ORIGINAL RESEARCH PAPER
Volume - 9 | Issue - 11 | November - 2020 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ROLE OF MR IMAGING AND USG IN EVALUATION OF ATRAUMATIC MUSCULOTENDINOUS PATHOLOGIES OF ELBOW JOINT

Radiodiagnosis

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ABSTRACT

AIM: To study the spectrum of imaging appearances on MRI and USG imaging in atraumatic musculotendinous pathologies of elbow joint. **Materials and Methods:** This was a prospective study conducted in the department of Radiodiagnosis, Dr Sushila Tiwari Memorial Hospital and Government Medical College Haldwani. This study was carried out on 62 cases of clinically diagnosed patients of atraumatic elbow tendinopathies (Tennis elbow and Golfer's elbow). USG examination was done in transverse and longitudinal plane and MRI features were observed on T1weighted, T2weighted and Short Tau inversion recovery (STIR) sequences. The Spectrum of imaging was studied on the basis of history, clinical evaluation and characteristic radiological features on USG and MRI. **Conclusion:** MRI and USG imaging can play an important part in the early detection and staging of disease and optimizing management of affected patients as per the stage for their better outcome. Imaging can also help in assessing disease progression and response to treatment in long standing cases of elbow tendinopathy.

KEYWORDS

Tennis elbow, Golfers' elbow, Elbow tendinopathy, common extensor tendon, common flexor tendon,

INTRODUCTION:-

Epicondylitis of elbow both lateral and medial is a common occurrence in the population in the 4th and 5th decade of life without any gender predilection. Lateral epicondylitis commonly termed as tennis elbow being more common of the two.[1,2] Epicondylitis of the elbow involves pathologic alteration in the musculotendinous origins at the lateral or medial epicondyle and are thought to be a degenerative process involving the origin of the extensor and flexor tendon origins at lateral and medial epicondyle of humerus respectively. It is believed that chronic repetitive stress lead to frequent microtrauma and tendinosis with microtears in tendon which has potential to progress to a full-thickness tendon tear.[3] Careful history and physical examination are the main tools for diagnosis of epicondylitis. The management relies mainly on conservative measures with cessation of the aggravating activity, applications of cold packs, administration of a non-steroidal anti-inflammatory drug (NSAID) or locally administered corticosteroid injection, with or without use of brace. [1] Other treatment options include injection of PRP (platelet-rich plasma), USG guided tenotomy, extracorporeal shock-wave therapy, and iontophoresis and phonophoresis to obtain deep penetration of topical medications into the soft tissues.[5] Those who fail to respond to conservative therapy are considered for surgical treatment. [6] When surgery is planned MRI and USG imaging are useful for evaluating the nature and extent of disease, detecting associated pathologic processes and to rule out other sources of elbow pain for making more accurate diagnosis and planning the surgical approach. With this study our purpose was to look for the MRI and USG findings of lateral and medial epicondylitis and to look for other associated conditions mimicking them.

OBJECTIVES-

1- To study the imaging appearances of atraumatic elbow tendinopathy with magnetic resonance imaging.
2- To study the imaging appearances of atraumatic elbow tendinopathy with ultrasound imaging.

MATERIALS AND METHOD: -

After obtaining clearance from ethical committee of Government Medical College, Haldwani, the study was carried out on a prospective basis in the department of Radiodiagnosis, Dr. Sushila Tiwari Memorial Hospital, Haldwani. Written informed consent was taken from all the patients. During the study period of 12 months(November 2017 to July 2018 and March 2019 to May 2019) 62 clinically diagnosed patients with atraumatic elbow tendinopathy (48 lateral epicondylitis, 14 medial epicondylitis) underwent MRI and USG examination. Of the total patients 34 patients were females and 28 males. The duration of symptoms ranged from 3 weeks to 7 years. Plain radiography had been performed to exclude the possibility of bony lesion. MRI examination was conducted using a Siemens Magnatom 1.5 Tesla MRI machine using dedicated surface coils with patients in supine position and USG examination was done using Aloka alpha 6 machine.The data were assessed and noted for the involvement of Common extensor tendon, Common flexor tendon, collateral ligaments, Surrounding muscles and bones and Joint Effusion.

