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Original Research Article

Role of High Resolution Ultrasonography (HRUS) in Musculoskeletal Diseases with its Clinico-Radiological Correlation

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ABSTRACT

Background: Ultrasonography has formed the mainstay of diagnostic human imaging especially as first line investigation for many decades. With the recent advent of high-resolution, linear ultrasound transducers, it is now possible to use ultrasonography for imaging of variety of musculoskeletal pathologies as a first line screening modality, guiding diagnostic procedures or for final diagnosis.

Introduction: High-resolution ultrasonography (HRUS) ideal for musculoskeletal pathologies requires a dedicated ultrasound scanner with high-frequency linear transducer and thorough clinical & radiological knowledge. Magnetic resonance imaging (MRI) has been a gold standard diagnostic tool so far either for confirmation of provisional diagnosis or knowing the extension of disease in a diagnosed case of musculoskeletal pathology.

Material & Methods: Present study evaluated the role of high-resolution ultrasonography (HRUS) in a variety of musculoskeletal pathologies in sixty-eight patients and the results were finally compared & correlated with the final diagnosis achieved by clinical / surgical procedure or MRI.

Results and Conclusion: Study revealed that HRUS is fairly accurate (more than 90%) in evaluating and achieving the final diagnosis in variety of musculoskeletal pathologies and in many cases obviated the need for surgery / MRI, at times by guided procedures. Hence, HRUS should be the preliminary method of evaluation of amenable musculoskeletal pathologies.

Keywords: Musculoskeletal, Magnetic Resonance Imaging, Ultrasonography, High-Resolution.

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INTRODUCTION

High-Resolution Ultrasonography (HRUS) has long been the main stay for radiologists. The wide and easy availability with improvement in technology along with its portability, safety and low cost make HRUS as first line of imaging investigation for evaluation of musculoskeletal diseases. HRUS skills coupled with necessary anatomical knowledge make clinical diagnosis more accurate and precise, thus reducing the uncertainty of choice of therapy.[1] HRUS has been used as an extension to physical examination. It can be performed instantly in the clinic, with assessment of multiple joints at same time.

HRUS offers several other advantages like non-invasiveness, lack of radiation and fast scan time. There are several advantages from clinician's point of view with few of them being contralateral examination and lack of limitations due to metal artefacts, as in case of magnetic resonance imaging (MRI). "The ability to visualize needles and target structures in real time makes it an ideal tool for the guided procedures used in diagnosis and management".[2] "HRUS performed by the radiologist also provides a very good opportunity for educating the patient and to explain the rationale for treatments".[3] With increasing experience the examiner is able to perform focussed examination which provides immediate answers to any clinical queries that have been raised. However, its major drawback is operator dependence and competence of radiologist. Musculoskeletal diseases can be broadly categorized into the following heads.

Congenital

Developmental dysplasia of the hip can be easily diagnosed. The best time for examination is from 6 weeks to 6 months. It has a advantage of being real-time dynamic examination allowing the stability of the hip to be assessed. The graph method for ultrasonography classification is used.

Traumatic

It includes ligament tears, musculotendinous tears (for example: rotator cuff tears), avulsion fractures and evaluation of union of fracture. "Ultrasonography can show tendon instability such as anterior dislocation of the extensor carpi ulnaris (ECU)”.[4] It plays an important role in the diagnosis of impingement of the shoulder by showing which structure is being impinged and reveals potential intrinsic and extrinsic causes.[5]

Inflammatory

Can be non-infectious which includes arthritis, degenerative joint diseases or Infectious / Infestation. “Infections of musculoskeletal system represent a common clinical problem and include cellulitis, soft tissue abscess, septic tenosynovitis, bursitis, arthritis, and osteomyelitis”.[6] Though we can assess intra-articular and periarticular pathology on plain radiographs and MRI, HRUS can have an added role for these modalities as in detection of small joint effusions that indicate underlying joint pathology. “In fact, effusions as small as one ml can be identified with diagnostic high-resolution ultrasonography”.[7] HRUS can also serve as guide for aspiration of these effusions.

Tumours

Can be benign / malignant, former include desmoid & leiomyoma while latter includes muscle & bone tumours. HRUS can detect of tumour & its characteristics like size, shape, margins, number, growth pattern and internal texture. Ultrasonography can easily assess whether the tumour is arising from bone or extraosseous tissues or both. Periosteal reaction, matrix mineralization, fluid-fluid levels can also be identified. HRUS also aid in guiding percutaneous needle biopsy.

AIMS

- To evaluate the accuracy of HRUS in musculoskeletal pathologies.

OBJECTIVES

- To evaluate role of HRUS in detecting musculoskeletal pathologies.
- To evaluate the role of MRI in detecting musculoskeletal pathologies.
- To compare the role of HRUS with MRI in musculoskeletal pathologies

MATERIALS & METHODS

The study was done on patients coming to the out-patient departments of Teerthanker Mahaveer Medical College & Research Centre, Moradabad, Uttar Pradesh (India) with clinically-diagnosed musculoskeletal pathologies. Elaborative history along with HRUS was recorded in all cases and further compared with those obtained from MRI scan or clinical procedure, whichever was required.

The USG scanner used was Siemens Accuson S2000 with linear-array transducer probe 7-12MHz. MRI was performed on Siemens Avanto 1.5 Tesla scanner.

HRUS was performed in transverse & longitudinal planes in the region of interest. Vascularity was also noted along with Resistive index (RI) and Pulsatility index (PI). Power Doppler was performed where there was minimal or no detectable vascularity on color Doppler imaging.

This was a prospective study comprising of 68 patients with clinically suspected musculoskeletal diseases who had undergone HRUS imaging with follow up MRI or clinical correlation, if required. The ultrasound findings were noted and charted into different categories viz. inflammatory, traumatic, tumoral and miscellaneous and then these were compared with the final diagnosis which was either made by magnetic resonance imaging, aspiration cytology, or clinical follow up.

Inflammatory cases were further subdivided into infective and non-infective categories. In cases of tenosynovitis, the synovial membrane was identified in the clinically palpable swelling and thickening of synovial sheath, with or without increased vascularity which can extend into tendon sheath and edema is noted.

Colour Doppler imaging helps us to in tendon sheath assessment. If only thickening is there it is more indicative of chronic disease unlike in tendon sheath collection which indicates acute tenosynovitis.

In traumatic cases, we either have a collection or involvement of a joint. In cases where collection is seen, its exact location in anatomical terms and volume in ml is noted. While in involvement of joint we examined whichever joint is traumatised.

The patient is made to sit at the same level as that of the examiner. Frequency of the probe depends on the build of the patient and the joint under evaluation. The tendons were evaluated for locating the tear.

In tumoral cases, the anatomical location and extent of the lesion, shape and margins of the lesion, size of the lesion with its echogenicity (hypoechoic, hyperechoic or isoechoic) and internal texture (homogeneous or heterogeneous) along with the vascularity including RI and PI values were noted. The distribution of vessels was also noted whether it is regular, irregular, abrupt, linear or with tortuous flow. The lesion was further classified into benign or malignant.

For Shoulder Patients: The bony landmark used is acromion, the scapular spine, the coracoid and acromioclavicular joint. Transverse images through long head of biceps are obtained with forearm and arm on the patient’s thigh. The bicipital groove serves as an anatomical landmark to differentiate subscapularis tendon from supraspinatus tendon. The groove is visualised as a concave structure with bright echoes reflecting off the bony surface of the humerus. The tendon of long head of the biceps is visualised as a hyperechoic oval structure on transverse scanning. The tendon courses through the rotator cuff interval and divides the subscapularis from the supraspinatus tendon. Intracapsular biceps is seen more obliquely in the shoulder capsule. When in transverse plane and the position is moved back along the humerus to visualise the supraspinatus tendon, which appears as medium level echoes, deep to sub-deltoid bursa and fat. The supraspinatus tendon is scanned perpendicular the axis transversely by moving the transducer laterally and posteriorly. Followed by supraspinatus tendon, visualisation of infraspinatus and teres minor tendons is done by moving the transducer posteriorly and in plane parallel to the scapular spine. The teres minor tendon is identified as a trapezoidal structure which is differentiated from infraspinatus tendon by its broader and more muscular attachment.

