

# Appraisal of Imaging Requests and Findings from MRI Scans of Patients at State Specialists Hospital Bauchi



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**Results:** This study revealed that majority of the MRI requests were for lumbosacral spine examinations (n=84, 60.9%), followed closely by MRI of the brain (n=42, 30.4%) and thirdly shoulder and abdomen examinations with a frequency of 4.3% each. Out of 138 MRI scans studied, intervertebral disc prolapse (n=60, 43.5%) was the commonest finding from MRI scans of patients, the second most prevalent finding was L4-L5 degenerative disc disease (n=12, 8.7%). Intramuscular lipoma and basal ganglia edema had a prevalence of 4.3%.

**Conclusion:** The commonest requests were MRI lumbosacral and, in terms of findings, we found intervertebral disc prolapse, L4-L5 degenerative disc disease, basal ganglia edema and intramuscular lipoma as the major findings from MRI scans in Bauchi.

## Abstract



**Background:** MRI plays a vital role in diagnosis of diseases.

**Objectives:** To determine the pattern of imaging requests and findings from MRI scans of patients in the Bauchi State Hospital.

**Methods:** A prospective cross-sectional study of MRI request forms and findings of 138 patients was conducted from August 2016 to January 2017. MRI scans were performed using a 0.35T Neusoft MRI scanner and reported by a group of consultant radiologists. Data were analysed using descriptive statistics with the computer software SPSS version 22 (IBM, New York, USA).

**Keywords:** basal ganglia, disc prolapse, metastasis, lipoma

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## INTRODUCTION

The emergence of Magnetic Resonance Imaging (MRI) as an imaging modality could be credited to four major scholars: Nikola Tesla, who discovered the rotating magnetic field in 1882; Professor Isidor Rabi, who conceptualized the quantum phenomenon dubbed Nuclear Magnetic Resonance (NMR) in 1937; Paul Lauterbur, who produced the first NMR image in 1973 at the State University of New York at Stony Brook, and Professor Raymond Damadian, who produced the first scan after creating the first whole-body MRI scanner in 1977 [1-3].

MRI is a non-invasive, non-ionising imaging modality used to diagnose and treat medical conditions [1]. It uses a powerful magnetic field and radiofrequency waves to construct multiplanar images of the body which are then displayed on a computer monitor [2-5].

Since the creation of the first MRI image in 1977, significant advances have been recorded in medical imaging leading to the creation of highly sophisticated MRI machines which produce high quality images used to detect and confirm the presence of certain pathologies which are not easily diagnosed using conventional X-ray imaging and other imaging modalities [5]. Despite the cost of MRI, its safety profile and the ability to provide accurate soft tissue details make it highly indispensable to medicine. A recent study by Griffiths et al. clearly demonstrated the extended clinical value of MRI in diagnosis of fetal brain abnormalities [6].

At the Radiology Department of the Specialist Hospital Bauchi, the demand for MRI scans remains high because this centre is the only hospital providing MRI imaging services in the state. Even though there are numerous hospitals providing medical services in the state, most of these hospitals cannot afford the high costs of the MRI machines. It is important to document referral patterns and imaging findings in the state in order to identify prevailing health challenges of residents. Hence, the aim of this study was to determine the pattern of requests for MRI scans and findings from a small-scale feasibility sample at the State Specialist Hospital.

## MATERIALS AND METHODS

Ethical clearance was obtained from the hospital Research Ethics Committee and a prospective cross-sectional study of MRI requests and findings from 138 MRI scans was conducted. Informed consents were obtained from all patients who were involved in this study.

The study was conducted across a period of six months (August 2016 - January 2017). The procedures were carried out in the MRI Unit of the State Specialist Hospital Bauchi, Nigeria, using an open bore MRI scanner (0.35T Neusoft MRI Machine). Multiplanar images were acquired using turbo-spin echo (T1WS: TR/TE 450-550/15-22ms; T2WS:4000-5000/100-125ms), slice thickness 4mm, no slice gap, field of view- sagittal 300mm, axial 250mm, image matrix 192 X 256 or 256 X 256.

