ORIGINAL ARTICLE

MRI Protocol, Referral Pattern and Appropriateness of Clinical Indications for Lumbar Spine MRI for Adult Low Back Pain

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ABSTRACT

Background: Lower back pain (LBP) affects millions of people worldwide. MRI is commonly used to diagnose LBPs. To reduce the negative effects of MRI overuse, the American College of Radiology (ACR) has set appropriate criteria for radiologists in LBP management.

Objective: This study evaluated MRI utilization for LBP, using ACR appropriateness criteria as the standard for comparison.

Methods: The retrospective study was conducted on 95 patients referred to the radiology department of Rehman Medical Institute for lower back pain. MRI lumbosacral scans were performed between 10 March 2020 and 10 September 2020 using a 1.5T GE MR machine and viewed using Synapse® (FUJI DICOM VIEWER). Each MRI scan was then evaluated and compared for appropriateness based on ACR guidelines, and data were analyzed using SPSS version 26.

Results: The overall appropriateness of MRI scans in our department was 60%, whereas 40% were categorized as "usually not appropriate." The majority of referrals were from the outpatient department (89.5%), with 10.5% from emergency departments. In terms of departments, most referrals were from the Neurosurgery department, followed by external referrals and Neurology. The percentage of referrals classified as "usually appropriate" was 64% for Neurosurgery and 70% for external referrals. Furthermore, two-thirds of Neurology referrals were classified as "usually not appropriate".

Conclusion: More than half of the MRI scans for lower back pain in our department were appropriate; however, there is still a significant number that did not follow proper ACR protocols. Patient education, improving referral protocols, and better collaboration between radiologists and clinicians can potentially improve the situation.

Keywords: *MRI, lower back pain, appropriateness criteria, radiology, audit.*

INTRODUCTION

Low back pain is a common musculoskeletal disorder that affects 619 million people worldwide [1]. The pain is characterized by a localized sensation in the lumbar region of the spinal cord, with a high morbidity rate globally [2]. The diagnostic and rehabilitation costs of these patients add to the economic burden on healthcare systems, particularly in countries with low socioeconomic conditions [3]. LBP is classified by clinicians based on etiology. Specific LBP has a known cause like malignancy and infection while nonspecific LBP, which is more common, has no identifiable cause for pain. LBP is further categorized into acute, subacute, and chronic based on the duration of symptoms [4].

Radiologists often use MRI as an initial imaging modality for the management of lower back pain. It provides a detailed anatomical view of the spinal cord and surrounding soft tissue with no radiation exposure to the patient [5, 6]. Recently, radiomics models have been introduced to improve the diagnosis of lower back pain with early features of fasciitis [7]. Specifically, in cases of spinal stenosis, radiculopathy, or infectious etiology, diagnosis by MRI has proven to be beneficial.

The use of MRI although crucial, may not be useful for uncomplicated lower back pain. In many instances the diagnostic capabilities of MRI are questionable, and literature reveals cases where important diagnoses were missed. For example, a study in an orthopedic center in the US reported 64% missed cases of spondylolysis in the adolescent population [8, 9]. Furthermore, MRI can detect anatomical defects with little clinical relevance, which may add to patients' distress [10]. These limitations indicate that a negative MRI report should not be used to rule out a diagnosis when there is high clinical suspicion.

The guidelines for the management of lower back pain by the American College of Radiology (ACR) suggest avoiding medical imaging initially [11]. Instead, it should be reserved for conditions where serious underlying etiology is suspected. The recommendation is to focus on history taking and physical examination alone. Despite these guidelines, clinicians are overusing MRI for the management of LBP. For instance, a US-based study found that 26% of MRI scans for LBP were clinically "inappropriate" [12]. Such inappropriate use of MRIs not only builds anxiety in patients but also increases healthcare costs. It can also lead to unnecessary surgical interventions when conservative management would have worked [13]. Thus, it is important to study the appropriateness of MRI and this

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study was planned to evaluate MRI utilization for LBP, using ACR appropriateness criteria as the standard for comparison.