For Elbow: The anterior and lateral aspects are best examined with the elbow extended. The common extensor tendons which include tendons from extensor digitorum, extensor digiti minimi, extensor carpi ulnaris and extensor carpi radialis brevis muscle inserts into lateral aspect of lateral epicondyle. The common tendon for origin of superficial flexor muscles include pronator teres, flexor carpi radialis, palmaris longus, flexor carpi ulnaris and flexor digitorum. Superficial flexor muscles insert into the medial epicondyle. Biceps brachii muscle can be visualised in the anterior cubital fossa as it inserts into the radial tuberosity. Because of the oblique direction, it appears hypoechoic. The tendon of triceps can be seen when the elbow is flexed and is identifiable on both longitudinal and transverse scans as it inserts into the olecranon process of ulna.

The Achilles tendon is formed by the fusion of aponeurosis of the soleus and the gastrocnemius muscle and it inserts onto the posterior surface of calcaneus. The tendon is echogenic and exhibits a characteristic fibrillary texture on longitudinal scans. The termination of hypoechoic soleus muscle is identified anterior to the origin of Achilles tendon. On transverse scan, cross section of Achilles tendon is grossly elliptical and tapers medially.

MRI PROTOCOL FOR SHOULDER

Shoulder stabilisation is must. The sequences used are axial & oblique coronal & sagittal, gradient echo, T2 FSE, T1 weighted and short tau inversion recovery (STIR).

Inclusion Criteria

All patients with clinical findings related to musculoskeletal diseases were included in the study.

Exclusion Criteria

- Any musculoskeletal condition which was not accessible for high resolution ultrasonography (for example deep seated bone).
- Absolute contraindications to MRI like in patients with pacemaker implants, cochlear and metallic implants).

Table 1: Distribution of etiology

Etiology	Count	Percentage
Congenital	2	2.94%
Infective	25	36.76%
Tumour	19	27.94%
Inflammatory	14	20.59%
Trauma	5	7.35%
Miscellaneous	3	4.41%
Grand Total	**68**	**100.00%**

Table 2: Anatomical distribution of the musculoskeletal diseases.

Location	Count	%
Shoulder	12	17.65%
Wrist	8	11.76%
Tibia	5	7.35%
Thigh	5	7.35%
Ankle	5	7.35%
Knee	5	7.35%
Hip	5	7.35%
Femur	3	4.41%
Elbow	3	4.41%
Leg	3	4.41%
Sternoclavicular Joint	2	2.94%
Forearm	1	1.47%
Scapula	1	1.47%
Arm	1	1.47%
Hand	1	1.47%
Humerus	1	1.47%
Cheek	1	1.47%
Biceps	1	1.47%
Costal Cartilage	1	1.47%
Foot	1	1.47%
Extensor Indices	1	1.47%
Metacarpal	1	1.47%
Radius	1	1.47%
Grand Total	**68**	**100.00%**

OBSERVATIONS & ANALYSIS

Sixty-eight patients were included in our study. Out of 68 patients, diagnosis of 60 patients could be achieved on high resolution ultrasonography.

Demography

The included patients were of predominantly male (n=39, 57%) with less number of female (n=29,42 %) patients. The mean age of the patients was 29.5 +/-16.1y. The most common age group that was involved was that of 20-29 years in both males and females accounting for about 29 % of total number of patients. The second largest subgroup was of age 10-19 years in both males and females accounting for 23% of total number of patients. The mean age for male was 32.1 +/- 15.9 years and that for females was 25.9 +/- 15.8 mean age. It was also seen that male patients tend to have a later peak i.e. after 40 years of age.

Etiological Distribution

In our study, inflammatory disease was commonest accounting for 36.7% (25 Patients) falling in category of infective and 20.58% (14 patients) in non-infective category. Tumour was the second most common category accounting for 27.94 % (19 patients). The least number of cases were found in the congenital age group that is of approximately 2.94%. Thus showing that HRUS is quite effective for inflammatory and tumoral etiologies. (Table 1)

Of all the joints evaluated, shoulder joint had the maximum number of cases i.e. 12, accounting for 17.6%. There were no patients in congenital or miscellaneous category. The non-infective inflammatory subgroup had the maximum number of patients (n=4, 33%). The second most common subgroup was infective-inflammatory (n=3,25%) and trauma (n=3,25%). Only 2 cases of tumour were seen in shoulder. Out of 12 cases that were examined it was found out that HRUS could make diagnosis of 11 cases. One case where HRUS could not make the diagnosis was of shoulder impingement.

All the 68 patients that were included in the study were further labelled according to their anatomical location and it was found out that the maximum number of cases were of shoulder (n=12, 17.6%).The second most common location in our study was wrist (n=8, 11.76%). (Table 2)

Of all cases evaluated, there were 12 cases with tendon pathologies, accounting for 23.5%. The non-infective inflammatory subgroup had the maximum number of patients (n=9, 56%).

The second most common subgroup was infective-inflammatory (n=3, 19%) and trauma (n=3, 19%).A single case of Achilles tendon xanthoma was also found which was categorized into miscellaneous type. (Table 3)

Table 3: Tendon aetiologies with its subgroup and number of patients

Infective	**3**
Infective Tendinitis	1
Infective Tenosynovitis	2
Inflammatory	**9**
Acute On Chronic Calcific Tendinitis Of Bilateral Achilles Tendon	1
Chronic Tenosynovitis	1
Compound Ganglion	1
Ganglion	1
Infective Tenosynovitis	1
Inflammatory Tendinosis Of Supraspinatus Ad Long Head Of Biceps	1
Inflammatory Tenosynovitis	1
Inflammatory Tenosynovitis Of Flexor Tendon -Carpal Tunnel Syndrome	1
Inflammatory Tenosyovitis Of Abductor Pollicis Longus, Degenerative Synovitis Of Ist MCP	1
Miscellaneous	**1**
Achilles Tendon Xanthomatosis	1
Trauma	**3**
Partial Tear Of L Supraspinatus Tendon	1
Partial Tear Of Rotator Cuff	1
Rupture Of Tendon Of Long Head Of Biceps	1
Total	**16**

BONE

Among all the bone tumors that we evaluated (n=19, 27.94%), it was found out that HRUS could detect the etiology in 15 cases, it gave negative results in rest of four cases. All the cases which could not be detected were those where ultrasound beam could not reach within the bone due to absence of the cortical breach. The cases included in this were that of osteoid osteoma, enchondroma and tumoral calcinosis.

Among 19 tumoral cases, 10 were benign tumors accounting for 52.6 % and 9 tumors were of malignant origin accounting for 47.6%. Of all the cases that were scanned with HRUS, it was found out that out of 68 cases, we could make diagnosis on the basis of ultrasonography for 60 cases. Eight cases where we could not make the diagnosis were those where the ultrasound beam could not penetrate and in case of shoulder impingement where MRI is the investigation of choice.

Table 4: Role of HRUS in Inflammatory Diseases

Etiology	Infective	Non-Infective Inflammatory
Sensitivity	96	100
Specificity	100	100
PPV	100	100
NPV	97.8	100

Table 5: Role of HRUS in Tumors

Etiology	Tumour
Sensitivity	85
Specificity	100
PPV	100
NPV	94.2

Table 6: Role of HRUS in Traumatic Diseases

Etiology	Trauma
Sensitivity	75
Specificity	100
PPV	100
NPV	98.5

Table 7: Role of HRUS in Congenital Diseases

Etiology	Trauma
Sensitivity	50
Specificity	100
PPV	100
NPV	98.5

CASE 1: A 40 YEAR OLD FEMALE PRESENTED WITH C/O PAIN AND SWELLING IN HAND FOR LAST 3 MONTHS.

