were L4/L5 and L5/S1. This observation is consistent with previous studies by Kuisma et al (2009)[1] and Tayone et al (1994) [33].

Modic changes are associated with LBP, but may be present in individuals without LBP [5]. In this study Modic changes were more common in patients with LBP with radiculopathy as compared to those with LBP only (33% vs 12%, p-value 0.000). This can be due to the reason that majority (80%) of patients in this study had LBP with radiculopathy compared to only 20% with LBP only.

Disk displacement is also a common finding in lumbar spine degenerative disease. The displaced disk can be just a simple bulge or herniation, herniated disks can be protrusion, extrusion or sequestration. In this study disk herniations were more common than bulges (63% and 39% respectively); and this is different to the findings reported by Sivas et al (2009) [10] and Ong et al (2003) [8]. This difference could be due to young study population (individuals below 30 years) included in these studies. The prevalence of disk herniation is similar to the findings reported by Modic et al (2005)[20], but lower than what was reported by Shobeir et al (2009) [28] and Siddique et al (2005) [29].

For herniated disks, majority (98%) of types of herniation were protrusion and only 2% disks were extrusion. In this study, no disk sequestration was seen. This can be due to the skip scanning technique used at MNH, MRI unit, whereby only intervertebral spaces where scanned, leaving vertebral body areas uncovered. Disk bulges were more common among young individuals aged 20 to 39 years (40%) as compared to individuals aged 60 to 80 years (32%), unlike disk herniation which was higher among older individuals. Though these findings were not statistically significant (p-value >0.05). In this study, no significant difference in sex was found in the prevalence of disk bulges and herniations.

Various studies have reported that disk herniation is common at L4/L5 and L5/S1 and the frequency at these levels is ranging from 30% to over 90% [8, 12, 16, 22, 28]. This was also reflected in this study as 74% of the herniated disks were at L4/L5 and L5/S1, this can be due

to the large work load causing stress at these lower lumbar levels of the spine. Disk herniation at L3/L4 and L1/L2 was observed in 17% and 2% respectively, this trend is similar to previous reports [16].

The most location for disk herniation was postero-lateral, seen in 75%, followed by posterocentral and foraminal 24%, 2% respectively, this finding is similar to previous report [16]. The intraspinal disk herniation (postcentral &posterolateral) were the most common (98%), and this is similar to the findings seen by Takarad et al (2008) [22]

The main presentation of disk herniation is sciatica. In this study 76% of patients with LBP with radiculopathy had disk herniation as compared to 12% in those with LBP only (p value 0.000), this is different from report published by Modic et al (2005) [20]. This difference could be due to the short duration of patient's presenting symptoms (less than 3weeks) in Modic's study, while in this study most of patients (88%) had symptoms for more than twelve weeks.

Fifty (30%) patients in this study had central canal stenosis, which is higher compared to that reported by Modic et al (2005),[20] .and Shobeir et al (2009)[28]. This diference could be due to much older study population in this study. The common age for canal stenosis presentation is between 30 and 50 years [16]. In this study canal stenosis was common in older patients (6.7% vs 48.6% in age groups 20 to 39 years and 60 to 80 years, respectively, p-value of 0.001). Both sexes were equally affected. Canal stenosis was frequent at L4/L5 and L5/S1 , while none was found at L1/L2 level, these findings are similar to other previous studies [20, 28].

Degenerative spinal stenosis is more common in patients with sciatica than in patients with low back pain [6, 20]. In this study the prevalence of canal stenosis among patients with radiculopathy was 38% and none was found among patients with LBP only (p-value 0.000). These findings are similar to findings by Shobeir et al (2009) [28]. The small canal in patients with stenosis causes thecal sac or nerve roots to impinge against the spine bone elements hence causing radiculopathy and activity dependent pain.