### MRI Sequences

#### T1 weighted

plane: sagittal (or volumetric 3D)  
sequence: fast-spin echo (T1 FSE) or gradient (T1 MPRAGE)

#### T2 weighted

plane: axial  
sequence: T2 FSE

#### FLAIR

plane: axial  
sequence: FLAIR

#### Diffusion weighted imaging (DWI)

plane: axial  
sequence: DWI: B=0, B=1000 and ADC

#### Susceptibility weighted imaging (SWI)

plane: axial  
sequence: susceptibility weighted imaging (ideal) or T2\*

MRI coils for the respective body part were utilized for the examination.

The request forms for MRI scans were reviewed and the clinical information which included age, sex and provisional diagnosis provided by the referrer was captured. All MRI reports were performed by a team of 3 consultant radiologists. Data was analysed using Statistical Package for Social Sciences (SPSS) version 22.0 (IBM, New York, USA).

## RESULTS

Of the 138 patients included in the study, 52% were females. Age range for the study sample was 11-70 years with a mean (SD) of 43.8 (14.9) years. The majority of the respondents were within the 51-60 years of age group (48, 35%), followed by 41-50 years (30, 21.7%) and then 21-30 years (24, 17%). Table 1 shows the pattern of MRI requests. MRI scans of the lumbosacral spine were the most frequent (n=84, 60.9%), followed by brain (n=42, 30.4%) and then, shoulder and abdomen (with frequencies of 6 [4.3%] each). Table 2 provides details of the common clinical indications for MRI scans. Lower back pain was the commonest indication (n=42, 30.4%), followed by lumbar spondylosis (n=18, 13%) and Pott's disease (n=12, 8.7%).

Table 3 illustrates the pattern of MRI findings. Intervertebral disc prolapse (n=60, 43.5%) was the commonest finding, followed by L4-L5 degenerative disc disease

(n=12, 8.7%) and then, Intramuscular lipoma (n=6, 4.3%) and basal ganglia edema (n=6, 4.3%). The pattern of findings in relation to gender showed that both sexes were evenly affected by intervertebral disc prolapse (50% females, 50% males). More females were affected by intramuscular lipoma and basal ganglia edema (n=6, 100%), while their male counterparts suffered more from multiple sclerosis and spinal metastasis (n=6, 100%) (Table 4).

Table 5 demonstrates the pattern of findings in relation to age. It shows that 90% of patients with intervertebral disc prolapse were within the 41-60 years of age group, 100% of the patients with L4-L5 degenerative disc disease were within the 41-50 years of age group and 71% of the patients with normal MRI scan were within the 11-40 years of age group.

**Table 1. Pattern of MRI Requests**

MRI Projections	Frequency	Percentage
MRI Lumbosacral	84	60.9
MRI Brain	42	30.4
MRI Shoulder	6	4.3
MRI Abdomen	6	4.3
Total	138	100.0

**Table 2. Reasons for Referral**

Indication for MRI Scan	Frequency	Percentage
Lower Back Pain	42	30.4
? Lumbar spondylosis	18	13.0
? Potts disease	12	8.7
? Metastasis	12	8.7
Intramuscular pain	6	4.3
Recurrent headache	6	4.3
Seizure disorder	6	4.3
? Brain tumour	6	4.3
? Disc prolapse	6	4.3
Recurrent drop attack	6	4.3
Hemiparesis	6	4.3
Vascular dementia	6	4.3
RTA	6	4.3
Total	138	100.0

**Table 3. Pattern of MRI Findings**

MRI Findings	Frequency	Percentage
Intervertebral disc prolapse	60	43.5
Normal	42	30.4
L4-L5 degenerative disc disease	12	8.7
Intramuscular lipoma	6	4.3
Basal ganglia edema	6	4.3
Multiple sclerosis	6	4.3
Spine metastasis	6	4.3
Total	138	100.0

**Table 4. Findings in Relation to Gender**

Findings	Male	Female	Total
Intervertebral disc prolapse	30	30	60
Normal	18	24	42
Intramuscular lipoma	0	6	6
Basal ganglia edema	0	6	6
Multiple sclerosis	6	0	6
Spine metastasis	6	0	6
L4-L5 degenerative disc disease	6	6	12
Total	66	72	138

**Table 5. Pattern of MRI Findings in Relation to Age**

Age Group	Intravertebral disc Prolapse	Normal	Intra-muscular Lipoma	Basal ganglia Edema	Multiple sclerosis	Spine metastasis	L4-L5 Disc Disease	Total
11-20	0	12	0	0	0	0	0	12
21-30	0	18	6	0	0	0	0	24
31-40	0	0	0	6	6	0	0	12
41-50	12	0	0	0	0	6	12	30
51-60	42	6	0	0	0	0	0	48
61-70	6	6	0	0	0	0	0	12
Total	60	42	6	6	6	6	12	138

## DISCUSSION

Understanding findings from MRI scans is vital for confirming diagnosis and the preparation of treatment plans for different diseases. In this study, we found that the commonest MRI requests were for lumbosacral spine examinations (n=84, 60.9%), followed closely by MRI of the brain (n=42, 30.4%) and thirdly shoulder and abdomen examinations with a frequency of 4.3% each.

