INTERVERTEBRAL DISC HERNIATION: PREVALENCE AND ASSOCIATION WITH CLINICAL DIAGNOSIS.

[1]Ray-offor OD, [2]Wachukwu CM, [1]Onubiyi CCB

Departments of [1]Radiology and [2]Internal Medicine University of Port Harcourt Teaching Hospital

ABSTRACT

BACKGROUND
Low back pain is one of the common health problems encountered in life with intervertebral disc herniation being a common cause of its occurrence. Magnetic resonance imaging has emerged the gold standard for diagnosing a herniated disc.

AIMSAND OBJECTIVES
To assess the frequency and pattern of occurrence of disc herniation as well as evaluate the association of disc herniation on magnetic resonance imaging with clinical symptoms.

METHOD
A total of 120 adult patients who came for magnetic resonance imaging scan of the lumbosacral spine for a period of 1year in the department of Radiology University of Port-Harcourt Teaching Hospital. The end plates of 600 lumbar interspaces were graded for type, size and site of lumbar disc herniation.

RESULTS:
The age distribution of patients was from 18-80 years; mean age was 51.0

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INTRODUCTION

Lumbar disc herniation is one of the most commonly diagnosed abnormalities associated with low back pain with resultant morbidity worldwide. Low back pain in itself is a multifactorial disorder with many possible etiologies, being a presenting symptom in 70- 80% of the population worldwide at some point in their lives[1]. Lumbar disc herniation is a localized displacement of disc material beyond the normal margins of the intervertebral disc space which may result in pain, weakness or numbness in a myotomal or dermatomal distribution[2].

Disc herniation is usually due to age-related degeneration of the annulus fibrosus, although trauma, lifting injuries, straining and sedentary lifestyle have been implicated3. Lumbar disc herniation can be generally classified into four types; disc bulge, protrusion, extrusion and sequestration. Although disc herniations may be completely asymptomatic4, they can also produce debilitating symptoms affecting the lower back, thigh, anal or genital region resulting in lower back pain, numbness, tingling sensation, radicular pain or sciatica.

Imaging plays a crucial role in confirming, differentiating subtypes and so modifying or changing treatment plans. Magnetic Resonance Imaging readily differentiates the different patterns of disc herniation, with its soft tissue contrast and less invasiveness.

A prospective, cross-sectional study thus was planned to determine the frequency of lumbar disc herniation and evaluate the association between MRI findings with clinical features in symptomatic patients.

MATERIALS AND METHODS

Study site
This study was conducted in the radiology department of University of Port Harcourt Teaching Hospital (UPTH) in the South South geo-political zone of Nigeria over a period of 12 months; from December 2012 to November 2013. This hospital is a 500 bed facility that serves as a referral centre for Rivers State. Ethical approval was obtained from hospital ethical committee before commencing the study.

Correspondence: :orayoffor@yahoo.com

Study design
This cross sectional descriptive and prospective study recruited Subjects of either gender 18 years and above referred to the department of radiology, UPTH for lumbosacral spine MRI scan on clinical diagnosis of low back pain. Patients with a history of trauma or any contraindication to MRI were excluded from the study. Informed consent was taken. Demographic data such as age and sex, clinical diagnosis, time of onset of symptoms were obtained using a structured interview form.

Imaging Technique
Patients were subjected to MRI examination after screening. A 0.2 tesla machine was used to obtain all MRI lumbar scans with standard protocol (Siemens Magnetom Concerto 2004A model). Technique of Scanning the Lumbosacral Spine: All patients were positioned supine on the scanner table such that the median sagittal plane was equidistant to the table. A radiofrequency surface coil was placed over the patient to cover the lumbar spine (area between the costophrenic angle and the iliac crest). Laser beam was aligned at the centre point (between L1 and L3). The table was then moved under the magnet until it was at the isocentre of the magnet. Scans were obtained in axial and sagittal planes, axial sections were taken along the lumbar disc and superior and inferior endplates.

Principal imaging performed using conventional spin echo pulse sequences.

i. Sagittal, axial and coronal images with a repetition time and echo time (TR/TE) of 500/20msec; field of view (FOV) 23-26cm, matrix 288x512.
ii. Axial view with TR/TE of 600-1100/20msec, FOV of 20cm, matrix 192x256.
iii. Sagittal view with TR/TE of 2500-3000/110 msec, FOV of 26cm, matrix 256x512.
iv. Axial view with a TR/TE of 4000 /120msec, FOV of 28-30cm, matrix 328x512.