MRI involvement of various structures was graded as shown in table 1 and 2.[7] On USG examination the size of the tendon was compared relative to the normal elbow. The size was assessed as either normal, enlarged or attenuated. It was graded attenuated or enlarged, if there was a 10% difference compared with the normal elbow. Tendinopathy was said to be present if there was loss of this normal fibrillar pattern by focal areas of hypoechogenicity and was graded as mild (<30% of fibers affected), moderate (30-70% of fibers affected), and severe (>70% of fibers affected). Tear in the tendon was defined as partial and complete. A partial tear is one with a focal anechoic area with no fibers intact or an echogenic irregular band that could run either horizontally or longitudinally in the common extensor origin whereas a complete tear is one with a distinct complete interval traversing or extending through the full width of the common extensor origin. Abnormalities were confirmed in at least two planes of imaging.[8] Any calcification in the tendon and cortical irregularity was also noted.

Inclusion criteria and Exclusion criteria:

Patients included were the patients with clinical diagnosis of atraumatic elbow tendinopathy with age >18years, both males and females with pain around elbow >2 week duration and patients ready to give consent for study. Exclusion criteria for the study were patients with age < 18 years, pain around elbow < 2 week duration, traumatic elbow pain, patients with contraindications to MRI.

RESULT:-

Out of total 62 patients diagnosed with atraumatic elbow tendinopathy 48 patients presented with lateral epicondylitis and 14 patients presented with medial epicondylitis. Female preponderance was seen as 34 patients were females (54.8 %), while 28 were males (45.2%). The age range of patients was between 20 to 60 years. The maximum number of patients were noted were in the age group of 30-40 years (35.5%) followed by 20 patients in age group 40-50 years (32.2%).
MRI findings in lateral epicondylitis are as described in table 3. On USG examination of common extensor tendon in patients with lateral epicondylitis enlarged tendon was found in 15 (31.3%) patients and attenuated tendon in 5 (10.4%) patients, remaining 28(58.3%) patients had normal tendon size. Mild tendinopathy was found in 15 (31.2%) patients, moderate in 14 (29.2%) patients and severe tendinopathy was found in 9 (18.7%) patients. Partial tear was seen in 10 (20.8%) patients and complete tear was seen in 2 (4.2%) patients. Tendon calcification was seen in 4 (8.4%) patients and cortical irregularity in lateral epicondyle was seen in 9 (18.7%) patients.

MRI findings in patient with medial epicondylitis as described in table 4. On USG examination of common flexor tendon enlarged tendon was

found in 6 (42.8%) patients and attenuated tendon was not found in any patient, remaining 8 patients had normal tendon size. Focal tendinopathy was found in 7 (50%) patients out of 14 and diffuse tendinopathy was seen in 2 (14.3%) patients. Partial tear was seen in 4 (28.5%) patients and complete tear was not seen in any patients. Tendon calcification and cortical irregularity was seen in 3 (21.4%) and 5 (35.7%) patients respectively. MRI and USG images of patient with lateral and medial epicondylitis are shown in figure 1 and 2 respectively.

DISCUSSION:-

Elbow tendinopathies are caused by activities that cause chronic repetitive stress at wrist flexor and extensor muscles. Lateral epicondylitis primary involves common extensor tendon (CET) and primary site of involvement of medial epicondylitis is common flexor tendon (CFT). Histopathological examination of the involved tendon shows collagen fibrillar degeneration, tissue necrosis, fibrosis, hyaline degeneration and angiofibrotic proliferation. [9,10] Patients usually present with lateral or medial elbow pain which usually gets worse with activities. Treatment is primarily conservative but the refractory cases have multiple surgical options such as debridement at the origin of common extensor / flexor tendon, release of tendon etc. Presently, imaging is used mainly in refractory cases to rule out other causes of lateral and medial elbow pain, to know the extent and severity of disease and to plan the mode of treatment and surgical planning. Ultrasonography is an easily and widely accessible imaging modality that enables correlation of symptoms and findings in real time but has low specificity and poor inter-observer reliability.[11] MRI, however, is costly but is more sensitive and specific to confirm elbow tendinopathies along with evaluation the adjoining structures for their involvement and contribution to elbow pain. The purpose of our study was to study clinically confirmed cases of medial and lateral epicondylitis for imaging characteristics in USG and MRI.

