British Journal of Research

www.britishjr.org

Original Article

# Study of 90 Cases of Pathology Involving Muscle and Tendon by Ultrasonography and Magnetic Resonance Imaging

**Falguni Shah[1], Hemangi Patel*[1], Dipali shah[2], Shital Turakhia[2], Nila Gandhi[1] and Parth Darji[1]**

*[1]Radiology department GMERS Sola medical college and hospital, Sola, Ahmedabad, India*
*[2]Radiology department B.J. Medical college, civil hospital, Asarwa, Ahmedabad, India*

*Corresponding author e-mail: Hemangi_63@yahoo.com

**A B S T R A C T**

**Objective:** Ultrasonography (USG) and Magnetic resonance imaging (MRI) has become a valuable diagnostic modality for the evaluation of musculoskeletal pathologies. Aim of the study was to evaluate usefulness of ultrasound and MRI in diagnosis and further management of various musculoskeletal pathologies and to compare the usefulness of USG with colour doppler and MRI in imaging of musculoskeletal system.
**Methods:** A prospective study of 90 patients with musculoskeletal pathology was carried. The study group consists of patients with complain of pain, swelling, deformity, restriction of movements and / or history of trauma to soft tissue. These patients were first subjected to ultrasound examination. Patients with positive USG findings involving muscle and tendon were undergone MRI. The result of USG and MRI then evaluated and compared.
**Results:** In our study, Males were more commonly affected than females. Majority of patients had traumatic etiology. Most commonly affected region was thigh. Shoulder was more prone to trauma. Younger age group commonly showed Infective pathologies, Traumatic pathologies were more seen in middle age group while older age group showed malignant neoplasms.
**Conclusion**: Both USG and MRI are quite useful modalities for diagnosis of musculoskeletal pathologies. Advantages of sonography is its easy availability, low cost with dynamic capability, repeatability and comparison with opposite side favouring its use in initial basic investigation while MRI provides better soft tissue contrast, multiplanner capability and helps in delineating the location of lesion and in staging of tumour.

**Keywords:** USG, MRI, Muscle, Tendon, Malignant tumour.

## INTRODUCTION

Ultrasound is inexpensive, easily available and can be repeated. Comparison with opposite side is very easy. Ultrasound is the only modality where dynamic scan along with movement of particular muscle is possible. With technologic advances and availability of extra high frequency linear transducers up to 18MHz evaluation of thin muscle and ligaments like superficial structures become easy. These high-frequency transducers allow visualization with resolutions approaching 200 μm. Improved resolution also allows visualization of skin, subcutaneous tissue plane, individual peripheral nerve fascicles and rotator cuff as well as for evaluation of soft-tissue foreign bodies.USG is the primary screening modality for diagnosis of tendoachilles tear; it helps in differentiating partial rupture or microruptures from focal area of Tendinosis[1]. MRI has excellent spatial and contrast resolution with multiplanner imaging capacity allows recognition of muscle, tendon, neurovascular bundle and associated marrow changes. However, detection of soft tissue calcification and non-metallic foreign bodies may be difficult to identify on MRI[2,3]. MRI is the standard imaging modality for staging of soft tissue tumour. It is inevitable that the expanding use of ultrasound for musculoskeletal imaging will impact the utilization of MRI. It is therefore important to address the pros and cons of musculoskeletal ultrasound compared with MRI.

## MATERIAL AND METHODS

A prospective study of 90 patients was carried out July 2013 to December2014. Study group includes patients with musculoskeletal pathology come to the Orthopaedic and surgical departments of sola GMERS medical college and Hospital, Ahmedabad. Patients with complain of pain, swelling, deformity, restriction of movements and trauma were included. Detailed history and presenting symptoms was studied. Only those patients with Diseases affecting muscles and tendons and Patients who have undergone both ultrasound and MRI examination for the presenting complaint were selected. Treated cases coming for follow up and pathologies affecting synovium, ligaments and articular cartilage were excluded in our study. Selected patients were first subjected to ultrasound examination. Patients were scanned with the convex probe and linear probe on the ultrasound machine Esaote My Lab series. Patient was scanned in both axial and longitudinal direction along with dynamic manoeuvre and contralateral comparison was done where ever required. Compression technique under real-time scanning was done to differentiate the composition of underlying pathology (i.e. cyst, lipoma vs. solid). Colour or power Doppler features show the degree of vascularity associated with inflammatory processes as well as with solid masses. After ultrasound examination all patients were referred to MRI examination. After complete pre procedure preparation patients were underwent to MRI scan. Patients were scanned on Philips achieva 1.5 tesla 16 channels MRI scanner. Data analysis was done on application software Release 2.6 and another closed type 1.5 Tesla MR Scanner (GE HDXT-8 channels, superconducting magnet). A typical musculoskeletal examination includes three to six sequences obtained in various anatomic planes like axial, coronal, sagittal or oblique.

MR imaging parameters and protocol for each pulse sequence is as follows. (See table 1&2.)

**Observation and analysis**

(See table 3 and Chat 1&2.)

Infections are more common in females while trauma and neoplasms more affect males. Infective pathologies are more common in younger age group along with benign neoplasms, while malignant neoplasms are more common in older ages. Traumatic pathologies are more occurring in middle age group. Pain is the most common presenting complaint followed by swelling. (See table 4&5.)

Most commonly affected region in this study was thigh followed by shoulder. According to this study, shoulder is more prone to trauma, majority of pathologies affecting back were infective.