Technical specifications included:

a. Slice thickness of 3 and 4 mm for sagittal and axial images respectively with 1 mm gap.
b. 90^0 flip angle for T1 and 180^0 angle for T2.
c. T1 and T2 Weighted axial sequences were stacked slices extending from the superior aspect of L1 through the inferior aspect of S1.

Image analysis:
The terms used to classify discs were defined as follows:

Disc herniation classified into a normal disc with no disc extension beyond the interspace, Disc protrusion as a focal or asymmetric extension of the disc beyond the interspace, Disc extrusion as extreme extension of the disc beyond the interspace and all layers of the annulus and sequestration as complete separation of the disc material from the parent disc.

Based on the MSU classification[5], the disc was further classified based on its size. The lesion is described as 1, 2, or 3. In reference to the intra-facet line, a determination is made as to whether the disc herniation extends up to or less than 50% of the distance from the non-herniated posterior aspect of the disc to the intra-facet line (size-1), or more than 50% of that distance (size-2). If the herniation extends altogether beyond the intra-facet line, it is termed a size-3 disc. Based on location disc herniation were classified as central, posterolateral or foraminal.

Intervertebral disc degeneration was defined by the presence or severity of reduced disc height and/or reduced signal intensity in T2-weighted scans evidenced by loss of normal high signal intensity of the nucleus pulposus on T2-weighted MRI scan. Spinal stenosis was analyzed based on Glenn classification6 were an anteroposterior diameter of the spinal canal 22-25mm was regarded as normal and stenosis as a canal diameter <10mm. Nerve root compression was noted to be absent or present.

Data Analysis
Data analysis was done using Statistical Package for Social Sciences (SPSS) software (version 20.0) for windows. Results were presented as mean ± standard deviation, percentages, tables and graphs as appropriate. Means were compared using Student's *t* test. Pearson's correlation was used to assess the association between MRI findings, and clinical diagnosis. *P* values less than or equal to 0.05 were considered statistically significant. Logistic regression was used to analyze pain variables with disc herniation

RESULTS

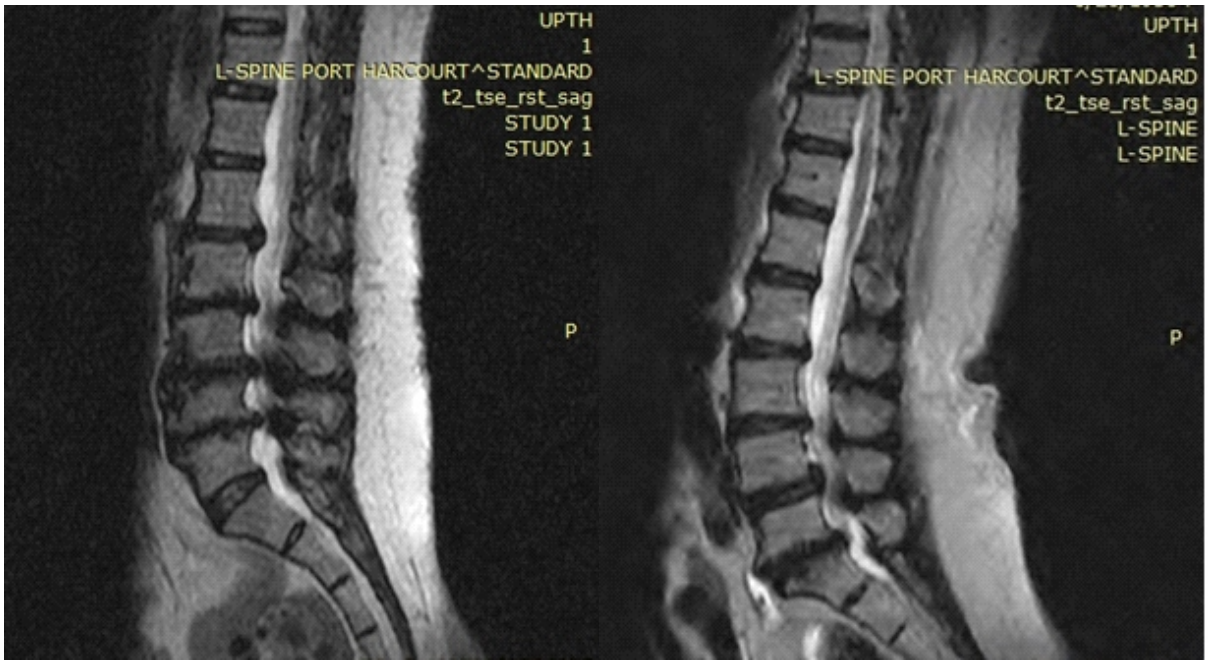
A total of 120 patients with low back pain were included in the study out of which sixty six (55%) were males and fifty four (42%) females. Age of the patients ranged from 22-80 years SD 51.0± 13.2years (table 1).