In our study, out of 62 patients, 48 patients were diagnosed with lateral epicondylitis and 14 with medial epicondylitis. Out of the 62 patients, 34 were female and 28 patients were male. The mean age of the patients in our study was 39 years with age of patients in range of 20 to 60 years which is similar to the observations found in study by Liang Qi et al. and Bredella M.A. et al., where mean age of patients is 46 years and 45 years respectively. [10,12] In lateral epicondylitis, the most common finding in our MRI study was involvement of common extensor tendon (CET) which was seen in all 48 patients (100%). This is quite similar to the study done by Liang Qi et al. and Cha.Y.K. et al. where 100 % and 98% patients have shown CET involvement.[7,13] Lateral collateral ligament injury was the next most common injury noted in our study where 28 out of 48 patients(58.3%) shows lateral collateral ligament injury , which correlates with the study done by Bredella et al.[12] where the incidence of lateral collateral ligament injury was found to be 54.2%. However, in a study done by Liang Qi. et al., the incidence of lateral collateral ligament involvement was found to be 92%.[7] In our study, extensor muscle involvement in the form of signal changes was seen in 14 patients out of 48 patients (29%) with lateral epicondylitis which is a similar finding as in the study done by Liang Qi et al. where incidence of extensor muscle involvement was found to be 30%.[7] The study done by Cha Y.K. et al. found only 5% of the patients having extensor muscle involvement.[13] In our study elbow joint effusion was seen in 11 patients out of 48 patients (23%), in the study done by Liang Qi et al. and Bredella M.A. et al. effusion was seen in 6 out of 22 patients (27.3%) and 9 out of 35 patients (25.7%) respectively.[7,12] Bone edema in lateral epicondyle, capitellum and radial head was found in 7 patients out of 48 patients (14.5%) which is similar to the observation made in the study done by Cha .Y.K. et al. where incidence of adjoining bone edema was 13.7%.[13] In our study, on ultrasonographic examination of patients with lateral epicondylitis common extensor tendon was found to be enlarged in 15 patients (31.3%), attenuated in 5 patients (10.4%) and normal in remaining 28 patients (58.3%) . Our findings are similar to the study done by Connell et al. where 34.7% patients, 5.5% patients and 59.7% patients have enlarged, attenuated and normal tendon size respectively.[8] Focal tendinopathy was found in 15 patients (31.2%) and diffuse tendinopathy was seen in 20 patients (41.7%) out of 48 patients. These findings are similar to the observations made by Boy et al. in their study where 35.5% patients had focal tendinopathy and 40 % patients had diffuse tendinopathy in patients with lateral epicondylitis.[14] However, in the study by Connell et. al. only 8.3% patients had focal tendinopathy and 63% patients had signs of diffuse tendinopathy[8.] Partial tear was seen in 10 patients (20.8%) and complete tear was seen in 2 patients (4.2%) ,in the study done by Connell et al. partial tear was seen in 25% patients and complete tear in only 2% patients.[8] Tendon calcification was seen in 4 patients (8.4%) and cortical irregularity in lateral epicondyle of humerus was seen in 9 patients (18.7%). Tendon calcification was seen in 11% patients and cortical irregularity in 22% patients in the study done by Connell et al.[8.] Boy et al. in their study found tendon calcification in 13% patients.[14]