## DISCUSSION

Present study includes 90 patients studied with USG and MRI. Cases were broadly classified into neoplastic (benign and malignant), infective, traumatic, inflammatory and degenerative pathologies. In our study, 46 patients (51%) were fall in the age group 20-40 years correlating with increased incidence of trauma and infection in this age group. Present study has 39 female and 51male patients. Pain is the most common presentation followed by swelling. Out of 90 patients, most common pathology was trauma 31 patients (34.4%) followed by infection 25patients (27.7%). Among them infections were more common in females while male showed traumatic origin. Thigh was the most commonly affected region in this study (17 patients) closely followed by shoulder (16 patients) with most of cases of thigh were infective. Out of 16 cases of shoulder pathology, 12 patients (75%) have traumatic injury. Shoulder is more prone to traumatic injuries, while infections are more common in back. Out of 12 patients of shoulder trauma, 12 patients had supraspinatus tear, 8 patients with partial tear and 4 patients had complete tear. All supraspinatus tear were diagnosed on USG as well as on MRI. One patient had fracture in head of humerus. De Jesus JO *et al*[4] in his study on "Accuracy of MRI, MR arthrography, and ultrasound in the diagnosis of rotator cuff tears: a meta-analysis" concluded that there are no significant differences in either sensitivity or specificity between MRI and ultrasound in the diagnosis of partial- or full-thickness rotator cuff tears. In present study, 6 patients had tendo achilles tear, among them 2 patients with complete tear and 4 patient had partial tear, 2 patients had associated intramuscular hematoma. All the patients showed location of tear at musculo tendinous junction. All patients were diagnosed on USG as well as on MRI.In present study we have 100% sensitivity in diagnosing tendo achilles tear on USG and in MRI, while according to Kalebo P *et al*[5]study there is 94% sensitivity in diagnosing partial tear of the Achilles tendon. In Present study 25 patients (27.7%) had infective pathology, among them 8 patient had abscess formation. And 6 patients had Koch's spine with psoas abscess. Psoas abscess were diagnosed on USG but vertebral involvement was diagnosed on MRI in all patients. According to Gouliamos *et al* study[5], Paraspinal soft tissue masses are seen in approximately 71 present of cases by MRI. In our study we have included only those patients who had Koch's spine with psoas muscle involvement. In my study, USG is able to detect infective collections in all patients but ability to detect underlying bone involvement and intraspinal extension was limited.USG is able to diagnose associated bony cortical involvement and to rule out accurately bony involvement in 9 out of 25 infective cases. In this setting of patients with infective pathology MRI is considered better because MRI not only detects but it is useful in determining extent of bone

involvement, associated marrow changes and identification of sequestrum and cloaca. In present study, 12 patients (13.3%) had inflammation, among them 5 patients had tenosynovitis around wrist. All patients were diagnosed on USG as well as on MRI. In our study out of 90 patients 8 (8.8%) patients have benign and 6 patients (6.6%) have malignant mass. Intramuscular lipoma was the most common benign lesion noted in 3 patients. Most of malignant mass affect the thigh. Definite characterisations of tumour mass in to benign and malignant mass is difficult in both in USG as well as in MRI, but it is useful to assess various criteria like location, signal intensity, margin, neurovascular or bony invasion, which can help to differentiate malignant from benign lesion[7]. Daniel A Jr and colleagues[8] carried out the prospective study of 50 cases on" Relevance of MRI in prediction of malignancy of musculoskeletal system. The reported sensitivity and specificity of MRI for malignant tumour detection was 95% and 84% respectively. T H Berquist and colleagues[9] carried out study of 95 lesions on" Value of MR imaging in differentiating benign from malignant soft-tissue masses" 50 benign and 45 malignant were selected. They reported sensitivity and accuracy of 90% in benign and malignant lesions. In our study, there were no false positive cases but one false negative case with MRI on malignant tumour. In our study, one patient had large irregular hypoechoic mass with abnormal vascularity and foci of calcification within it in left thigh that was diagnosed as malignant mass on USG and MRI. But a histopathological diagnosis was fibromyxoma. In our study, there was 100% sensitivity and 89% specificity for detecting malignancy in MRI. Gerd Bodner and colleagues[10] carried out the study on "Differentiation of Malignant and Benign Musculoskeletal Tumours: Combined Colour and Power Doppler US and Spectral Wave Analysis." 79 musculoskeletal tumours (34 malignant, 45 benign) were examined with colour and power Doppler USG. All tumours were subject to USG-guided or open biopsy for histologic correlation. They reported sensitivity and specificity of 94% and 93% respectively for malignant tumour. In present study, there are one false positive and one false negative result with USG and Doppler examinations. In USG, we had one false negative result for malignant tumour, one patient had well defined mixed echogenic hypoechoic lesion with vascularity which was considered to be benign or infective. But that turned out malignant sarcoma on MRI and was confirmed on histopathological examination. We also had one false positive result in USG as well as in MRI for malignant tumour, one patient had large, ill-defined, irregular mass lesion with foci of calcifications and abnormal vascularity in right thigh that turned out benign mass fibromyxoma on histopathological examination. We reported sensitivity of 91% while specificity of 89% for malignant tumour in USG. In present study, 8 patients (8.8%) have Tendinosis. Among them 4patients affect supraspinatus while 4patients have tendo achilles involvement.

## CONCLUSION

Both ultrasound and MRI are highly sensitive modalities for diagnosis of musculoskeletal pathologies with few limitations of each modality. Main advantage of sonography over MRI is its easy availability, repeatability, comparison with contralateral side, low cost and ease of examination with dynamic capability. All favours itsuse as an initial assessment of pathologies while MRI provides better soft tissue contrast than USG. Infections can be detected with USG, but associated bony involvement may be sometimes difficult to detect. MRI offers an advantage of detecting

bony involvement with high accuracy and also extent of involvement, marrow edema. In case of neoplastic pathologies, USG with doppler can help in making an accurate diagnosis but MRI was superior in identifying internal characteristics of lesion and indicating proper site of biopsy.MRI is the technique of choice for identification and characterization of soft-tissue masses. Because of the recent technologic advances, ultrasound can now be considered an important diagnostic tool alongside MRI for imaging the musculoskeletal system. However USG can be complementary to MRI, it cannot replace the MRI.