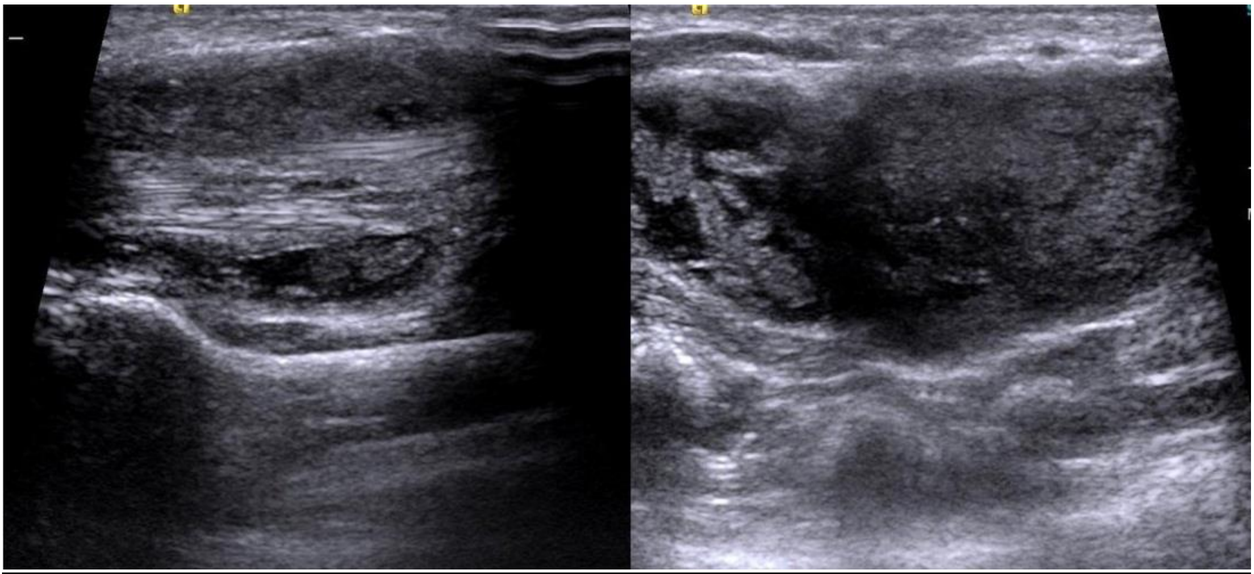


Fig 1: USG Findings: HRUS of wrist reveals tenosynovitis and synovial collection with multiple rice bodies around the right wrist joint.

Fig 2,3: MRI Findings: Coronal T1W and T2GRE images of right wrist joint reveals subarticular erosions with variable marrow edema in multiple carpal bones.

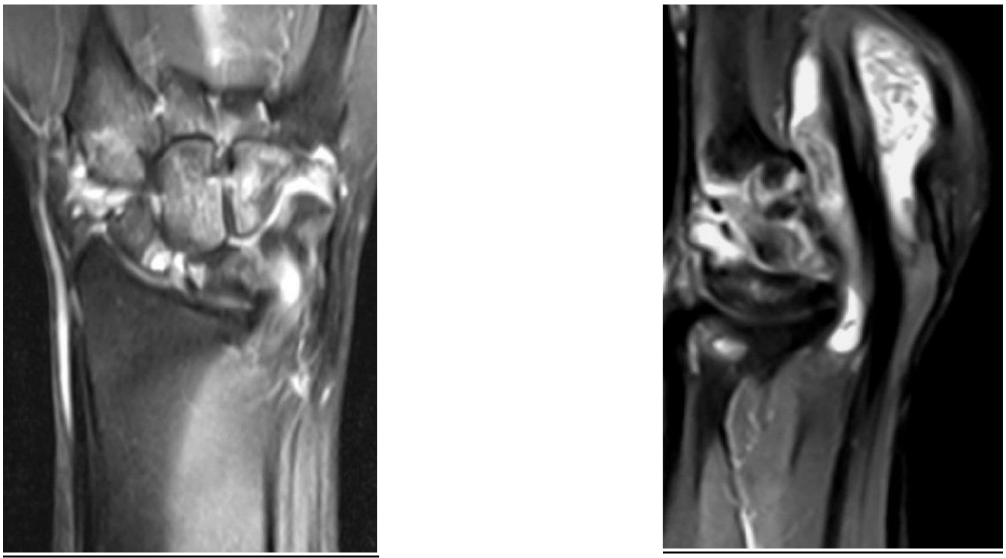


Fig 4,5: MRI Findings: Coronal and sagittal PDW images shows erosions with marrow edema in multiple carpal bones and collection along the thickened Flexor digitorum tendon with multiple hypointense irregular filling defects representing rice bodies.

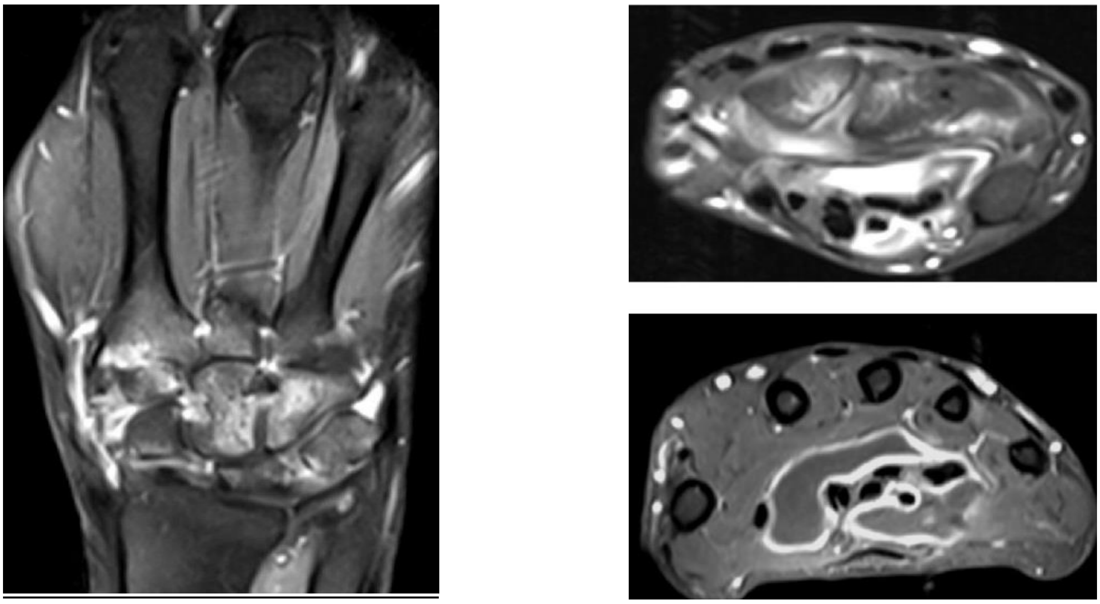


Fig 6,7: MRI Findings: Coronal and axial Post contrast fat-saturated T1W images show enhancing erosions and marrow in multiple carpal bones with thickened & enhancing synovium and collection around flexor tendons.

CASE 2: A 16 YEAR EULIPIDEMIC FEMALE WITHOUT H/O CONSANGUINEOUS PARENTS PRESENTED WITH B/L SYMMETRICAL PAINLESS SOFT TISSUE MASSES AT KNEE AND POSTERIOR ANKLE JOINTS WITHOUT SIGNS OF CENTRAL OR PERIPHERAL NERVOUS SYSTEM INVOLVEMENT.

Fig 8: Clinical Presentation

Fig 9,10: Radiograph of both ankles in lateral projections show symmetrical thickening in region of Achilles tendon while radiographs of both knee joints in frontal projection show pretibial soft tissue swelling in region of patellar tendon.