Table 1: Frequency of disc herniation in relation to age.

Age group	Frequency	Percentage (%)
20-29	6	7.5%
30-39	9	11%
40-49	18	22%
50-59	29	38%
>60	17	21.5%
Total	79	100%

Ninety-eight (82%) patients had chronic low back pain, while thirteen (11%) and nine (7%) had sub-acute and acute low back pain respectively. The pain was further classified based on symptoms into those with low back pain alone 48 (61%), radicular pain 24 (30%), sciatic pain 5(6%) and cauda equina syndrome 2 (3%).

Results were analyzed based on disc herniation, disc degeneration, nerve root compromise and stenosis of the spinal canal. Out of 120 patients only 79(65%) had significant radiological evidence of disc prolapsed at lumbar vertebral levels. Among these patients, 24(30%) had disc herniation at L5-S1, 33(42%) at L4-L5, 15(19%) at L3-L4, 5(6%) at L2/L3 and only 2 (3%) had involvement of L1-L2 level.(fig 1)

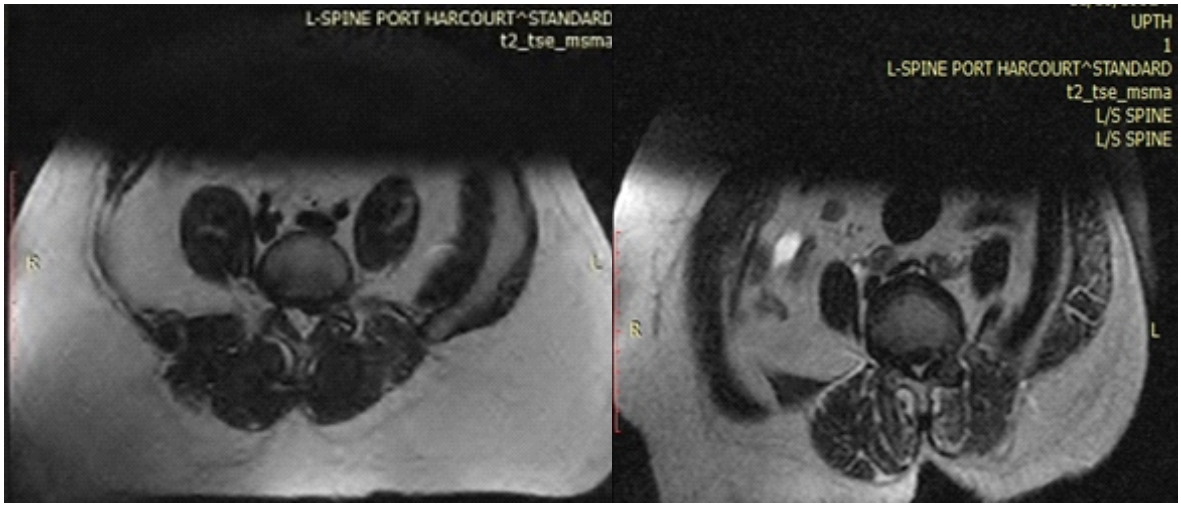


A B

Fig 1 A &B: Intervertebral disc herniation. (A) T1 weighted sagittal image showing altered signal intensity and multilevel disc protrusion at L1/L2, L2/L3, L3/L4 and L4/L5 levels and B L4/L5 disc extrusion.

Out of sixty six male patients, 49 (62%) had lumbar disc herniation and out of fifty four females, 30(38%), indicating a predominance of male gender in the cases of lumbar disc herniation but with no statistically significant difference (p=0.35). Male to female ratio was 1.4:1

Disc herniation was seen to increase with increasing age with the highest frequencies in the 5th (23.3%) and 6th (24.2%) decade and lowest frequency in the 2nd (3.3%) decade but this was not statistically significant (p=0.092). Posterolateral herniation was the most common location of disc herniation accounting for (76%), central (20%) and foraminal (4%). (figures 2)



A B

Fig 2:A&B: Location of disc herniation. (A) Central disc herniation. (B) Central and posterolateral disc herniation with left nerve root compression and spinal canal stenosis.