## REFERENCES


1. Carol M. Rumack. Diagnostic ultrasound, *gastrointestinal tract*. Vol-1, 4th edition; 23: 918.
2. Cohen MD, weetman RM, Provisor AJ, *et al*. Efficacy of magnetic resonance imaging in 149 children with tumours. *Arch Surg*. 1986; 121:522-529.
3. Peterson JJ, Bancroft LW, Kransdorf MJ. Wooden foreign bodies: imaging appearance. AJR Am J Roentgenol. 2002; 178: 557-562.
4. De Jesus JO, Parker L, Frangos AJ *et al*, Accuracy of MRI, MR arthrography, and ultrasound in the diagnosis of rotator cuff tears: a meta-analysis. *PubMed* central.
5. Kalebo P, Allenmark C, Peterson L, Sward L. Diagnostic value of ultrasonography in partial rupture of the Achilles tendon. *Am J Sports Med*. 1992; 20:378-381.
6. Gouliamos AD, Kehasgias DT, Lahanis S *et al*: MR imaging of tuberculous vertebral osteomyelitis: Pictoral review *Eur. Radiol*. 2001;11:575-579
7. Manorama berry, veena chowdhary, simamukh opadhyay, sudhasuri. Diagnostic radiology masculoskeletal and breast imaging 2nd edition; 20: 476.
8. Daniel A Jr, Ullah E, Wahab S *et al*. Relevance of MRI in prediction of malignancy of musculoskeletal system--a prospective evaluation. *BMC Musculoskelal Disord*. 2009 Oct 8; 10:125.
9. Berquist TH, Ehman RL, King BF, Hodgman CG, Ilstrup DM. Value of MR imaging in differentiating benign from malignant soft-tissue masses: study of 95 lesions. *AJR Am J Roentgenol*. 1990; 155:1251–5.
10. GerdBodner, Michael F. H. Schocke, Franz Rachbauer, MD Differentiation of Malignant and Benign Musculoskeletal Tumors: Combined Color and Power Doppler US and Spectral Wave Analysis: May 2002, Vol. 223: 410-416.

**Table 1.** Pulse Sequences: Imaging Parameters

| Sequence | TR (m.sec) | TE (m.sec) | TI (m.sec) | Flip Angle (°) | ETL |
|---|---|---|---|---|---|
| T1W | ≤1000 | ≤30 | N/A | 90 | N/A |
| Proton density | ≥1000 | ≤30 | N/A | 90 | N/A |
| T2W | ≥2000 | ≥60 | N/A | 90 | N/A |
| FSE T2 | ≥2000 | ≥60 | N/A | 90 | 2-16 |
| GRE T1 | Variable | ≤30 | N/A | 70–110 | N/A |
| GRE T2* | Variable | ≤30 | N/A | 5–20 | N/A |
| FSE STIR | ≥2000 | ≥60 | 120-150 | 180→90 | 2-16 |

*T1W*-T1weighted image, *T2W*- T2 weighted image, *FSE*- fast spin echo, *ETL*- echo train length, *GRE*- gradient echo, *TE*-time echo, *TI*- inversion time, *TR*-time repetition.

**Table 2.** Use of Specific Pulse Sequences

| Sequence | Use |
|---|---|
| T1W | Bone marrow, tumour staging |
| T1W -FS | Post contrast imaging |
| PD | Anatomy |
| PD - FS | Anatomy, cartilage, labrum, edema, cysts |
| T2 / T2 FS | Cartilage surfaces, marrow (FS), masses |
| STIR | Edema, fluid |
| Mod IR | Anatomy & edema, fluid |
| Gradient | Cartilage, susceptibility artefacts |

*PD*- Proton Density, *FS*- Fat Saturated, *STIR*- Short Tau Inversion Recovery.

**Table 3.** Age wise distribution

| Age | Number of patients | % |
|---|---|---|
| 0 - 10 | 3 | 3.33 |
| 11 - 20 | 14 | 15.5 |
| 21 - 30 | 21 | 23.3 |
| 31 - 40 | 25 | 27.7 |
| 41 - 50 | 14 | 15.5 |
| 51 - 60 | 5 | 5.55 |
| 61 - 70 | 2 | 2.22 |
| 71 - 80 | 4 | 4.44 |
| 80 -100 | 2 | 2.22 |
| Total | 90 | 100 |

Majority of patients fall in the age group 21-40 years.

**Table 4.** Distribution of Musculoskeletal Pathologies

| S. No. | Diagnosis | | | No of cases | Total patients | % |
|---|---|---|---|---|---|---|
| 1 | Infection | | Tuberculous osteomyelitis with collection | 2 | 25 | 27.7 |
| | | | Abscess | 8 | | |
| | | | Koch's spine with bilateral psoas abscess | 6 | | |
| | | | Osteomyelitis with abscess | 7 | | |
| | | | Mayocysticercosis | 2 | | |
| 2 | Inflammation | | Foreign body with inflammation | 3 | 12 | 13.3 |
| | | | Tenosynovitis | 5 | | |
| | | | Tendinitis | 3 | | |
| | | | Myositis ossificans | 1 | | |
| 3 | Neoplasm | Benign | Intramuscular lipoma | 3 | 8 | 8.88 |
| | | | Giant cell tumour of tendon sheath | 1 | | |
| | | | Myxoma | 1 | | |
| | | | Hemangioma | 2 | | |
| | | | lymphangioma | 1 | | |
| | | Malignant | Fibrosarcoma | 2 | 6 | 6.6 |
| | | | leiomyosarcoma | 2 | | |
| | | | Malignant fibrous histiocytoma | 1 | | |
| | | | Liposarcoma | 1 | | |
| 5 | Trauma | | Supraspinatous tendon tear | 12 | 31 | 34.4 |
| | | | Tendo achilles tear | 6 | | |
| | | | Muscle strain | 2 | | |
| | | | Hematoma | 7 | | |
| | | | Flexure digitorum profundus tendon tear | 1 | | |
| | | | Patellar tendon complete tear | 2 | | |
| | | | Rectus Femoris tear | 1 | | |
| 6 | Degenerative | | Tendinosis | 8 | 8 | 8.88 |
| | Total patients | | | | 90 | 100% |

Majority of patients have traumatic and infective etiologies followed closely by neoplastic one.