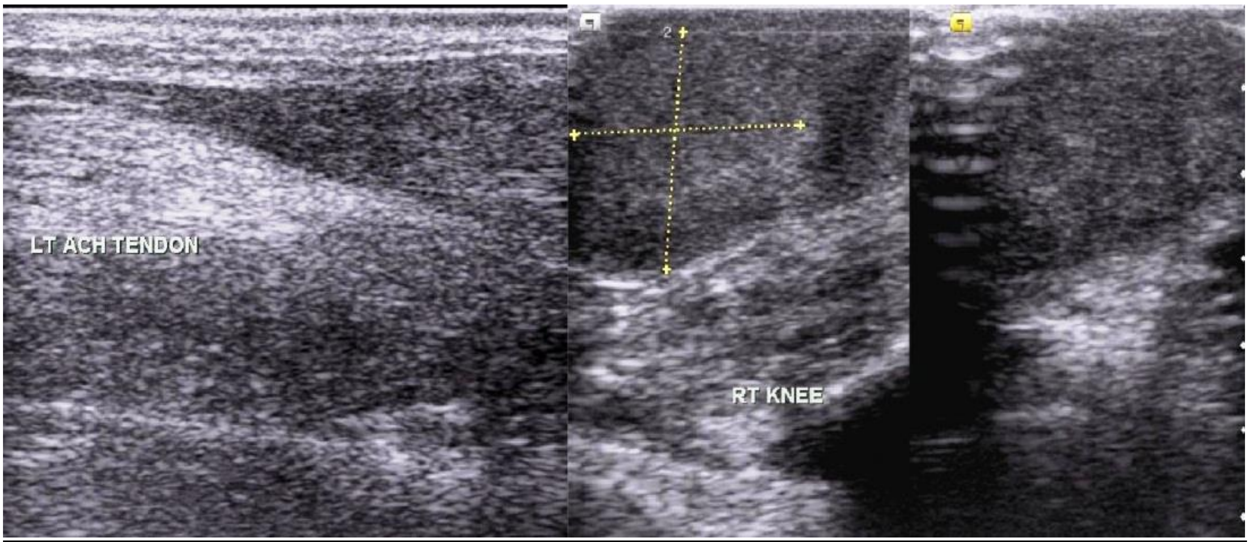


Fig 11: High resolution ultrasonography shows thickening of Achilles and patellar tendon with internal hypoechoic masses and loss of normal architecture.

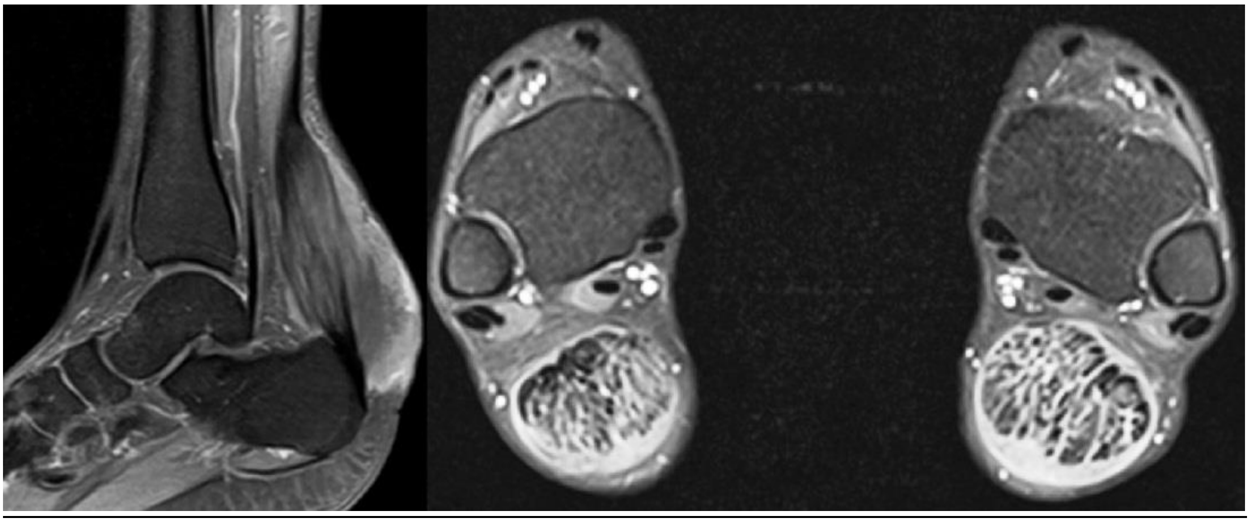
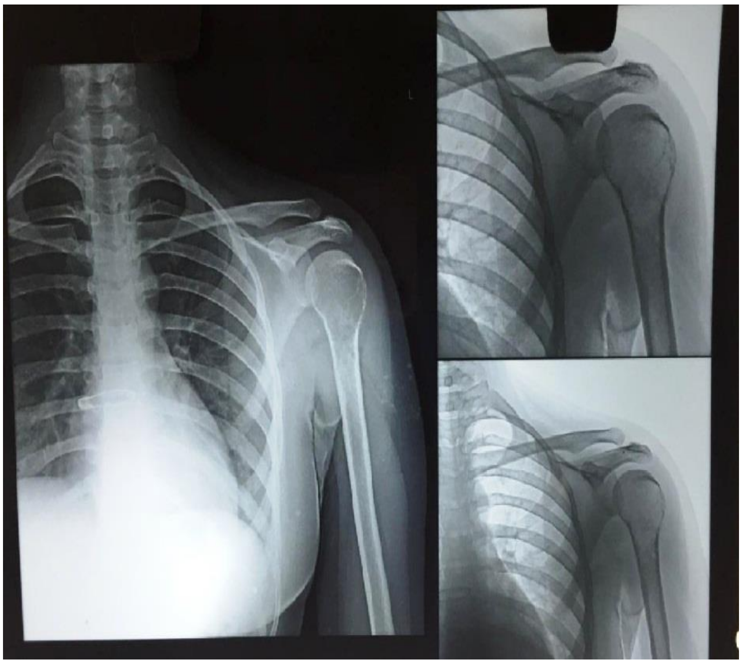


Fig 12: Non-contrast unilateral, fat-saturated T1W sagittal image and postcontrast, bilateral fat-saturated T1W axial images through Achilles tendon showing thickening with internal hyperintensity and speckled appearance.

DIAGNOSIS: Imaging findings are s/o high possibility of xanthomatosis involving Achilles and quadriceps tendon.Biopsy through tendinous swellings revealed lipid laden macrophages, inflammatory cells and giant cells secondary to cholesterol deposition and tenson representing xanthomatosis of tendon.

CASE 3: A 21 YEARS FEMALE PRESENTED WITH COMPLAINTS OF PALPABLE SWELLING IN LEFT SHOULDER FOR LAST 1 MONTH.



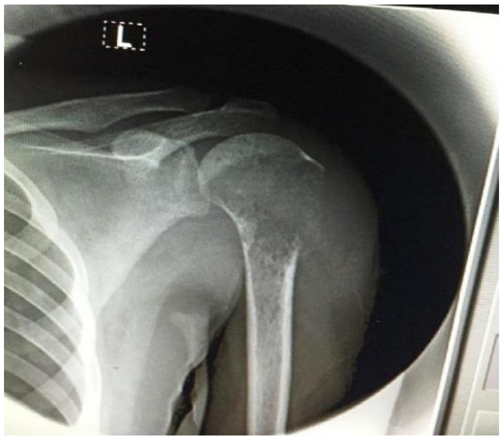


Fig 13,14: XRAY left humerus shows illdefined expansile eccentric lesion with wide margins and cortical breach is seen in proximal dia-metaphyseal region of left humerus. Adjacent soft tissue swelling with displacement of fat planes is also seen.

