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# ORIGINAL ARTICLE

# To evaluate how well MRI can distinguish between benign and malignant lesions based on the various signal characteristics of the intralesional tissue

[1]Mohammed Hasan, [2]Vishal Saraswat

[1]Assistant Professor, Department of Radio Diagnosis, Major S D Singh Medical College & Hospital, Farukkhabad, Uttar Pradesh, India
[2]Director & Chief Radiologist, Dr Vishal Imaging Centre, Aligarh, Uttar Pradesh, India

***ABSTRACT:***
**Aim:** The purpose of this study is to evaluate how well MRI can distinguish between benign and malignant lesions based on the various signal characteristics of the intralesional tissue. **Material and methods:** This research comprised a total of sixty different patients. With the exception of patients who had emergencies due to trauma, every patient was seen by appointment only. Their doctors gave them advice and answered any questions they had. All of the patients' significant clinical results were meticulously documented. The majority of the patients were examined without any kind of preliminary medicine being administered. A sedative was administered, under the supervision of an anesthesiologist, to smaller children and patients who were not cooperating with the procedure. In addition to obtaining a pertinent medical history about allergies and fitness for the contrast study, the renal function tests were also examined. **Results:** Out of total study participants 60 patients, 40 cases were malignant and 20 cases were benign. The majority of tumors had a hypointense appearance on the T1W studies (55%) but a hyperintense appearance on the T2W pictures (85%). On T2W images, the presence of heterogenous hyperintensity was seen more often in malignant lesions than in benign lesions. In the following, we will discuss the sensitivity and specificity of this trait in predicting malignancy. According to the statistics, heterogenous hyperintensity has a greater sensitivity, specificity, PPV, and NPV in predicting malignancy. Additionally, the p value indicates that there is a substantial difference between malignant and benign lesions. (Chi = 15.85; p = 0.0001). **Conclusion:** As a result of this investigation, we came to the conclusion that magnetic resonance imaging (MRI) is the method of choice for the assessment of soft tissue cancers since it is very sensitive in the identification of soft tissue tumors practically all of the time.
**Key words:** MRI, Soft tissue tumors, malignant lesions

**Corresponding author**: Vishal Saraswat, Director & Chief Radiologist, Dr Vishal Imaging Centre, Aligarh, Uttar Pradesh, India

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## INTRODUCTION

A soft tissue mass, also known as a soft tissue tumour, is a neoplastic growth that arises in the non epithelial extraskeletal connective tissue and soft tissues of the body, such as the muscle, tendon, and blood vessels, and which are often mesodermal in origin [1]. Soft tissue tumours are the most common kind of soft tissue mass. [2] Soft tissue masses are more common in women than in men. Even though there are many different factors that might lead to the formation of a soft tissue tumor, the symptoms and treatment choices are all relatively the same. One can determine the diagnosis for the subset of determinate lesions that have characteristic clinical and imaging features by systematically using clinical history, lesion localization, mineralisation on radiographs, and signal intensity characteristics on MR images. This allows one to narrow the differential diagnosis for lesions that demonstrate indeterminate characteristics [2]. Less than one percent of malignant tumors are classified as soft tissue sarcomas. They manifest themselves most often in the limbs, the chest wall, and the retroperitoneum. Older adults and men are more likely to be affected, despite the fact that age and gender might be variable depending on the histological type [3]. When diagnosing a patient with a soft tissue mass in the trunk or extremities, it is normal practice to send the patient for imaging. These lesions include disorders that are not neoplastic, as well as tumors that are benign and malignant. At the moment, imaging only offers a limited capacity to effectively differentiate benign soft tissue lesions from malignant soft tissue lesions [4]. Therefore, the major purpose of the imaging referral is to confirm the existence of a mass and to evaluate the extent of the mass so that a treatment plan may be developed. It is possible to restrict the list of possible diagnoses by using specific clinical and imaging evidence in an important subgroup of patients. The clinical history, the location of the lesion, the mineralization that can be seen on radiographs, and the signal intensity (SI) features that can be seen on magnetic resonance (MR) imaging are all included in these characteristics. At the moment, tests of bone and soft tissue are the ones that are requested by MRI patients the most often [5]. The intensity of each pixel in an MRI scan is a reflection of the density of hydrogen, which is often seen as water or fat. To be more specific, the strength

of the MR signal is a reflection of the density of mobile hydrogen nuclei, which is affected by the chemical environment, namely by the magnetic relaxation durations (T1 and T2), as well as by motion [6]. As a result, the current investigation was carried out to evaluate the accuracy of MRI in distinguishing between benign and malignant lesions based on the unique signal features of the intralesional tissue.