**Table 5.** Region wise distribution of individual pathologies

| Region of affection | Benign | Degenerative | Infective | Inflammation | Malignant | Trauma | Total |
|---|---|---|---|---|---|---|---|
| Ankle | 0 | 4 | 0 | 3 | 0 | 6 | 13 |
| Arm | 2 | 0 | 2 | 0 | 0 | 1 | 5 |
| Back | 0 | 0 | 7 | 0 | 1 | 1 | 9 |
| Foot | 0 | 0 | 2 | 2 | 0 | 0 | 4 |
| Fore arm | 1 | 0 | 1 | 0 | 0 | 0 | 2 |
| Hip | 0 | 0 | 2 | 0 | 0 | 0 | 2 |
| Hip & thigh | 1 | 0 | 2 | 0 | 1 | 0 | 4 |
| Knee | 1 | 0 | 0 | 0 | 0 | 4 | 5 |
| Leg | 0 | 0 | 4 | 0 | 0 | 2 | 6 |
| Shoulder | 0 | 4 | 0 | 0 | 0 | 12 | 16 |
| Thigh | 3 | 0 | 5 | 1 | 4 | 4 | 17 |
| Wrist and hand | 0 | 0 | 0 | 6 | 0 | 1 | 7 |
| Total | 8 | 8 | 25 | 12 | 6 | 31 | 90 |

Most commonly affected region in this study was thigh followed by shoulder. According to this study, shoulder is more prone to trauma, majority of pathologies affecting back were infective.

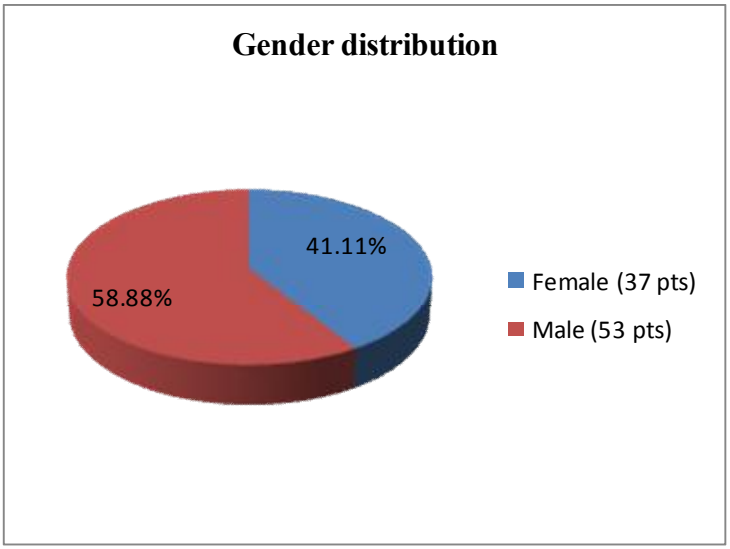



**Chart 1.** Gender distribution

Males are more commonly affected as compared to females.