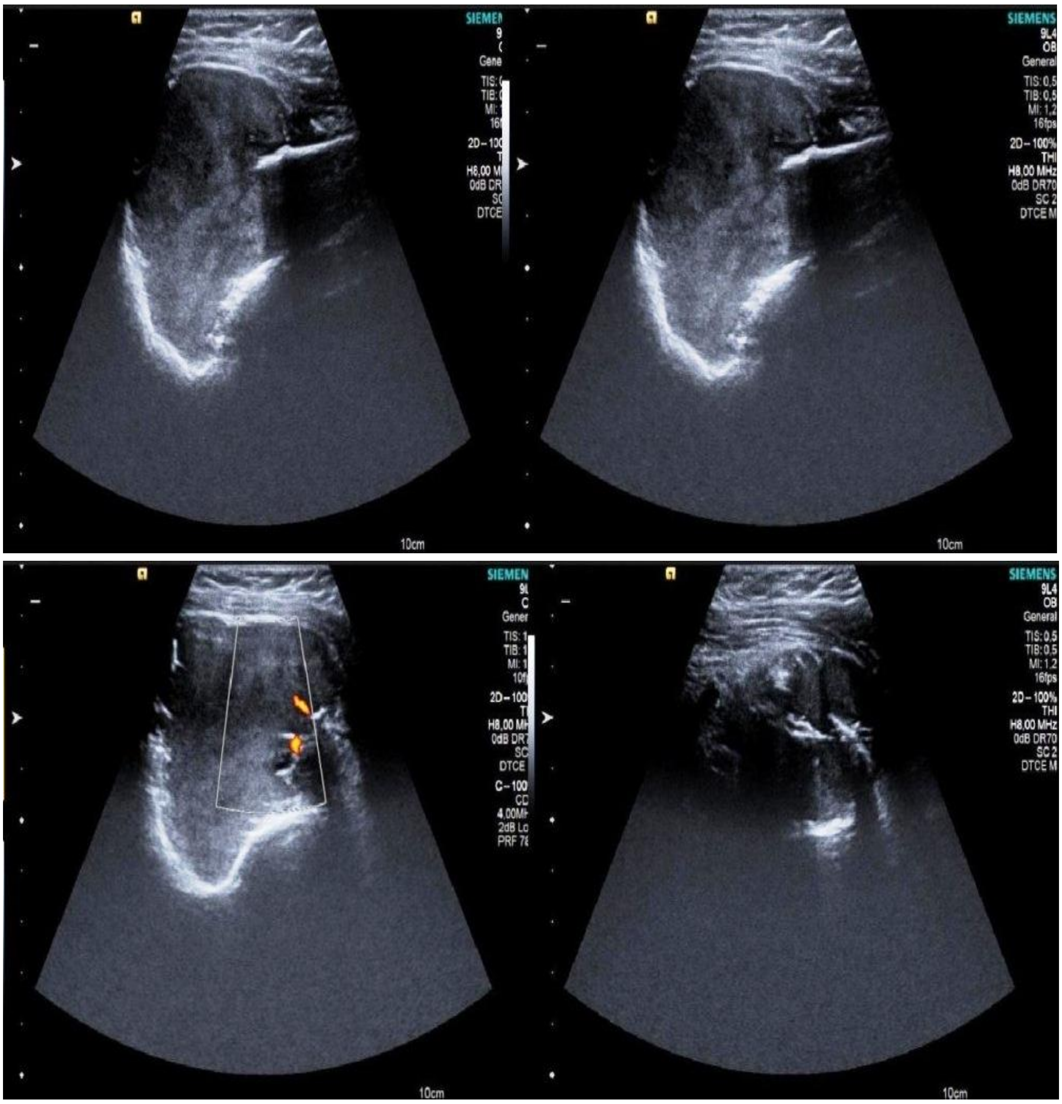


Fig 15,16: HRUS In axial and coronal images showing soft tissue well defined lesion with cortical breach seen in proximal dia-metaphyseal region of left humerus with minimal vascularity. Features suggestive of tumor etiology likely to be malignant.

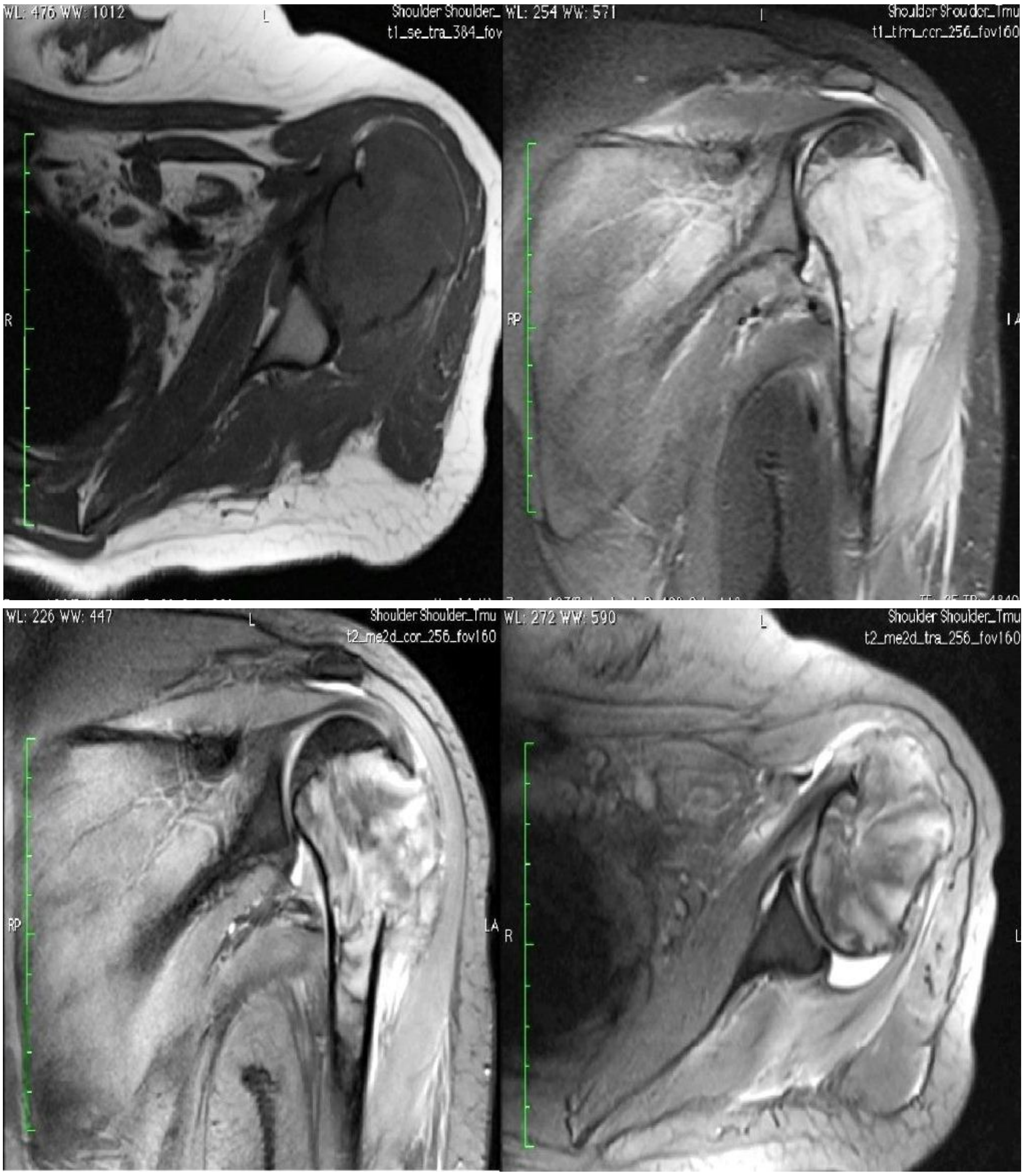


Fig 17,18: T1 Axial ,STIR coronal ,T2GRE coronal and axial images showing altered signal intensity soft tissue lesion with cortical breach in proximal diaphyseal lesion of humerus s/o malignant tumor.

CASE 4: A 30 YEAR OLD MALE PRESENTED WITH PAIN AND RESTRICTED MOVEMENTS OF KNEE JOINT FOR LAST 2-3 MONTHS.