Based on the size of disc herniation 42(53%) were classed as 1, 22(28%) as 2 and 15(19%) as 3.

The prevalence of protrusions and extrusions according to the age of the patients and location of the abnormalities in the intervertebral disc space are presented in tables (2 and 3). Posterolateral herniation was also more implicated in radicular pain (table 4)

Table 2: Percentage distribution of type of disc herniation

DISC LEVEL	PROTRUSION	EXTRUSION	SEQUESTRATION	TOTAL
LI/L2	2	-	-	2(3%)
L2/L3	5	-	-	5(6%)
L3/L4	12	3	-	15(19%)
L4/L5	25	6	2	33(42%)
L5/S1	17	5	2	24(30%)
TOTAL	61(77%)	14(18%)	4(5%)	79(100%)

Table 3: Number of subjects with protrusion based on the age and location of disc protrusion

	No. of subjects					
Age (years)	L1-L2	L2-L3	L3-L4	L4-L5	L5-S1	total (%)
20-29(n=4)			1	2	1	7% `
30-39(n=6)		1	1	2	2	10%
40-49(n=16)		1	3	7	5	26%
50-59(n=24)		2	5	10	7	39%
>60 (n=11	2	1	2	4	2	18%
Total (n=61)	2	5	12	25	17	100%

Table 4: type of pain and location of disc herniation

Type of pain	Location of disc herniation			*p* value
	central	posterolateral	foraminal	
Low back pain 48(61%)	6(7%)	41(51%)	1	0.003
Radicular pain 24(30%)	4(5%)	18(22%)	2	0.043
Sciatic pain 5(6%)	4(5%)	2(3%)	-	0.175
Total 79(100%)	16 (20%)	61(76%)	3(4%)	

$\leqslant 0.05$ considered statistically significant

Intervertebral disc degeneration was observed in 90(75%) of patients with an L4/L5 predominance of 36(40 %) patients followed by L5/S1 level 22 (24.5%), L2/L3 level 15(16.7%), L3/L4 level 13 (14.4%) and at L1/L2 4(4.4%). Spinal canal stenosis was present in 39 patients (32.5%) with 20 males and 19 females. Of these 68% had posterolateral stenosis, 22% had central stenosis and 10% had stenosis at the foramina. Nerve root compression noted more at L4/L5 then L5/S1, L3/L4, L2/L3 and L1/L2 in decreasing order of frequency being present in 52% of patients. The presence of compression and type of herniation is noted in (table 5).

Table 5: Association between type of herniation and clinical finding

Type of herniation	Neural canal compromise	number	Percentage
Disc protrusion	Without nerve root compression	13	16.4%
	Nerve root compression	48	60.8%
Disc extrusion	Without nerve root compression	6	7.6%
	Nerve root compression	8	10.1%
Disc sequestration	Without nerve root compression	1	1.3%
	Nerve root compression	3	3.8%

DISCUSSION

A degenerated disc is said to be one with structural failure together with accelerated or advancing signs of aging. Other contributory factors include reduction in oxygen and nutrient supply, mechanical stress, inflammation, abnormal proteoglycan and possible genetic factors. Intervertebral disc herniation is a major cause of low back pain and results in a complex picture of symptoms and signs[7].

In the present study there was a male predominance. This concurred with Prasad et al[8] in their study of Epidemiological characteristics of lumbar disc prolapse in a tertiary hospital. Our largest group of patients was in the 6th decade. Irurhe et al[9] in a prospective study done in Lagos Nigeria and Mustapha et al[10] in a retrospective study done in North east Nigeria differed with their highest frequencies of patients occurring in the 5th and 4th decades respectively. The mean age of patients in the study was 51years and is comparable with a study done in South-west Nigeria[11] with a mean age of 53.27years but slightly higher than a study done in Kenya[12] with a

mean age of 47.4years.The findings of the current study showed that LBP is predominant in the middle age group. Hence, LBP could be likely due to the normal aging process or is multifactorial.