Nerve root compression is most common among sciatic patients [28, 29], and lower among patients with LBP [28]. In this study prevalence of nerve root compression was 77%, and it

increased with age being 56.7% and 89.2% in 20 to 39 and 60 to 80 years of age respectively (p-value 0.002). Males were slightly more affected than females, prevalence being 80.8% and 73.6% respectively, though the results were not statistically significant.

Shobeir et al (2009) [28]-reported nerve root compression to be more frequent at level L5/S1 , which is different from this study in which L4/L5 was the common site. However, only 3% of patients had nerve root compression at L1/L2 level.

CHAPTER SEVEN

9.0 Conclusion

Ninety four percent of studied patients had lumbar degenerative imaging findings. Disk degeneration was the most frequent finding followed by nerve root compression. The least finding was modic changes, whereby type II was more common than type I. Disk protrusion was the most common type of herniation and were commonly located posterolaterally. Prevalence of degenerative findings was increasing with age (p-value < 0.05), being more common among males than females, though the difference was not statistically significant (p-value >0.05). Findings were more frequent at lower lumbar levels(L4/L5 & L5/S1). Canal stenosis, disk herniation and nerve root compression were common in patients who presented with LBP with radiculopathy. These radiological findings should receive more emphasis during the interpretation of MR images of patients who present with radiculpoathy, especially when their symptoms have become chronic.

Though in this study MRI has revealed high frequency of lumbar degenerative imaging findings, MRI may also reveal high rates of abnormalities in asymptomatic individuals[10]. About 35% of asymptomatic individuals have abnormal MRI findings (disk degeneration, HNP, disk bulge, ,spinal stenosis) [2, 3, 4, 17]. Because of these findings among asymptomatic individuals, MRI alone cannot be used to define the cause of symptoms among symptomatic patients. MRI findings must be correlated with patient age, clinical signs and symptoms following a careful physical examination for accurate management decisions.

10.0 Recommendations

1) MR axial images should be obtained in a contiguous manner, (i.e., no skip areas or gaps) in order not to miss any free disk fragment, which is one of the common causes of failure of back surgery.

2) Careful evaluation of images is needed as different types of lumbar spine degenerative findings are common among patients referred for Lumbar MRI

11.0 References

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APPENDICES

Appendix 1(a): Informed Consent Form (English version)

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

DIRECTORATE OF RESEARCH AND PUBLICATIONS, MUHAS

INFORMED CONSENT FORM

ID-NO. ☐☐

Consent to Participate in a Study

Greetings! My name is Dr Mboka Jacob; I am working on this research with the objective of determining prevalence, pattern, severity of lumbar spine degenerative disease and associated symptomatology among patient referred for lumbar scanning at Magnetic Resonant Imaging unit, Muhimbili National Hospital from June-December 2010.

Purpose of the study

The study is conducted in partial fulfillment of the requirements for the degree of Master of Medicine in Radiology of MUHAS. This study is aiming to establishing; prevalence,pattern and severity of lumbar spine degenerative disease and associated symptomatology among patient referred for lumbar MRI at MNH. You are being asked to participate in this study because your information on symptoms and findings of MRI lumbar scan will help to establish the unknown prevalence of this problem. Kindly please be honest and true for betterment of the results that could lead to better intervention and recommendations for future.

What Participation Involves

If you agree to join the study, you will be interviewed in order to answer a series of questions in the questionnaire prepared for the study and you will be scanned as per request made by attending Doctor.

Confidentiality

I assure you that all the information collected from you will be kept confidential. Your name will not be written on any questionnaire or in any report/documents that might let someone identify you. Your name will not be linked with the research information in any way. All information collected on forms will be entered into computers with only the study identification number. Confidentiality will be observed and unauthorized persons will have no access to the data collected.

Right to Withdraw and Alternatives

Taking part in this study is voluntary. You can stop participating in this study at any time, even if you have already given your consent. Refusal to participate or withdrawal from the study will not involve penalty.

Benefits

The information you provide will help to establish, pattern of lumbar spine degenerative disease and associated symptomatology. This study therefore will raise awareness on presence of lumbar spine degenerative disease and hence early diagnosis and accurate intervention.