Fig 19: Clinical Presentation

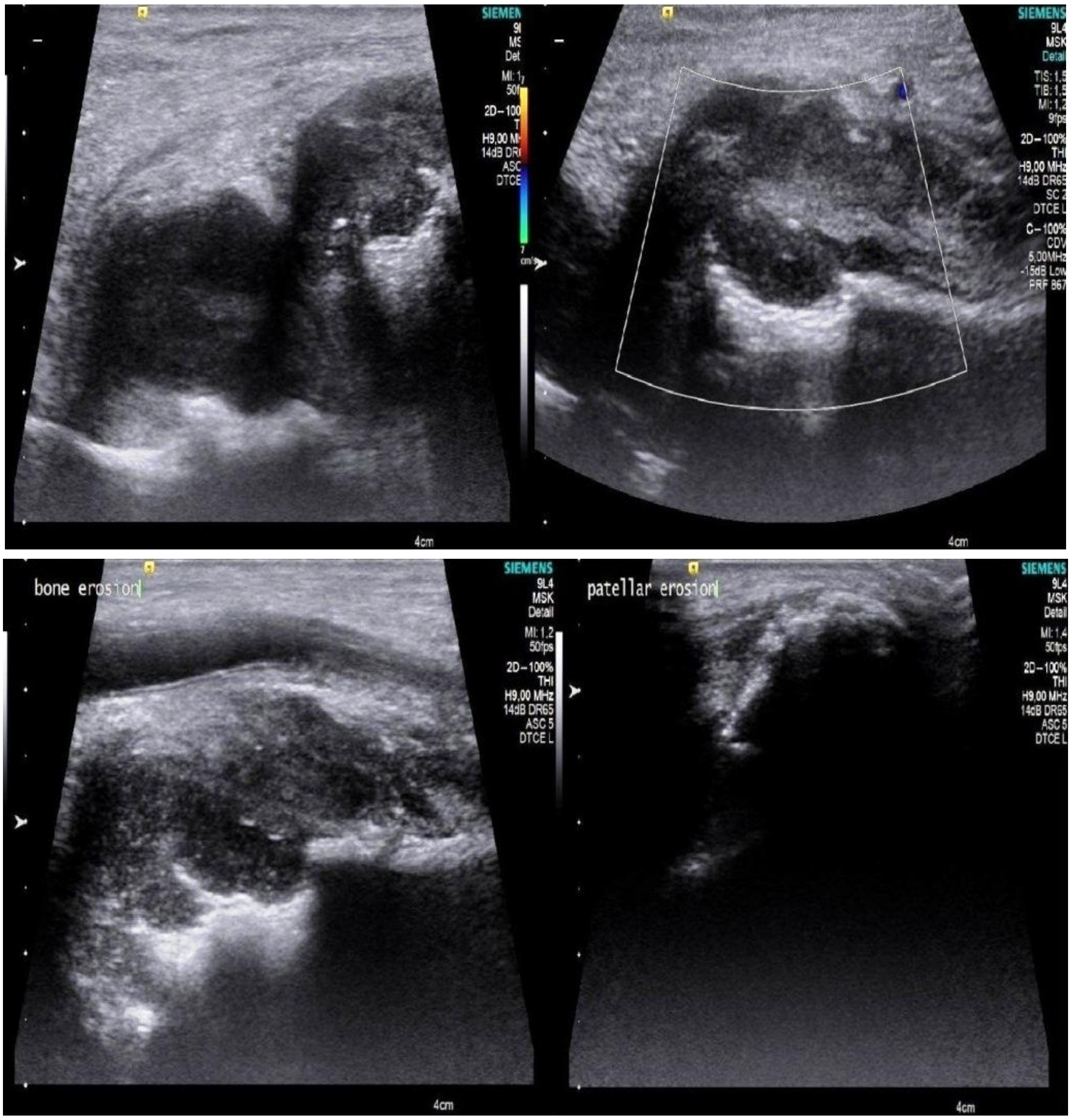


Fig 20,21: HRUS of lower end of femur and upper end of tibia and patella show ill-defined collection with bony erosions seen in patella. There is mild joint effusion with synovial thickening. F/S/o infective etiology likely to be tubercular.

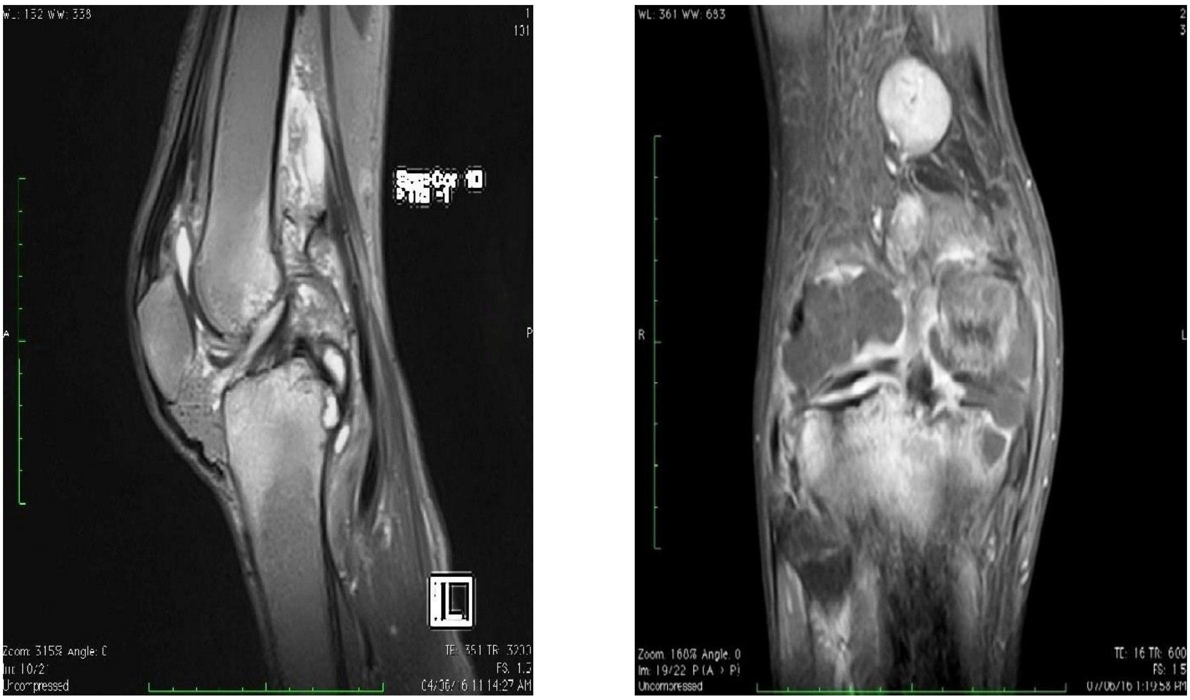


Fig 22,23: T2W sagittal and T1W, fat-suppressed, post contrast coronal images show collection in joint cavity, enhancing lymph node and osteomyelitis of lower end of femur and upper end of tibia.

CASE 5: A 4 YEAR OLD MALE CHILD PRESENTED WITH C/O PAIN IN LEFT LEG FOR LAST 1 MONTH.