These results prove that, in our environment, MRI is mainly used for ascertaining lumbosacral and brain pathologies and so healthcare providers across the country must ensure that the MRI unit is always functional as this significantly improves patient care and management. While requests for MRI are now common nationwide, it is essential to have clearly specified criteria for the everyday use of MRI for both referring practitioners and radiologists in order to preclude inappropriate use of MRI and leverage on economic outcomes [7]. More

importantly, radiologists should get more involved in the fight against unwarranted studies, even through the use of such expressions as “does not require further inspection”, “no clinical significance” among others [8]. While studies have been conducted on findings from lumbosacral MRI, there is dearth of empirical evidence globally on the findings from other MRI requests [9-11].

With regards to the gender distribution of patients in this study, we found more females (n=72, 52.2%) presenting for MRI scans. In this study, 60.9% of the patients (n=84) had to undergo a lumbosacral MRI, and the majority were female (n=44, 52%). Previous studies on lumbosacral MRI conducted by Mustapha et al. in Maiduguri, Nigeria (34% females), Uduma et al. in Cameroun (40% females) and Iurhe et al., (35% females) reported fewer females in their respective studies [9, 10, 11]. The reason for having more females present for MRI is likely due to the fact that clinicians knew about the safety of MRI and that women of child-bearing age had no radiation risk while taking MRI scans [6, 12]. Consequently, more males were referred for CT scans in view of cost, availability and lesser degree of radiation safety concerns.

The age distribution of patients revealed that 51-60 years of age group had the highest frequency (n=48, 34.8%), 41-50 years of age group was next, with a frequency of 30 (21.7%). Previous studies on lumbosacral MRI by Mustapha et al., Iurhe et al., and Younis et al. reported that majority of patients who underwent MRI scans were either in their forties or fifties [9, 11, 13]. In this study, we evaluated MRI lumbosacral scans and found that 70% (n=42) of patients suffering from intervertebral disc prolapse were in their fifties. This suggests that patients over the age of 40 are more likely to be imaged with MRI scan than those under 40, and that patients over the age of 40 are more likely to suffer from spinal and brain-related diseases. In terms of significance, these findings suggest that clinicians need not refer patients under 40 for MRI scans, unless this is highly imperative, as well as clinically beneficial. The fact that majority of the patients under 40 (71%) had normal MRI scans further emphasized the need to enhance efficiency of MRI services. In this study, lower back pain (n=42, 30.4%) was the commonest indication for MRI scans, lumbar spondylosis (n=18, 13 %) was the second, and Pott's disease (n=12, 8.7%) was the third. Lower back pain remains a major problem throughout the world, with the highest prevalence among female individuals and those aged 40–80 [14, 15]. Among females, lower back pain could be attributed to pain related to osteoporosis, menstruation, or pregnancy [16-21]. Causal dimensions to

the prevalence of lower back pain among males in the region may not be unconnected to work-related stress.

The Royal Australian and New Zealand College of Radiologists (RANZCR) generally recommends that MRI reports address the clinical question, provide a diagnosis or differential diagnosis and, where a number of possibilities exist, state them and describe their relative likelihood [22]. It is equally imperative to provide a concise, clinically contextualised interpretation of the previously described imaging observations. If findings are normal or non-significant, this should be stated explicitly as well as recommendations for further imaging, investigations, referral or treatment, where relevant [22]. In this study, we identified intervertebral disc prolapse (n=60, 43.5%) as the most prevalent finding. Other findings were normal (n=42, 30.4%), L4-L5 disc degeneration (n=12, 8.7%), as well as intramuscular lipoma and basal ganglia edema with 4.3% prevalence. Other studies on findings from lumbosacral MRI findings conducted earlier by Mustapha et al., Uduma et al., Ibe, and Cheung et al., also found intervertebral disc prolapse to be a prevailing health challenge among residents in Maiduguri, Cameroun, South East Nigeria, and Southern China respectively [9, 10, 23, 24]. Emphasis on the role MRI plays in diagnosis of spinal diseases remains paramount [25].