Whom to Contact

If you ever have questions about this study, you should contact the **Principal Investigator**, **Dr Mboka Jacob,** of Muhimbili University of Health and Allied Sciences, P. O. Box 65001, Dar es Salaam. If you ever have questions about your rights as a participant, you may call

Prof. E. F. Lyamuya, Chairperson of the Senate Research and Publications Committee, P. O. Box 65001, Telephone : 255 22 2152489 Dar es Salaam and **Dr. R.R Kazema.** who is the supervisor of this study (Tel. +255754288644).

Signature:

Do you agree?

Participant agrees ……..Participant does NOT agree …….

I ……. have read the contents in this form. My questions have been answered. I agree to participate in this study.

Signature of participant …… Signature of Research Assistant ……..

Date of signed consent …….

Appendix 1 (b): Informed Consent Form (Kiswahili version)

CHUO KIKUU CHA SAYANSI ZA AFYA MUHIMBILI

KURUGENZI YA TAFITI NA UCHAPISHAJI

FOMU YA RIDHAA

Namba ya utambulisho ☐☐

Ridhaa ya kushiriki kwenye utafiti

Habari! Ninaitwa Dr Mboka Jacob nafanya utafiti wenye lengo la **kutathmini matatizo ya kulika kwa pingili za mgongo(disk degeneration) kwa wagonjwa wenye maumivu ya mgongo. Madhumuni ya Utafiti-** Utafiti huu unafanyika katika kutimiza sehemu ya matakwa ya shahada ya uzamili ya matibabu kitengo cha vipimo vya mionzi (Radiology) Chuo Kikuu cha Afya na Sayansi ya Tiba Muhimbili. Unaombwa kushiriki katika utafiti huu ili tuweze pata matokeo ambayo yatatusaidia kujua kwa uhalisia ukubwa wa tatizo la magonjwa ya kulika kwa pingili za mgongo.

Jinsi ya kushiriki- Ukikubali kushiriki katika utafiti huu, utasailiwa ili kuweza kujibu maswali toka kwenye dodoso lililoandaliwa. **Usiri** ; Taarifa zote zitakazokusanywa kupitia dodoso zitaingizwa kwenye ngamizi kwa kutumia namba za utambulisho.Kutakuwa na usiri na hakuna mtu yeyote asiyehusika atakayepata taarifa zilizokusanywa. **Uhuru wa kushiriki na haki ya kujitoa** ; Kushiriki kwenye utafiti huu ni hiari.

Nani wa kuwasiliana naye ; Kama una maswali kuhusiana na utafiti huu, wasiliana na Mtafiti mkuu wa utafiti huu, **Dr Mboka Jacob** wa Chuo Kikuu cha Afya na Sayansi ya Tiba Muhimbili, S. L. P. 65001, Dar es Salaam, **Prof. E.F. Lyamuya**, Mwenyekiti wa kamati ya Utafiti na Uchapishaji, S.L.P 65001, Simu: 255 22 2152489 Dar es Salaam au msimamizi wa utafiti huu **Dr R.R. KAZEMA.** (Simu: +255754288644) **Sahihi:** Kama umekubali kushiriki weka sahihi

Mshiriki amekubali ……..... Mshiriki Mimi..... nimesoma maelezo ya fomu hii nimeielewa na nimekubali kushiriki katika utafiti huu.

Sahihi ya mshiriki…… Sahihi ya mtafiti msaidizi……Tarehe ya kutia sahihi kwenye utafiti.....