## MATERIAL AND METHODS

This research comprised a total of sixty different patients. With the exception of patients who had emergencies due to trauma, every patient was seen by appointment only. Their doctors gave them advice and answered any questions they had. All of the patients' significant clinical results were meticulously documented. The majority of the patients were examined without any kind of preliminary medicine being administered. A sedative was administered, under the supervision of an anesthesiologist, to smaller children and patients who were not cooperating with the procedure. In addition to obtaining a pertinent medical history about allergies and fitness for the contrast study, the renal function tests were also examined. We looked through the results of the previous examinations, such as USG and CT scans. The operation and any potential side effects were thoroughly discussed with the patients. Every single patient was required to provide their permission by signing a document. Each and every study was carried out in the presence of a radiologist who also had anaesthetic assistance on standby.The magnetic resonance imaging (MRI) scans of the soft tissue tumors were carried out using a Phillips (MR ACHIEVA) machine with a field strength of 1.5 Tesla. Gadolinium-DTPA was administered at a dosage of 0.1 ml mol/kg over the course of the research as the contrast agent. In pediatric patients, the non-ionic MR contrast agent omni scan (gadodiamide injection) was administered intravenously at a dosage of 0.2 mL/kg. The scan was performed using gadodiamide injection.

This research includes participation from all individuals who had previously been identified as having a diagnosis of soft tissue tumors. Among them were lesions of primary neoplastic aetiology of soft tissue over the whole body. The following categories were not considered: tumors of soft tissue having an unclear or incorrect histopathological diagnosis, Patients who had soft tissue lesions that were not included in the WHO classification, such as ganglions, abscesses, and neurogenic tumors. Patients who had had surgery but still had a recurring or persistent lesion. Patients who had previously received therapy. Applying the chi-square test as part of the test of significance allowed for the determination of the quantifiable centrality of the information being analyzed.

## RESULTS

Out of total study participants 60 patients, 40 cases were malignant and 20 cases were benign.[Table 1]

**Table 1: Distribution of study subjects according to the type of lesion**

| Type | No. of patient | % |
|---|---|---|
| Benign | 20 | 33.33% |
| Malignant | 40 | 66.67% |

In the demographic research, the patients' ages ranged from 5 months for a female patient diagnosed with angiofibroma to 74 years for a male patient diagnosed with leiomyosarcoma. The age range of 30 to 40 years old was the most prevalent across the board (33.33%). Again, people in their 30s and 40s made up the most prevalent age group for both malignant and benign tumors, accounting for 10% of benign cases and 15% of malignant ones. Females were more likely to have benign lesions, whereas men were more likely to have malignant lesions. [Table 2]

**Table 2: Age and gender of the patients**

| Gender | Number | Percentage |
|---|---|---|
| Male | 35 | 58.33 |
| Female | 25 | 41.67 |
| Age | | |
| below 10 | 5 | 8.33 |
| 10-20 | 7 | 11.67 |
| 20-30 | 10 | 16.67 |
| 30-40 | 20 | 33.33 |
| 40-50 | 7 | 11.67 |
| 50-60 | 6 | 10 |
| above 60 | 5 | 8.33 |

**Table 3: Distribution of study subjects according to the MRI findings**

| $T_2$ Heterogeneous Hyperintense | Malignant | Benign | Total | | |
|---|---|---|---|---|---|
| Yes | 34 | 6 | 42 | 80.95% | PPV |

| | | | | | |
|---|---|---|---|---|---|
| No | 6 | 14 | 18 | 77.78% | NPV |
| Total | 40 | 20 | 60 | | |
| | 85% | 70% | | | |
| | Sensitivity | Specificity | | | |

The majority of tumors had a hypointense appearance on the T1W studies (55%) but a hyperintense appearance on the T2W pictures (85%). On T2W images, the presence of heterogenous hyperintensity was seen more often in malignant lesions than in benign lesions. In the following, we will discuss the sensitivity and specificity of this trait in predicting malignancy. According to the statistics, heterogenous hyperintensity has a greater sensitivity, specificity, PPV, and NPV in predicting malignancy. Additionally, the p value indicates that there is a substantial difference between malignant and benign lesions. (Chi = 15.85; p = 0.0001).

**Table 4: Distribution of study subjects according to the MRI findings**

| **Margin** | **Malignant** | **Benign** | **Total** | | |
|---|---|---|---|---|---|
| Ill defined | 23 | 3 | 26 | 88.46% | PPV |
| Well Defined | 17 | 17 | 34 | 50% | NPV |
| Total | 40 | 20 | 60 | | |
| | 57.5% | 85% | | | |
| | Sensitivity | Specificity | | | |

Statistics show that ill-defined margins has high sensitivity, specificity, PPV and NPV in predicting malignancy and p value suggests that there is significant difference amongst the malignant and benign lesions [Chi = 5.26; p = 0.003].