Intervertebral disc prolapse also known as disc herniation is the extrusion of nucleus pulposus through a rent in annulus fibrosus [26]. It causes impairment of function by nerve root compression compelling the patient to seek medical advice for low backache. Disc prolapse can generally be resolved with physical therapy and an epidural injection of glucocorticoids or by a surgical intervention [27]. Degenerative disc disease is another major finding from lumbosacral MRI scans in this study. It occurs from degenerative changes in the intervertebral disc. Degenerative changes represent a broad category which includes the subcategories of annular fissure, herniation, and degeneration. [28] Degeneration may include any or all of the following: real or apparent desiccation; fibrosis; narrowing of the disc space; diffuse bulging of the annulus beyond the disc space; extensive fissuring (e.g., numerous annular tears), mucinous degeneration of the annulus; and the occurrence of osteophytes at the vertebral endplates [27, 28]. In relation to findings across gender, we observed that both male and female patients were evenly affected by intervertebral disc prolapse. In this study, 24 females (57.1%) and 18 males (52.9%) had normal MRI scans. Females were more affected by basal ganglia edema and intra-

muscular lipoma (n=100%), while more males suffered from multiple sclerosis and spine metastasis. The relationship between MRI findings and age revealed that 90% of patients with intervertebral disc prolapse were between the ages of 41 and 60. 100 percent of patients with L4-L5 degenerative disc disease were in the 41-50 years of age group, while 71% of the patients who had normal scans were between 11 and 40 years of age.

## CONCLUSION

This small-scale feasibility study has identified lumbosacral MRI as the commonest request, while intervertebral disc prolapse was the major finding from MRI scans of patients in Bauchi State, Nigeria. L4-L5 degenerative disc disease was second most prevalent finding, while basal ganglia edema, lipoma, metastases and multiple sclerosis were less common but with equal incidences.

## COMPETING INTERESTS

The authors declare that they have no competing interest.

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## PROCJENA ZAHTJEVA ZA SNIMANJE I NALAZA NA TEMELJU MR SLIKA PACIJENATA U DRŽAVNOJ SPECIJALISTIČKOJ BOLNICI BAUCHI

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**Rezultati:** Ovo istraživanje pokazalo je da se većina zahtjeva za MR snimanje odnosila na preglede lumbosakralne kralješnice (n = 84, 60,9 %), nakon čega slijedi MR mozga (n = 42, 30,4 %), a zatim pregledi ramena i abdomena (po 4,3 % za obje vrste). Od 138 snimljenih MR slika, najčešći nalaz na temelju MR snimanja pacijenata bio je prolaps intervertebralnog diska (n = 60, 43,5 %), dok je drugi najčešći nalaz bio degenerativna bolest diska L4-L5 (n = 12, 8,7 %). Intramuskularni lipom i edem bazalnih ganglija imaju prevalenciju od 4,3 %.

**Zaključak:** Najčešći zahtjevi odnosili su se na MR snimanje lumbosakralne kralješnice, dok su prolaps intervertebralnog diska, degenerativna bolest diska L4-L5, edem bazalnih ganglija i intramuskularni lipom glavni nalazi na temelju MR snimanja u Bauchiju.

### Sažetak

**Pozadina:** MR snimanje ima važnu ulogu kod dijagnosticiranja bolesti.

**Ciljevi:** Odrediti obrazac zahtjeva za snimanje i nalaza na temelju MR slika pacijenata u Državnoj bolnici Bauchi.

**Metodologija:** Prospektivno transversalno istraživanje obrazaca zahtjeva za MR snimanje i nalaza 138 pacijenata provedeno je od kolovoza 2016. do siječnja 2017. godine. MR slike snimljene su MR skenerom 0.35T Neusoft, a izradila ih je skupina konzultanata radiologa. Podaci su analizirani deskriptivnom statistikom uporabom računalnog programa SPSS, verzija 22 (IBM, New York, SAD).

**Cljučne riječi:** bazalni gangliji, prolaps diska, metastaza, lipom