METHODOLOGY

This was a retrospective study conducted on 95 patients with lower back pain, referred to the radiology department of Rehman Medical Insitute, Peshawar. The Ethical Review Committee approval (RMI/RMI-REC/Article Approval/137) was obtained from the review board. The MRI lumbosacral spine scans were performed between 10th March 2020 and 10th September 2020 using a 1.5 T GE MR machine and viewed using Synapse® (FUJIDICOMVIEWER). The data were analyzed in 2024. Relevant clinical data of the patient was taken from the Radiology Department's database. Finally, the MRI lumbosacral scans were compared and evaluated for appropriateness using American College of Radiology (ACR) guidelines. The scans were then classified as "Usually Appropriate" or "Usually Not Appropriate." "Usually Appropriate Scans" were those in which imaging procedure or treatment was indicated in the specified clinical scenarios at a favorable risk-benefit ratio for patients and the other hand "Usually Not Appropriate" scans were those in which imaging procedure or treatment was unlikely to be indicated in the specified clinical scenarios, or the risk-benefit ratio for patients was likely to be unfavorable.

Data collected for each MRI included patient age, gender, referral source (emergency or outpatient department), clinical information, requested examination, scan performed, recommended imaging according to ACR guidelines, and the appropriateness of the scan. SPSS version 26.0 for Windows was used for data entry and to perform descriptive analyses. Descriptive statistics were calculated for age, gender, clinical indications, imaging findings, and the appropriateness of the lumbar spine MRI. Frequency and percentages were computed to summarize categorical variables.

RESULTS

A cohort of 95 patients (47 males and 48 females), aged 18 years and above, underwent magnetic resonance imaging (MRI) for lower back pain during the study period. The distribution of patients by age group and gender is presented in Table **1**. The MRI protocol employed consisted of three types of sequences: T1-weighted imaging (T1WI) and T2-weighted imaging (T2WI) in both the axial and sagittal planes, as well as short-tau inversion recovery (STIR) in the sagittal plane. This protocol was deemed appropriate for 100% of the patients. Contrast administration was utilized selectively, only in cases with suspected infection or neoplasm.

Table 1: Gender-wise distribution of age group.

Age (years)	Male n (%)	Female n (%)
18-25	7 (7.37)	8 (8.42)
26-35	13 (13.68)	8 (8.42)
36-45	10 (10.53)	7 (7.37)
46-55	6 (9.32)	14 (14.74)
55+	11 (11.58)	11 (11.58)

Magnetic Resonance Imaging (MRI) referrals predominantly originated from outpatient departments (89.5%), with the remaining 10.5% originating from emergency departments. Among the referrals, the highest proportion emanated from the Neurosurgery department, followed by "external referrals" and Neurology. Table **2** illustrates the distribution of appropriateness by referral source. Specifically, 64% of referrals from Neurosurgeons were classified as "usually appropriate," while 70% of cases referred from external hospitals were similarly categorized. Conversely, two-thirds of referrals from Neurologists were classified as "usually not appropriate."

Fig. **(1)** illustrates the overall appropriateness of MRI scans in our radiology department, showing that 60% of the scans were classified as "usually appropriate" and 40% as "usually not appropriate."

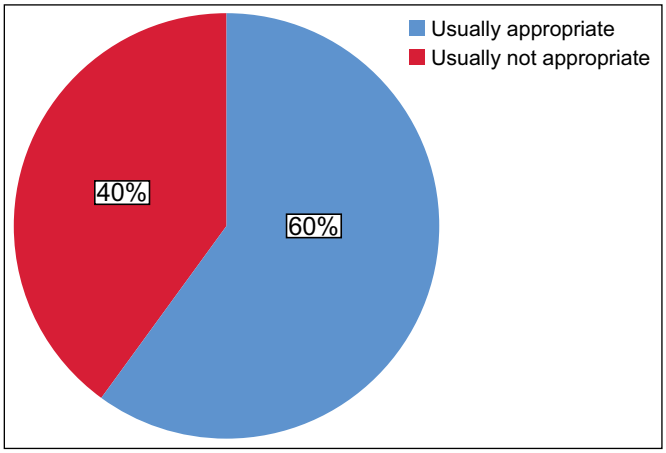

Fig. (1): Distribution of MRI appropriateness in the radiology department.

Table 2: Appropriateness of MRI referrals by department.