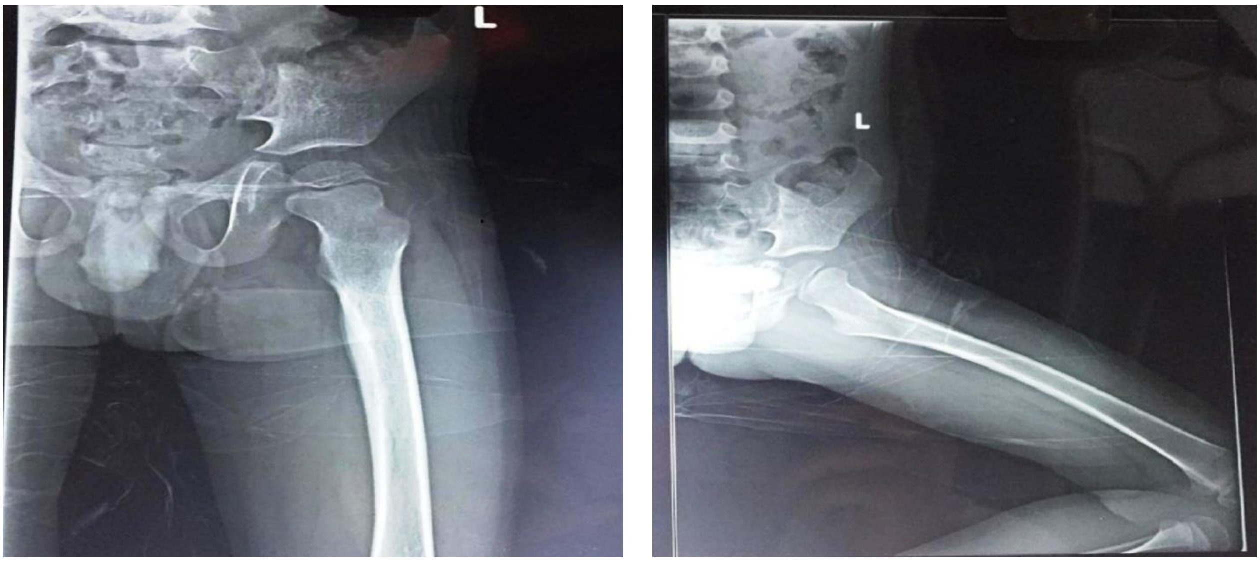


Fig 24,25: X-ray left femur showing solid periosteal reaction with cortical thickening.

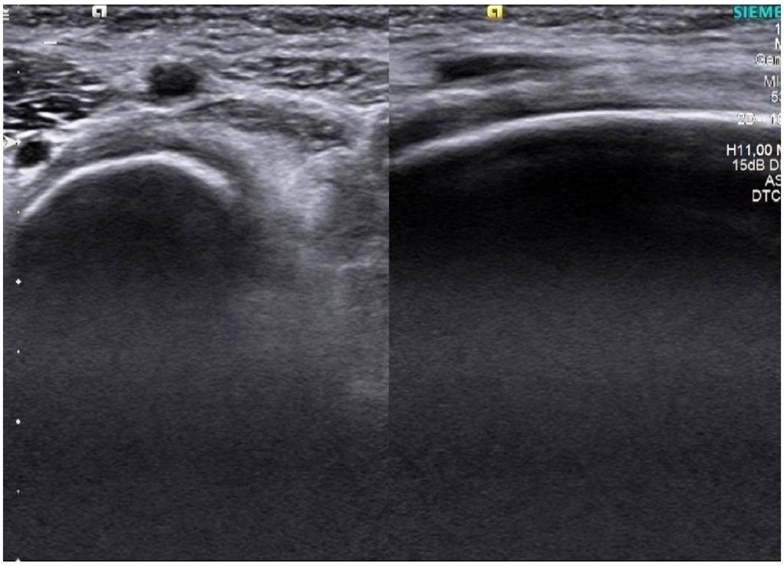


Fig 26: On HRUS no radiological finding.

Fig 27: CT coronal image of left femur show focal lucent lesion with sclerotic bone and a central sclerotic dot. F/S/O osteoid osteoma.

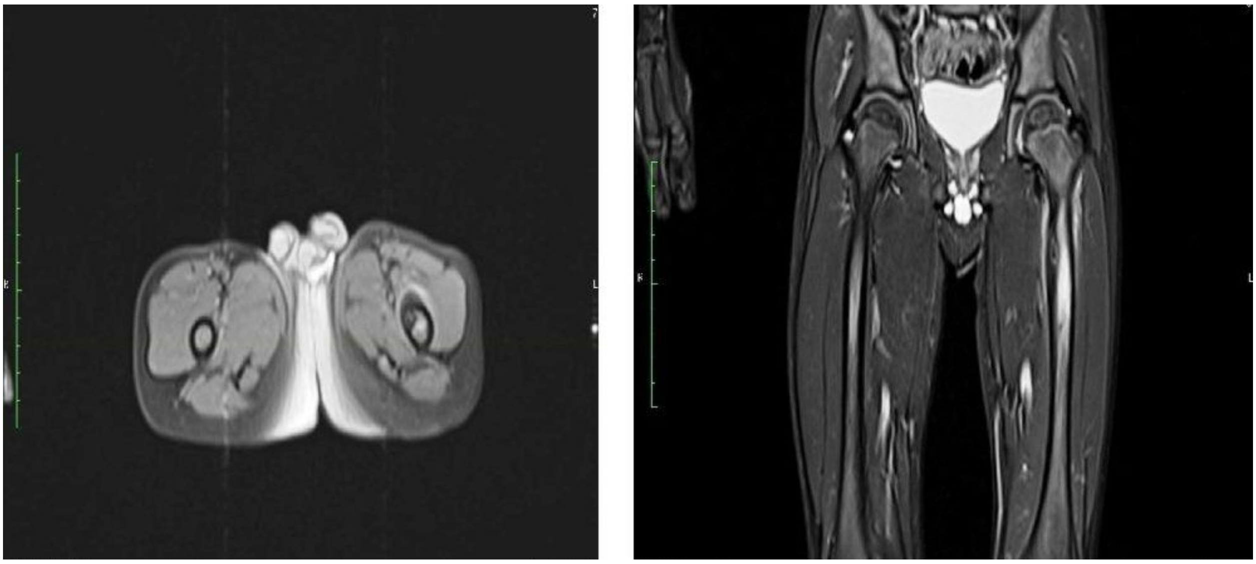


Fig 28,29: Noncontrast T1 fat-saturated axial and T2 STIR images show central nidus and bone marrow edema likely to be osteoid osteoma.

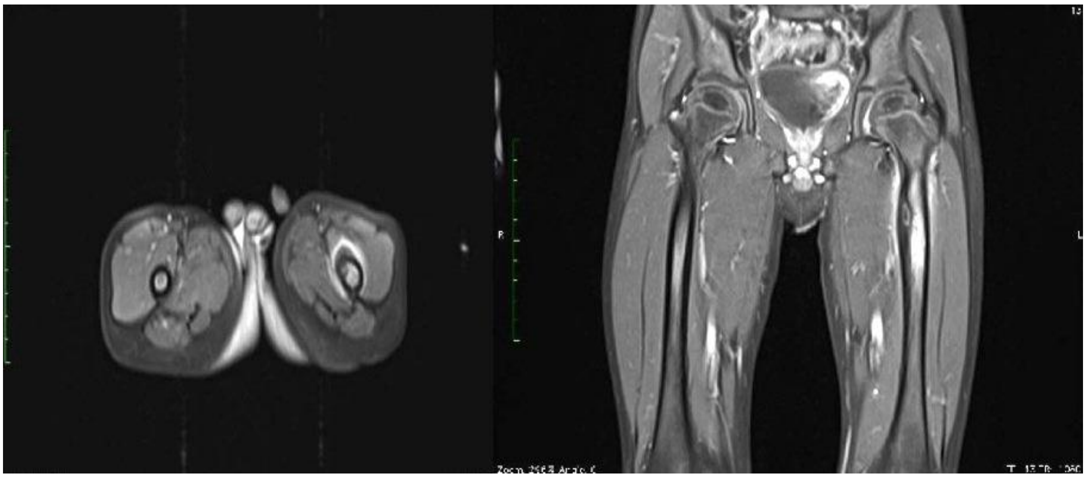


Fig 30,31: Post contrast T1W fat-saturated axial, coronal and sagittal images showing central nidus with minimal enhancement s/o osteoid osteoma.