 ISSN 2394-3718

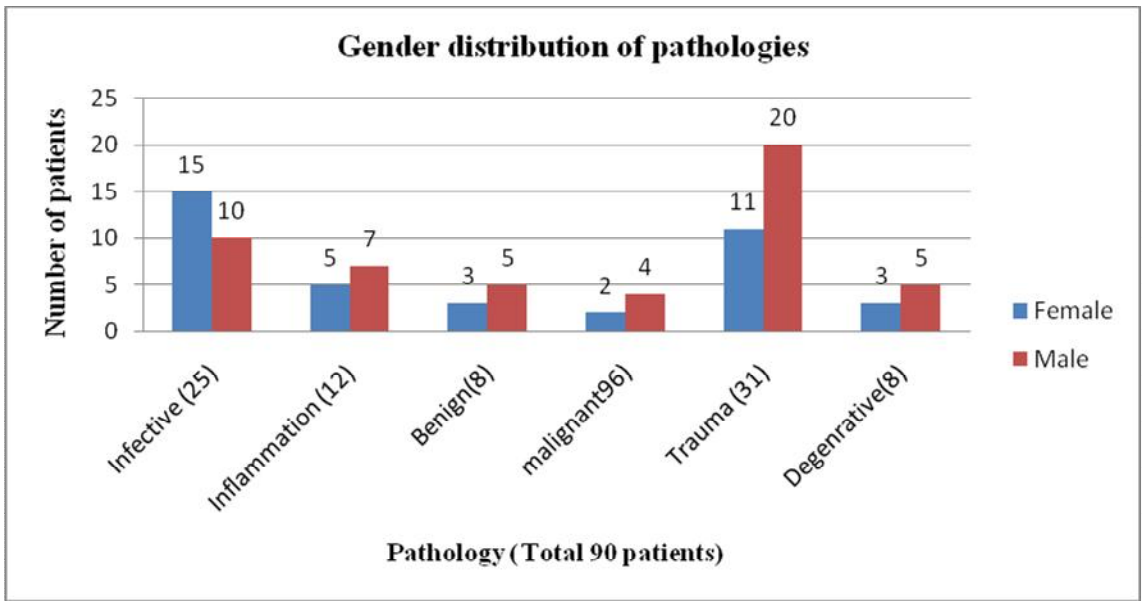



**Chart 2.** Gender distribution of pathologies

 ISSN 2394-3718

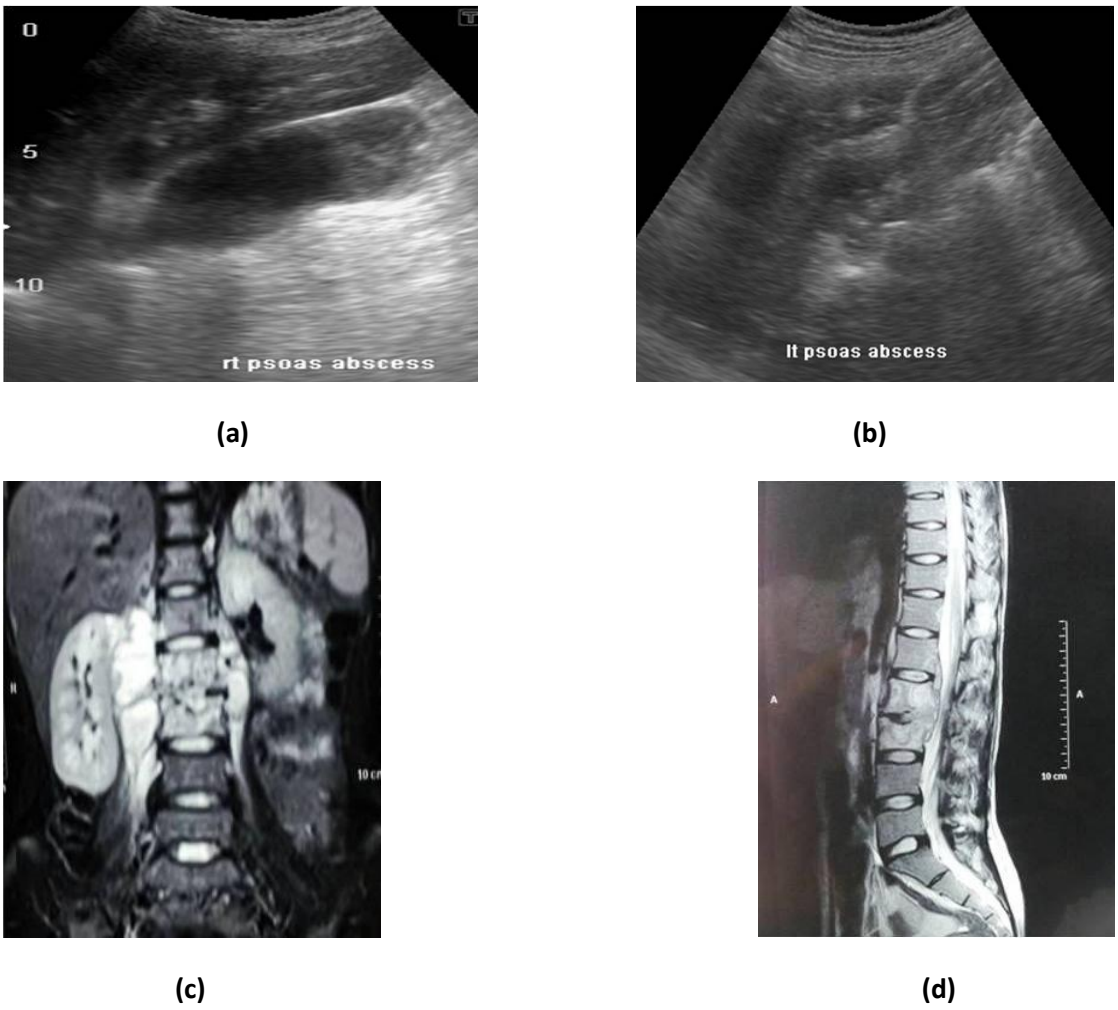
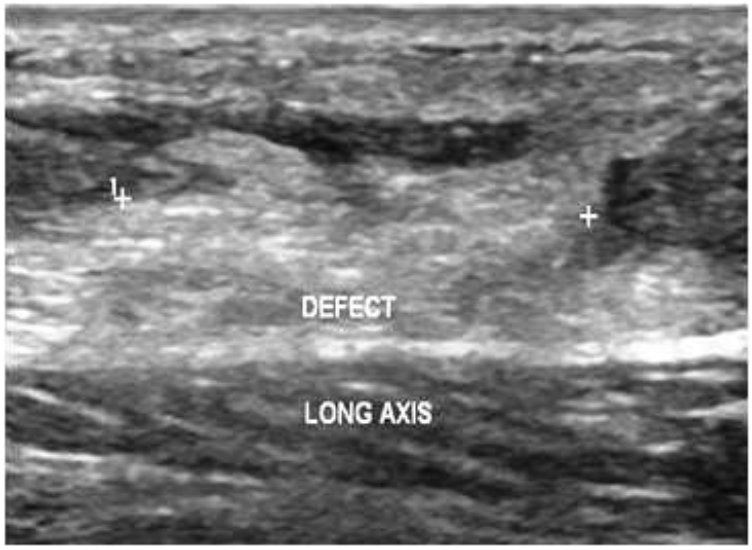



**Figure 1.** (a) & (b) USG images show bilateral psoas abscesses larger on right side. (c) & (d) MRI images of the same patient T2W coronal and sagittal scan showing bilateral psoas abscess with Koch's lesion involving L2-3 vertebrae with pre and paravertebral collection

 ISSN 2394-3718




**(a)**

**(b)** **(c)**

**Figure 2.** (a) USG (b) & (c) MRI images T1W and T2W showing complete tendo achilles tear with intrasubstance haemorrhage