## DISCUSSION

When diagnosing pathological diseases that affect the musculoskeletal system using MR imaging, signal intensity as well as morphological alterations in the tissues that are being examined are taken into consideration. Both a high contrast resolution (different signal intensities in normal and diseased tissues) and a high spatial resolution are required in order to detect even the most minute changes in these characteristics. In order to achieve these objectives, the pictures' signal-to-noise ratios (SNRs) need to be as high as they may possibly be. Utilizing local coils is the most effective strategy for increasing the signal-to-noise ratio (SNR) in musculoskeletal MR imaging. In an ideal situation, the coil would go all the way around the limb, which is feasible for the knee, the ankle, the wrist, and the elbow, but not for the hip or the shoulder.Imaging artifacts may originate from a wide variety of causes, such as defects in the instruments and magnetic fields, intrinsic qualities of the mathematics used to reconstruct the pictures, tissue interfaces, and foreign substances. Imaging artifacts can also be caused by a combination of these factors. Patient motion is the cause of artifacts that can be avoided with the least amount of effort. Motion artifacts may be avoided by situating the patient in such a way as to maximize their level of comfort [7]. A study conducted in 2009 by Chen et al. and titled "Differentiating benign and malignant soft tissue masses by magnetic resonance imaging: Role of tissue component analysis" demonstrated that 118 histologically proven soft tissue masses exhibit T2 low signal matrix, fibrous tissue, calcification, necrosis, septum, and fat rim sign. There were statistically significant differences between benign and malignant tumors in terms of the amount of peritumoral edema and hemorrhage (p 0.05) [8]. In the current research, the majority of tumors (55%) were found to be hypointense on the T1W studies, whereas the majority of tumors (85%) were found to be hyperintense on the T2W pictures. On T2W images, the presence of heterogenous hyperintensity was seen more often in malignant lesions than in benign lesions. In the following, we will discuss the sensitivity and specificity of this trait in predicting malignancy. According to the statistics, heterogenous hyperintensity has a greater sensitivity, specificity, PPV, and NPV in predicting malignancy. Additionally, the p value indicates that there is a substantial difference between malignant and benign lesions. Similar findings were achieved in a research that was carried out by Kalyanarooj et al. They discovered that a heterogenous signal on T2W; Perilesionaloedema or invasion and necrosis in the masses to be statistically significant for differentiating between benign and malignant soft tissue masses. [9] According to the data shown in this research, ill-defined margins have a high sensitivity, specificity, PPV, and NPV in predicting malignancy. Furthermore, the p value indicates that there is a substantial difference between malignant and benign lesions. There was no correlation between the degree and pattern of enhancement and the various stages of malignancy, according to the findings of a study carried out by Schepper et al [10], which found that even though malignant tumors have increased vascularity and large extracellular spaces, these characteristics can vary depending on the level of tumoral activity or aggressiveness. Similar findings were reached in a research that was carried out by Kransdorf et al. They noted that in ordinary clinical practice, synovial sarcoma is usually misunderstood as benign when seen on non-enhanced MR imaging. This may be due to the fact that synovial sarcoma is typically modest in size, has well-defined borders, and progresses slowly. On the other hand, these sarcomas

will show early signs of diffuse enhancement while undergoing dynamic contrast enhanced magnetic resonance imaging. Enhancement features may thus raise a red signal in benign seeming lesions, and they may also enable less experienced radiologists to pinpoint lesions that need additional work up at a referral center [11]. However, it was reported that aggressive sarcomas may have a pseudocapsule, whereas benign lesions, such as desmoid tumors, may invade neighboring tissues. These findings were obtained in a study that was conducted by Bongartz et al., who found that benign tumors are well delineated while malignant tumors have rather ill-defined margins. Similar findings were obtained in a study that was conducted by Bongartz et al. They came to the conclusion that the margin of soft tissue masses on MRI (well-defined vs. infiltrating) did not have any statistical value in the prediction of malignancy [12].Current recommendations imply that the most relevant characteristics for estimating the probability of malignancy in a soft tissue lesion are size, depth in relation to fascia, growing size, and pain[13]. Similar findings were achieved in a research that was undertaken by Datir et al.

## CONCLUSION

As a result of this investigation, we came to the conclusion that magnetic resonance imaging (MRI) is the method of choice for the assessment of soft tissue cancers since it is very sensitive in the identification of soft tissue tumors practically all of the time. The magnetic resonance imaging (MRI) technique is the modality of choice for the assessment of soft tissue tumors because it is very accurate in establishing the location, type, and features of the lesion. MRI has been around for a long time and is a well-established imaging tool for the detection and local staging of soft tissue tumors. The MRI plays a significant part in detecting the cause of these lesions, as well as characterizing their extent and the relationship between them and the structures that are nearby. When radiologic examination is non-specific, however, an MRI cannot reliably differentiate between benign and malignant tumors. This is an important point that has to be stressed.

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