DISCUSSION

Optimal diagnosis of musculoskeletal diseases is greatly dependent on determining the precise status of the pathology which can be either in congenital, inflammatory, tumoral, traumatic or miscellaneous. HRUS is a non-invasive procedure and is not painful. It is widely available, easy to use and inexpensive. The best part is it is safe and does not use any ionising radiation. It gives clear picture of all the soft tissues that is not well recognised on x-rays. It is a fast imaging technique. HRUS can be used as an excellent alternative to claustrophobic patients. Patients with pacemakers and certain types of implants (metallic) which cannot be taken for MRI due to strong magnetic fields can be safely examined by ultrasound. The major limitations of ultrasound is where the ultrasound beam cannot penetrate the bone and therefore can only visualise the surface of bone and not that what lies within the bone (this is not the case in infants who have more cartilage in their skeleton), also where depth is limitation like in heavy patients and in cases of shoulder joint where shoulder impingement has to be diagnosed. Thus radiological imaging by high-resolution ultrasonography can give us the crucial information so as to diagnose the patient and provide the optimal treatment.

Of all the parameters used to describe the diagnosis, the most important is to categorise them so as to get the optimal results. Once the categorisation has been done further imaging and management can be done.

In our study, on comparing the findings of high resolution ultrasonography with Magnetic resonance imaging, concordance was seen in 96% of cases and discordance in 4% cases of infective-inflammatory etiology. The negative predictive value was as high at 97.8 %.Thus ultrasound has a considerable impact on the treatment planning of the patient and may help in improving the outcome of the disease. In our study, on comparing the findings of HRUS with MRI, concordance was seen in 100% of cases of non-infective-inflammatory etiology. (Table 4) Thus HRUS can be used as an accurate diagnostic tool for such cases. However, it is operator dependent so observer variations may be seen.

On comparing the findings of HRUS with MRI, concordance was seen in 85% and discordance in 15% of cases of tumoral etiology. (Table 5) Out of the 19 patients of bone tumours, it was found out that 47% of them were malignant and 52% were benign. The cases where ultrasound beam could not penetrate the bone, the diagnosis could not be made.

On comparing the findings of HRUS with MRI, concordance was seen in 75% and discordance in 25% of cases of traumatic etiology. In this we found out that MRI was gold standard and there were cases like that of shoulder impingement where MRI scores over HRUS. On comparing the findings of HRUS with MRI, concordance was seen in 75% and discordance in 25% of cases of miscellaneous etiology.

In our study, we had 12 patients of shoulder joint; trauma was seen in 4 cases. Out of the trauma patients, sensitivity was 75%, specificity was 100%, PPV was 100% and NPV of 98.5%. (Table 6) Samira Saraya et al found that HRUS in different tendon pathologies had different sensitivities. In tendinitis, sensitivity was 85%, accuracy of 90% and NPV of 86 %. In cases of Partial-thickness tear, sensitivity was 88%, specificity was 89 %, accuracy of 83%, PPV of 94%, NPV of 80%. In cases of full-thickness tears, 100% sensitivity, specificity and accuracy was achieved. The main objective for patients presenting with shoulder pain and shoulder impingement, the basic aim is to find out whether the rotator cuff is intact or torn with the status of the tendon tear and to find the severity of tendon tear. The management of the tear depends on the accurate diagnosis. There are so many studies which have been published comparing ultrasound with MRI, but still difficult to state whether the efficacy and low cost of ultrasound is better over MRI. But it can be stated that Ultrasound is comparable to MRI in full thickness tears and in those patients were getting an MRI done is not feasible. In review of radiology, the effectiveness of high resolution ultrasonography in rotator cuff diseases forms an authentic base provided that the examining radiologist has expertise in his field. According to Al-Shawi[8] et al, HRUS is an effective tool for diagnosing full thickness tears by trained radiologists. There are chances of error by inexperienced radiologists.

In 2008, Fotiaduo [9] et al, study showed that accuracy of full thickness tears was 98% and 100% for ultrasound and magnetic resonance imaging respectively. In cases of partial thickness tears it was 87% and 90% for ultrasonography and magnetic resonance imaging respectively. In Fischer[10] et al, Ultrasound is compared to MRI and it revealed accuracy of 91.1 % and 84% in supraspinatus tendon ad infraspinatus tendon respectively. Thus by comparing with the previous studies we can say that ultrasound is comparable to MRI in diagnosing tears.

In evaluation of bone tumours, we found out that specificity was 85%, sensitivity of 100%, PPV of 100% and NPV of 94.2 %. In the study carried out by Gerd Bodner et al where he took 79 cases of musculoskeletal tumours (34 cases of malignant and 45 cases of benign), all the cases underwent ultrasound guided biopsy or open biopsy whichever required. High sensitivity i.e. 94 % and specificity of 93 % was found. The study was based on good spatial resolution of high resolution ultrasound. The gray scale ultrasound has high sensitivity for detecting the tumour but is not useful for differentiating between benign and malignant tumours. Echotexture can be used to differentiate whether the tumour is benign or malignant with specificities of 75.6% and 40 % respectively. Colour and power Doppler can detect vessels as small as 0.2mm in diameter which can check for vascularity. Doppler has been used to define ultrasound criteria for malignancy in many cases. According to our results, we found out that high-resolution ultrasound combined with colour Doppler imaging can be used for picking up the tumour and diagnosing it as benign or malignant.

CONCLUSION

- In Present study, males outnumbered females in prevalence of musculoskeletal diseases.
- Present study shows high incidence of musculoskeletal diseases in 20-29 years of age group.
- Present study shows that infective-inflammatory, non-infective-inflammatory and tumoral from the major groups of musculoskeletal diseases with infective group being the most prevalent.
- Among all the joints, the commonest joint involved by various pathologies is shoulder joint.
- Commonest pathology involving the tendon is non-infective-inflammatory etiology.
- HRUS is more than 90 % accurate in achieving the final diagnosis.
- MRI was highly accurate in achieving the final diagnosis in all cases including those where HRUS was either suboptimal or inaccurate.

To summarize, HRUS can be used as a non-invasive, inexpensive and readily-available imaging modality in a wide variety of musculoskeletal pathologies with high degree of accuracy. Its major limitation appears to be internal derangement of joint and lesions of bone with poor acoustic window/penetration where magnetic resonance imaging can be used as a problem-solving tool.

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REFERENCES

1. Patil P, Dasgupta B. Role of diagnostic ultrasound in the assessment of musculoskeletal diseases. Therapeutic advances in musculoskeletal disease 2012:1759720X12442112.

2. Del Cura JL. Ultrasound-guided therapeutic procedures in the musculoskeletal system. Curr Probl Diagn Radiol 2008;37(5):203-218.

3. Borg F, Agrawal S, Dasgupta B. The use of musculoskeletal ultrasound in patient education. Ann Rheum Dis 2008;67:419.

4. Bianchi S, Martinoli C, Sureda D, Rizzatto G. Ultrasound of the hand. European journal of ultrasound 2001;14(1):29-34.

5. Bureau NJ, Beauchamp M, Cardinal E, Brassard P. Dynamic sonography evaluation of shoulder impingement syndrome. Am J Roentgenol 2006;187(1):216-220.

6. Wu S, Liu G, Tu R. Value of ultrasonography in neurilemmoma diagnosis: the role of round shape morphology. Medical ultrasonography 2012;14(3):192.

7. Kane D, Balint PV, Sturrock RD. Ultrasonography is superior to clinical examination in the detection and localization of knee joint effusion in rheumatoid arthritis. J Rheumatol 2003 May;30(5):966-71.

8. Chiou H, Chou Y, Chiu S, Wang H, Chen W, Chen T, et al. Differentiation of benign and malignant superficial soft-tissue masses using grayscale and color Doppler ultrasonography. Journal of the Chinese Medical Association 2009;72(6):307-315.

9. Chiou HJ, Chou YH, Chiou SY, Chen WM, Chen W, Wang HK, et al. High-resolution ultrasonography of primary peripheral soft tissue lymphoma. J Ultrasound Med 2005 Jan;24(1):77-86.

10. Choo HJ, Lee SJ, Lee YH, Lee JH, Oh M, Kim MH, et al. Pilomatricomas: the diagnostic value of ultrasound. Skeletal Radiol 2010;39(3):243-250.

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