 ISSN 2394-3718

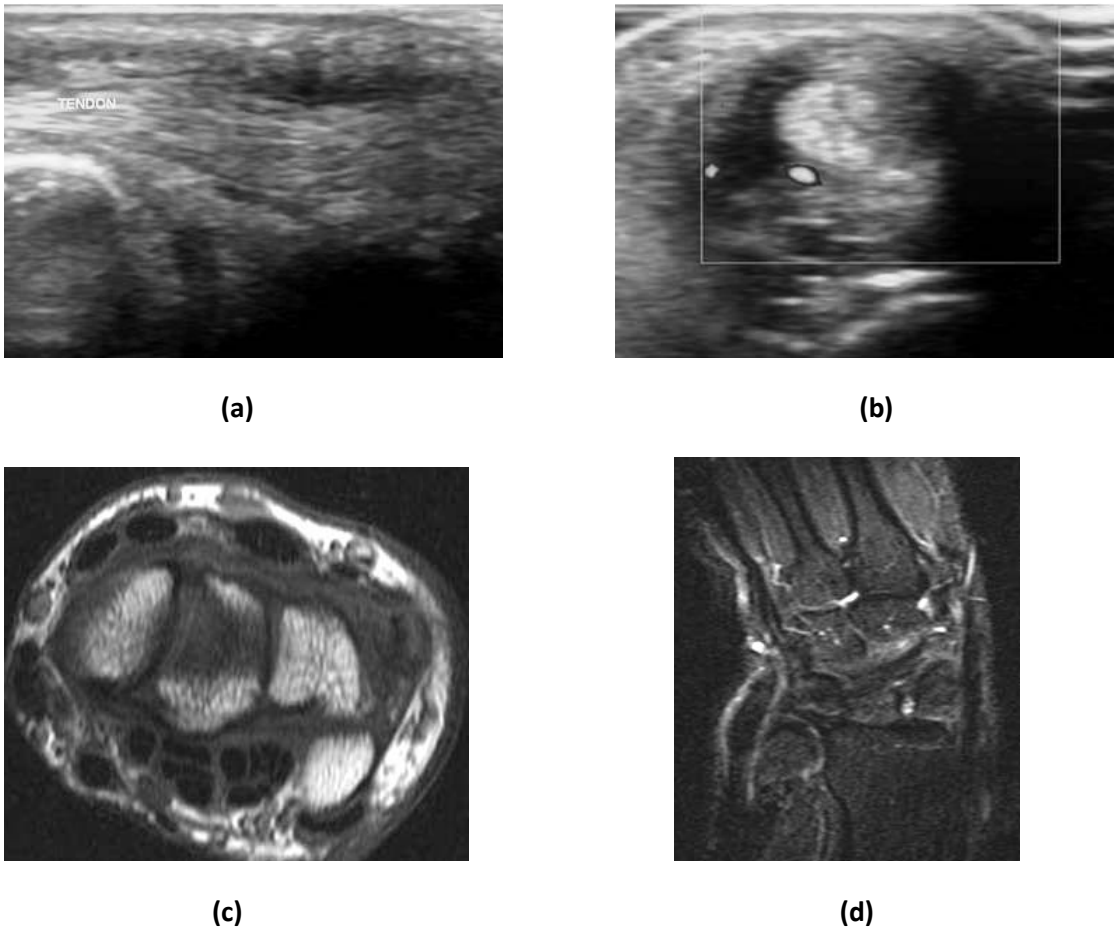
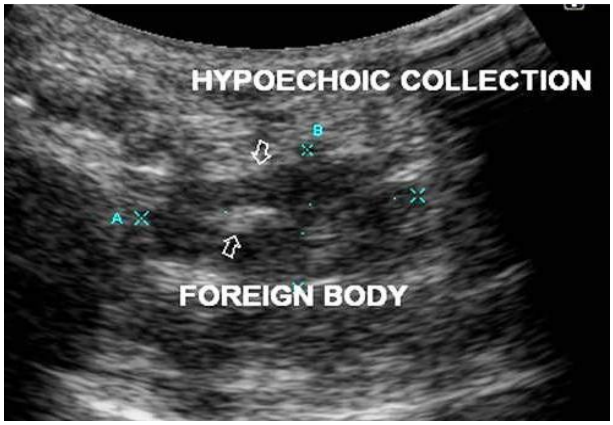
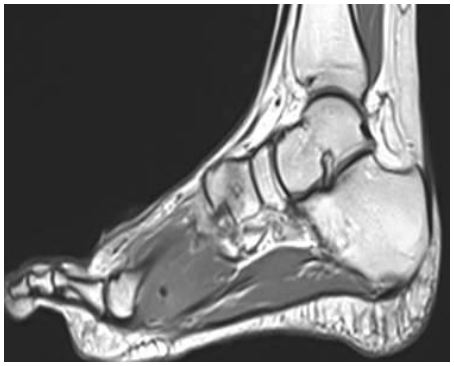



**Figure 3.** (a) & (b) USG show edematous tendon with inflamed synovium and prominent vascularity on color Doppler mode. (c) & (d) MRI STIR and T1W images show tenosynovitis of external carpi ulnaris

 ISSN 2394-3718




(a)



(b)

(c)

(d)

**Figure 4.** (a) USG images show hyperechoic foreign body within muscular palne on planter aspect of foot with surrounding edema and inflammation. (b) (c) &(d) MRI images of same patient T1W, T2W & STIR images showing signal void of foreign body with surrounding edema and inflammation