This study demonstrated a high frequency of occurrence of disc herniation (65%). This was similar to a study done by Yong et al (63.2%) and Irurhe et al with (59.7%) although slightly higher. The prevalence of disc herniation among patients with low back pain varies[2], with disc protrusion being the most common type and posterolateral herniation the common location[3,4]. Our study was in keeping with these studies. Protrusion of the disc was seen in 61% of patients while the most common location was posterolateral 76%. It was observed that posterolateral herniations were more associated with symptoms than central or foraminal herniations. Although disc herniation is considered one of the underlying factors for low back pain, controversy still prevails about its relationship. In some MRI studies[13] an association has been found with disc herniation and low back pain but this is also common in asymptomatic people as well[13,14]. Approximately 30% of people without history of low back pain or leg pain have disc protrusions[14].

The level of disc herniations have also shown variable incidence although the L4/L5 disc and L5/S1 disc levels are more frequently reported. In the current study herniation was common at L4/L5 (42%) and L5/S1 (33%) disc levels; the annulus fibrosus is thin and not supported by the posterior longitudinal ligament at these points. A study by Spangfort et al[15] had (49.8%) and (46.9%) occurring at the L4/L5 and L5/S1 levels respectively Prasad et al[8] also had L4/L5 (34.4%) and L5/S1 (26.7%) disc as prevalent in their study consistent with the current study. However Rehman et al had more disc herniation in the L5/S1 (46%) levels than L4/L5 (34%). Kim et al17 in their study also found a 95% occurrence of disc herniation at L4/L5 and L5/S1 and a 5% occurrence at the upper lumbar with L2/L3 and L3/L4 disc more implicated at these levels The L4/L5 and L5/S1 levels have been associated with the presence of increase radicular and sciatic pain as observed in the study than herniations on other levels.

In a study by Mysliwiec et al[5] on MSU classification of herniated lumbar disc on MRI towards developing an objective criteria for surgical selection on 200 patients found that size 2 disc herniation's were more symptomatic than either size 1 or 3. This concurred with the present study as size 2 lesions were more associated with radicular pain due to the narrow area of the disc at that level. However Karpinen et al[18] in their study disagreed with the size of the disc having much effect on the degree of pain or disability of a patient. It is well established that MR imaging is more sensitive for detecting nerve root compression than other imaging modalities. Disc herniation's with nerve root compromise are likely to be more symptomatic than those without neural compromise, we observed that the position of the disc herniation can affect neural foramen compromise as posterolateral and foraminal herniation's were more implicated than central herniations independent of whether the disc was extruded or sequestrated. Jarnardhana et al[19] in their study on Correlation between clinical features and magnetic resonance imaging findings in lumbar disc prolapse also concurred with these findings. In this study, 52% of patients were noted to have compression of at least 1 nerve root level. This is also likely due to the high incidence of posterolateral disc herniation(76%) than either foraminal or central.

Stenosis depending on the extent of the degeneration could be central, lateral and foraminal[20]. Stenosis can occur alone or in combination with L4–L5 disc usually implicated. Mboka et al[21] in Tanzania observed stenosis of the spinal canal in 30% of the study population similar to findings of 32.5% in current study. Katz et al[20] and Uduma et al[22] differed with a higher incidence of 46% and 66% respectively while Irurhe et al[23] had a lower incidence of 20%. The high incidence of spinal stenosis is likely due to the high incidence of disc herniation in this study, which is one of the common acquired causes of spinal canal stenosis.

CONCLUSION

Posterolateral disc protrusions/extrusions and significant nerve root compromise on MRI are more likely in clinical setting of radicular pain. This study shows the utility of MRI in depicting objective evidence of lumbar disc herniation in symptomatic adult patients with clinical suspicion of the disease.

LIMITATION

The high cost of magnetic resonance imaging scan made it difficult to have a wide range of patients as only those who could afford the scan where imaged.