Department	Usually Appropriate n (%)	Usually Not Appropriate n (%)
Neurosurgery	16 (16.84)	9 (9.47)
External referral	14 (14.74)	6 (6.32)
Neurologist	6 (6.32)	12 (12.63)
Orthopedics	6 (6.32)	5 (5.26)
Emergency	6 (6.32)	4 (4.21)
General Physician	3 (3.16)	1 (1.05)
Others	6 (6.32)	1 (1.05)

DISCUSSION

This audit was conducted to evaluate the appropriateness of MRI use for lower back pain within our institute's radiology department, using the American College of Radiology (ACR) guidelines as a benchmark. Our findings reveal that 60% of MRI scans were classified as "usually appropriate," whereas 40% were deemed "usually not appropriate" This indicates that while a majority of the MRI referrals align with ACR guidelines, improvement in referral practices is needed. Our results are consistent with findings from similar studies conducted in other regions. For instance, Studies conducted in Ghana and the US found that appropriate MRI scans for lower back pain were around 25% and 26% respectively, which suggests a relatively better adherence in their setting compared to ours [14]. Another study from the general medicine unit in Australia reported that 40% of imaging requests were unnecessary, pointing to a common challenge of inappropriate imaging in lower back pain management across different healthcare settings [15].

We observed significant variation in the appropriateness of MRI referrals among different departments as mentioned earlier 25%, and 26% of referrals were appropriate in Ghana and the US. Similarly, 40% of imaging requests were unnecessary in Australia. Referrals from the Neurosurgery department and external sources were more closely aligned with the ACR guidelines, with a higher percentage categorized as "usually appropriate." In contrast, the referrals from the Neurology department demonstrated a concerning trend, with two-thirds classified as "usually not appropriate." This shows some departments require targeted education and intervention to improve adherence to guidelines.

Considering the harmful effects associated with improper use of MRI, this audit evaluates the appropriateness of MRI utilization for LBP within our institution. It will specifically compare the imaging practices of our institution to the ACR appropriateness criteria.

RECOMMENDATIONS

1. Enhance Collaboration through Informatics: Implement a system that fosters better collaboration between radiologists and referring physicians. Using informatics tools can improve communication and decision-making, ensuring that MRI referrals adhere to current guidelines [16].
2. Educate Patients on Imaging Needs: Launch patient education programs on lower back pain (LBP) to help them understand that unnecessary imaging often does not lead to better outcomes[17]. By addressing common misconceptions and clarifying when imaging is truly needed, these programs can help reduce unnecessary self-referrals.
3. Revise Referral Processes and Protocols: Recent reviews suggest that simply distributing educational materials to clinicians may not suffice [18]. Evidence-based protocols should be introduced, including the use of physical therapy as an initial step in managing LBP [19] to reduce unnecessary MRI referrals and ensure appropriate use of imaging.

Audits in the future should follow these recommendations to assess whether adherence to ACR guidelines improves and if MRI use for lower back pain becomes more appropriate.

CONCLUSION

In conclusion, while the majority of MRI scans for lower back pain in our department were deemed appropriate, a significant portion did not adhere to ACR guidelines. Improving guideline adherence, especially within specific departments, is important. Our audit was conducted at a single institution with a limited sample size; future studies should address these limitations for better evaluation of MRI appropriateness in the management of lower back pain. Imaging correlates with outcomes only if combined with the clinical data. Most patients with low back pain will go into clinical response and may not need an imaging procedure until a red flag is raised. Knowing the red flag is important to perform appropriate imaging procedures. Red Flag includes potential underlying condition as cause of LBP history of cancer, Unexplained weight loss, Immunosuppression, Intravenous drug use, Back pain not improved with conservative management, Cancer or infection, History of significant trauma, Minor fall or a potentially osteoporotic or elderly individual, Spinal fracture, Acute onset of urinary retention or overflow incontinence, Loss of anal sphincter tone or fecal incontinence, Saddle anesthesia, Bilateral or progressive weakness in the lower limbs, Cauda equina syndrome or other severe neurologic condition. Back pain is going to be an important clinical topic shortly due to its economic implications.

ETHICS APPROVAL

The data was analyzed in 2024. The Ethical Review Committee approval (RMI/RMI-REC/Article Approval/137) was obtained from the review board. Studies involving human participants were following the ethical standards of the institutional and/ or national research committee and the Helsinki Declaration.

CONSENT FOR PUBLICATION

Not applicable.

AVAILABILITY OF DATA

All the research data is available in the form of Excel sheets and the proforma are kept in the lock with the principal investigator maintaining the confidentiality of the patients.

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None.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORS' CONTRIBUTION

Ummara Siddique - Conceptualization, Methodology, Investigation, Writing Review & Editing.

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Saleel Ahmed - Conceptualization, Methodology, Formal Analysis, Investigation, Writing - Original Draft Preparation, Writing - Review & Editing.

Aliya Sharif - Methodology, Investigation, Writing Review & Editing.

Karishma Israr - Methodology, Investigation, Writing Review & Editing.

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