 ISSN 2394-3718

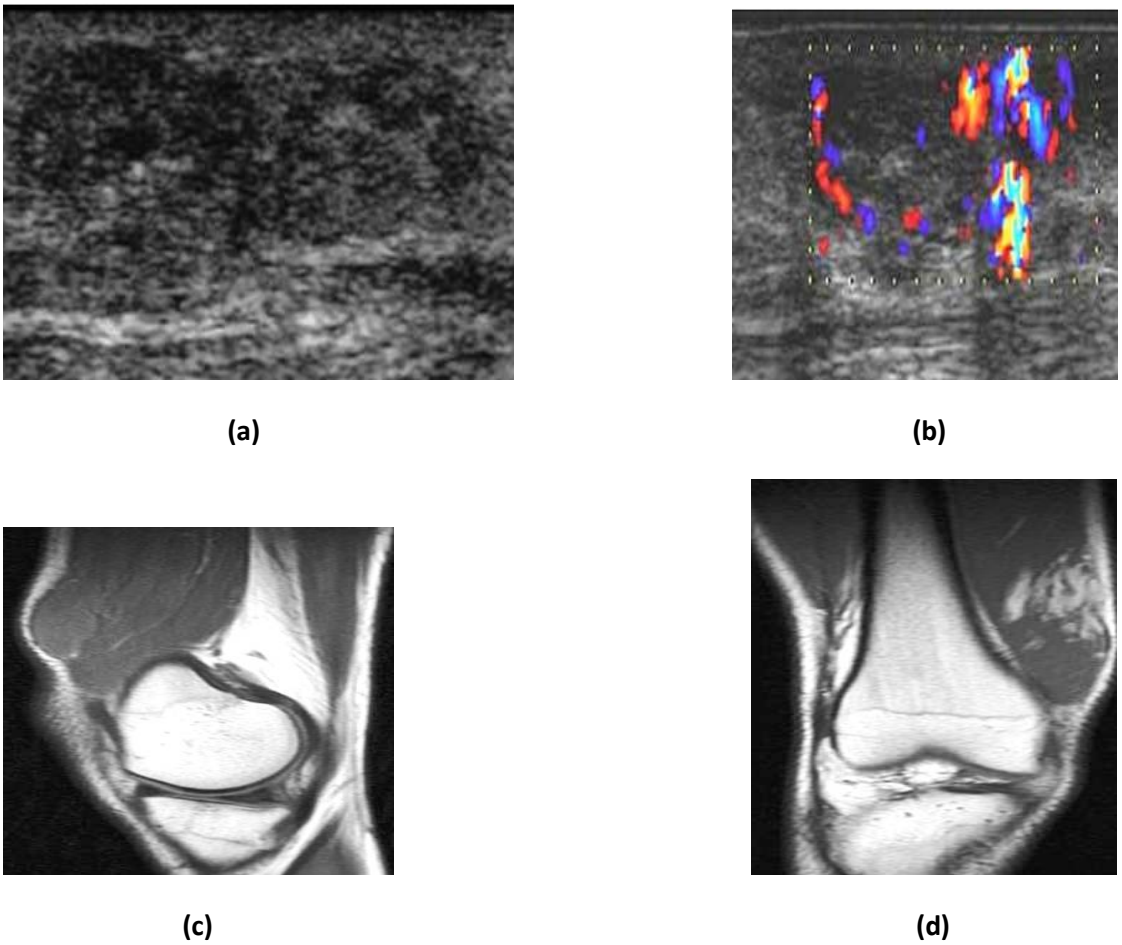



**Figure 5.** (a) & (b) USG image showing iso to hypoechoic lesion showing vascularity within it on release of compression suggestive of hemangioma or AV malformation. (c) & (d) MRI images T1W & post contrast T1 images showing charecteristic features of haemangioma