Appendix 2 (a)(English version)

RECORDING FORM FOR DERMOGRAFIC FACTORS AND SYMPTOMS ASSOCIATED WITH LUMBAR SPINE DEGENERATIVE DISEASE

ID [__|__|__] Date ___/___/2010

(*Tick in appropriate position*)

A. Socio-demographic details

A1.Gender

(1) Male [ ]

(2) Female [_]

A2. Date of Birth (year): [_][_][_][_]

Tick either "Yes" or "No"

B. Presenting symptomatology

Presenting Symptoms	Yes	No
1. Low back pain		
2. Duration of Low back pain		
(a) Less than twelve weeks		
(b) More than twelve weeks		
3. Radiating or referred pain a) Right lower limb, b) Left lower limb, (c)Both lower limbs		
4.Lower limb pain. (a)Right lower limb, (b)Left lower limb, (c)Both		

lower limbs		
5. Lower limb numbness, (a)Right lower limb, (b)Left lower limb, (c)Both lower limbs		
6. Lower limb weakness/muscle atrophy, (a)Right lower limb, (b)Left lower limb, (c)Both lower limbs		
7. LBP exacerbated by; a) coughing, sneezing or physical activity b) on-sitting, when straightening/elevating the leg, (c)on walking		
8.Pain relieved by squatting or bending forward		

Appendix 2 (b) Kiambatanisho 4 *(Toleo la kiswahili)*

DODOSO LA UTAFITI WA KULIKA KWA VIUNGO VYA UTI WA MGONGO

Na. [__|__|__] Tarehe ___/___/2010

A. Taarifa za kijamii na kidemografia.

A1. Jinsia

1) Mwanaume [ ]

2) Mwanamke [_]

A2.Umri (miaka) [_][_][_][_]

(Kama umehahi fanyiwa upasuaji wa mgongo, pata ajali ya mgongo au una kansa naomba usijaze fomu hii)

Kama huna matatizo niliyoainisha hapo juu naombaWeka alama ya tiki aidha kenye kiboksi cha ndiyo au hapana kwenye maswali yote yafuatayo

Dalili za magonjwa ya kulika viungo vya uti wa mgongo

B1 Je una dalili kati ya zifuatazo	Ndiyo	Hapana
1. Maumivu ya mgongo/kiuno		
2.Una mumivu ya mgongo/kiuno kwa muda gani? (a) kwa zaidi ya wiki 12		
(b) Chini ya 12		
3.Je huwa unapata maumivu yanayo uma toka kiunoni mpaka mapajani au miguuni?		
4.Je unapata maumivu ya miguu ?a)kulia b)kushoto c)miguu yote		

5.Je unasikia ganzi kwenye mapaja au miguuni? a)kulia b)kushoto c)miguu yote		
6.Je mapaja au miguu imedhoofika au imepungua ukilinganisha na sehemu nyingine ya mwili? a)kulia b)kushoto c)miguu yote		
8.Je mambo yafuatayo huwa yanazidisha maumivu ya mgongo/kiuno.		
(a)kukohoa,kupiga chafya au kufanya kazi ngumu		
(b)Kuketi/ kusimama au kuinua mguu		
(c)Kutembea		
(9)Je huwa unasikia nafuu unapochuchumaa au unapoinama?		

Appendix 3: MRI findings recording form

LUMBAR SPINE DEGENERATIVE MRI FINDINGS RECORDING FORM

Na. [__|__|__] Date ___/___/2010 Age[ ] Sex [ ]

MRI Findings	Disk Level									
	L1-L2		L2-L3		L3-L4		L4-L5		L5-S1	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1.Disk degeneration										
a)Mild, b)Moderate, c)Severe										
2.Modic changes										
3.Type I										
4.Type II										
5.Type III										
6. HNP										
a)Protrusion, b)Extrusion, c)Free fragment										
7.Location of HNP										
a.Posterolateral,										
b.Posterocentral										
c.Foraminal,										
d.Extraforaminal										
8.Canal Stenosis										
a) Mild, b) Moderate, c) Severe										
9.Nerve root compression										
a. Thecal sac										
b. Lateral recess										
c. Foramen										
d.Multiple location										
10. Disk bulge										
a. Asymmetric										
b. Diffuse										
11.Hypetrophyof ligaments (LF)										
12.Hypetrophy of facet joints										