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REFERENCES

1. Leboeuf-Yde C, Kyvik KO. At What Age Does Low Back Pain Become A Common Problem? A Study Of 29,424 Individuals aged 12-41 Years. Spine 1998; 23:228-234.
2. Fardon DF, Milette PC. Nomenclature and classification of lumbar disc pathology: Recommendations of the Combined Task Forces of the North American Spine Society, American Society of Spine Radiology, and American Society of Neuroradiology. Spine 2001; 26:93–113
3. Katz JN. Lumbar Disc Disorders And low-back Pain: Socioeconomic Factors And Consequences. J Bone Joint Surg Am 2006; 88: 2-21
4. North American Spine Society Clinical Guidelines for Multidisciplinary Spine Care Diagnosis and Treatment of Lumbar Disc Herniation with Radiculopathy
5. Mysliwiec LW, Cholewicki J, Winkelpleck MD, Eis GP. MSU classification for herniated Lumbar discs on MRI: toward developing objective criteria for surgical selection. Eur Spine J. 2010l; 19(7):1087-93.
6. Eberhard S, Harald P, Randolf K, Vieri F, Karl M, Jan MS. Lumbar Spinal Stenosis: Syndrome, Diagnostics and Treatment. Nature Reviews Neurology 2009; 5l: 392- 403.
7. Bandar LS, Press J. Diagnosis and Nonoperative Management of Lumbar Disk Herniation. Operative Techniques in Sports Medicine, 2005; 13: 114-121
8. Prasad R, Hoda M, Dhakal M, Singh K, ASrivastava A, Sharma V. Epidemiological Characteristics of Lumbar Disc Prolapse In A Tertiary Care Hospital. The Internet Journal of Neurosurgery. 2005; 3 Number 1.
9. Irurhe NK, Adekola OO, Quadri AR, Menkiti ID, Udenze IC, Awolola NA. The Magnetic Resonance Scan Findings in Adult Nigerian with Low Back Pain. World J Med Sci 2012; 7 (4): 204-9.
10. Mustapha Z, Ahmadu MS, Abba Ali A, Ibrahim K, Okedayo M. Patterns of Requests and Findings in Magnetic Resonance Imaging (MRI) of the Lumbosacral Spine at University of Maiduguri Teaching Hospital, Northeastern Nigeria. IOSR J Den Med Sci 2013; 11(4): 18-24.
11. Adeyinka AO, Omidiji OA. Magnetic Resonance Imaging Diagnoses in the Lumbar Spine of Adults with Low Back Pain in South West Nigeria. West Afr J of Radiology 2011; 18:1-9.
12. Orege JA, Abuya JM, Elias GD. Association Of Lumbar Disc Degeneration With Socio-demographics Of Low Back Pain Patients in Eldoret, Kenya. International Journal Of Advanced Research 2013; 1:115-123.
13. Jensen MC, Brant-Zawadzki MN, Obuchowski N, Modic MT, Malkasian D, Ross JS. Magnetic Resonance Imaging of the Lumbar Spine in People without Back Pain. N Engl J Med 1994; 331:69-73.
14. Weishaupt D, Zanetti M, Holder J, Boos N. Imaging of the Lumbar Spine: Prevalence Of Intervertebral Extrusion And Sequestration, Nerve Root Compression, End Plate Abnormalities, And Osteoarthritis of the Facet Joints in Asymptomatic Volunteers. Radiology 1998; 209:661-6. .
15. Spangfort EV: The lumbar disc herniation. A computer-aided analysis of 2504 operations. Acta Orthop Scand 1972; 142:40-44.
16. Rehman, LS. Khaleeq A, Hussain G.E. Mushtaq, Zaman k. Correlation between Clinical. Features and Magnetic Resonance Imaging Findings in Patients with Lumbar Disc Herniation. Journal of Postgraduate Medical Institute.2007; 21(1): 65-70.
17. Kim KY, Kim YT, Lee CS. Magnetic Resonance Imaging in the evaluation of the lumbar herniated intervertebral disc. Int Orthop.1993;17:241-244.
18. Karppinen J. Malmivaara A, Tervonen O, Pääkkö E, Kurunlahti M et al. "Severity of Symptoms and Signs in Relation to Magnetic Resonance Imaging Findings among Sciatic Patients." Spine 2001; 26(7):149-154.
19. Janardhana AP, Rajagopal, Rao S, Kamath A. Correlation between clinical features and Magnetic resonance imaging findings in lumbar disc prolapse. Indian Journal of Orthopedics. 2010; 44(3):263-269.
20. Katz JN, Dalgas M, Stucki G, Katz PN, Bayley J, Fossel AH. Degenerative lumbar Spinal stenosis: diagnostic value of the history and physical examination. Arthritis Rheum 1995; 38: 1236-41.
21. Mboka J. Pattern of Spine Degenerative Disease among Patients Referred For Lumbar Magnetic Resonance Imaging at Muhimbili Hospital Dares Salam Tanzania March to September 2011.Mmed Radiology Dissertation Muhimbili University of Health and Allied Sciences. May 2011.
22. Uduma FU, Ongolo P, Assam G, Fokam P, Motah M. Evaluation Of Magnetic Resonance Imaging Of Lumbosacral Spine In Cameroon-A Pioneer Study. Global J Med Research 2011; 11:31-41.