 ISSN 2394-3718

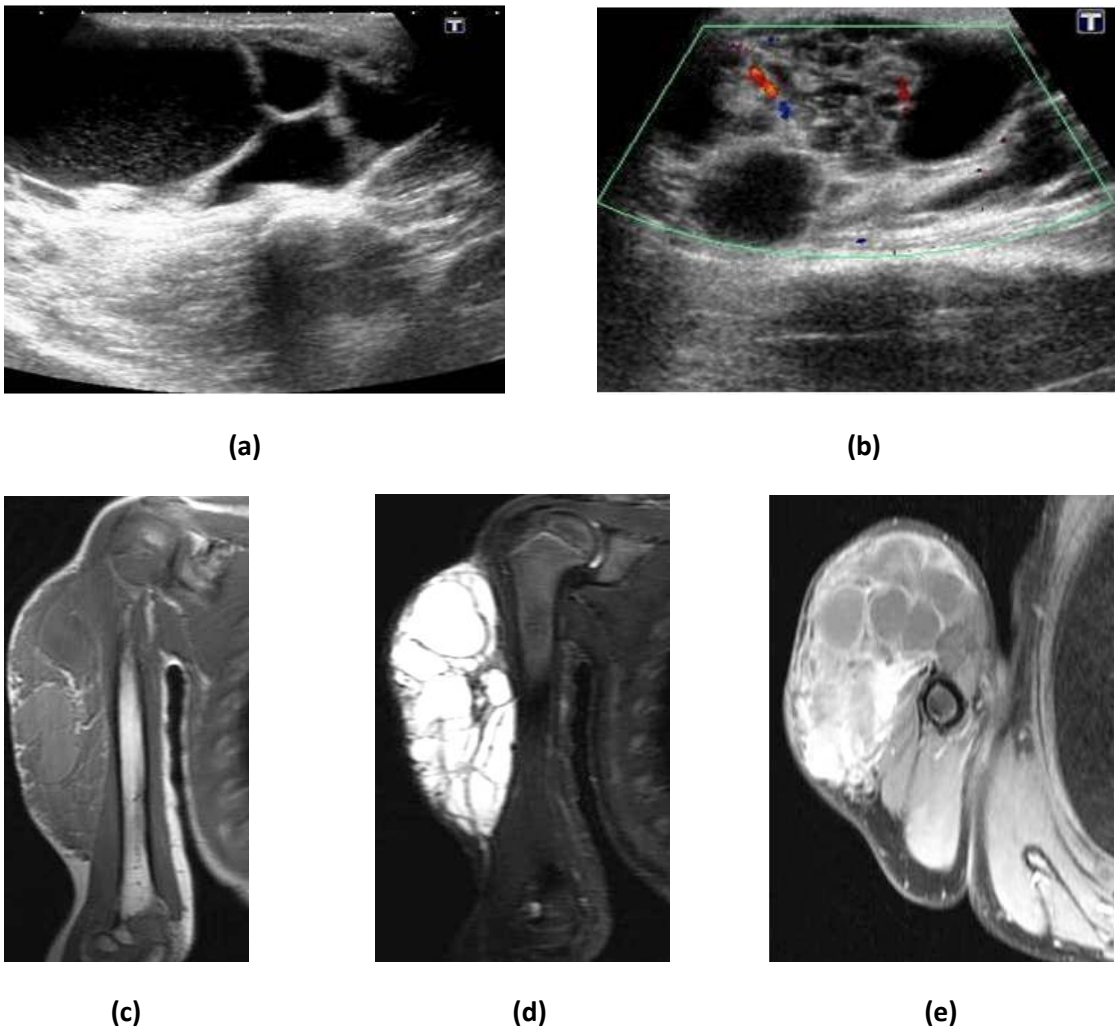



**Figure 6.** (a) & (b*)* USG show multiloculated cystic lesion with septations with minimal vascularity within it suggestive of haemangioma-lymphangioma. (c) (d) & (e) MRI T1W, STIR, and post contrast T1W images show multiloculated cystic lesion with enhancing septations and solid component typical of Haemangioma-Lymphangioma

 ISSN 2394-3718

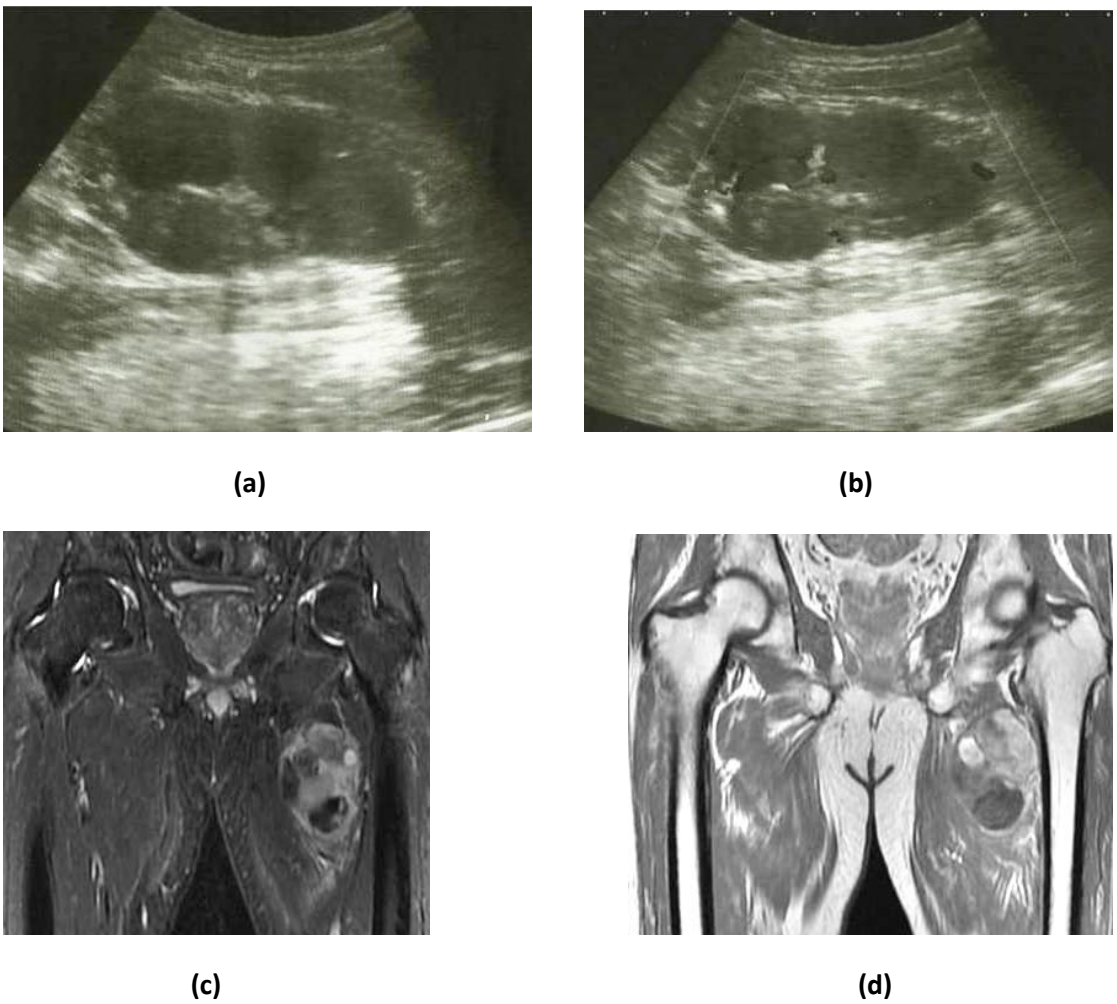



**Figure 7.** (a) & (b) USG shows well defined mixed echogenic hypoechoic lesion with vascularity which was considered to be benign or infective. (c) & (d) MRI coronal STIR and post contrast T1W images show lesion is heterogeneously hyper intense on STIR with heterogeneous post contrast enhancement suggestive of malignant sarcoma