CET tendinopathy was better appreciated in MR imaging where all 48 patients showed signs of tendinopathy, whereas in USG study only 35 of the patients showed signs of tendinopathy. However, the severe form of tendinopathy was found in equal frequency in both MRI and USG studies. While examining patients with medial epicondylitis, we found in the MRI that common flexor tendon involvement was observed in 12 patients (85.7%) out of 14 patients in form of tendon thickening and increased signal intensity on T2 weighted MRI images. This result is similar to study done by Kijowski and Smet, where common flexor tendon involvement was seen in 11 patients (84.6%) out of 13[15.] Bone edema at medial epicondyle was seen in 4 patients (28.6%) out of 14 patients. This finding is similar to the observation made by Kijowski and Smet where 3 (23%) out of 13 patients presented with bone edema[15.] Joint effusion was seen in 3 patients (21.4%) out of 14 patients. The changes in medial collateral ligament was seen in form of increased signal intensity in 3 patients (21.4%) out of total 14 patients with medial epicondylitis, while in the study done by Kijowski and Smet 3 (23%) out of 13 patients had signs of medial collateral ligament involvement[15.] Flexor muscle involvement was seen in 3 patients (28.6%) in form of increased signal intensity. Ultrasonographic examination of elbow in patients with medial epicondylitis shows common flexor tendon enlargement tendon in 6 patients (42.7%) and attenuated tendon was not found in any patient, remaining 8 patients had normal tendon size. Park et al. in their study found common flexor tendon enlargement in 29% patients and 71% patients had normal tendon thickening.[16] Focal tendinopathy was found in 7 patients (50%) out of 14 patients and diffuse tendinopathy was seen in 2 patients (14.3%), which is similar to the study done by Park et al.[16.] Partial tendon tear was seen in 04 patients (28.7%) and complete tear was not seen in any patients. This result is similar to the study done by Park et al. where partial tear was seen in 24% patients.[16] Tendon calcification and cortical irregularity was seen in 3 (21.4%) and 5 (35.7%) patients respectively. Flexor tendon tendinopathy was better appreciated in MR imaging where 12 out of 14 patients showed signs of tendinopathy, whereas in USG study 9 out of 14 patients showed signs of tendinopathy and rest of the patients had normal study on USG examination. However, the severe form of tendinopathy was found with equal frequency in both MRI and USG studies.

Conclusion:-

In our study, we found that elbow tendinopathy does not involve a single structure but a wide spectrum of structures in addition to common extensor tendon and common flexor tendon. Elbow tendinopathies are usually accompanied by different grade of injury in lateral and medial collateral ligaments, extensor and flexor muscles and involvement of bone in form of bone edema and cortical irregularity. Identifying the structures involved, along with the severity of the disease will immensely help in planning the treatment strategy for the patients. The USG and MRI can play a major role in achieving this goal, as both are non-invasive, widely available investigations and pose no risk of radiation exposure.

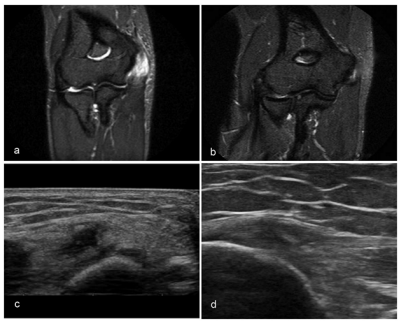
Conflicts of interest There are no conflicts of interest.

Figure 1. Showing MRI and USG features of lateral epicondylitis

MR coronal STIR image of elbow shows (a) partial tear in common extensor tendon, (b) complete tear in common extensor tendon. USG

image© and (d) shows anechoic focal area in common extensor tendon denoting partial tear.

Figure 2. Showing MRI and USG features of medial epicondylitis



MR coronal STIR image of elbow shows (a) complete tear in common flexor tendon (b) partial tear in common flexor tendon. USG image© and (d) shows tendinopathy in common flexor tendon in form of focal hypoechoic area, tendon thickening and loss of normal fibrillar pattern.

Table 1- MRI grading of tendon and ligament involvement

INJURY DEGREE	TENDON	LIGAMENT
0	Complete homogenous low intensity without thickness	Complete homogenous low intensity without thickness
Mild	Thickened tendon with internal focal increasing signal on fat-suppressed T2 image	Thickened ligament characterized by normal to hyperintensity and without interruption on fat-suppressed T2 image
Moderate	A fluid-filled gap affecting 20–80% of the thickness	Thinning of the ligament with hyperintensity within and surrounding the ligament
Severe	A fluid-filled gap affecting more than 80% of the thickness	A complete rupture and discontinuity of the fibers with fluid-like intensity

Table 2- MRI grading of muscle, bone and joint involvement

INJURY GRADING	MUSCLE	BONE	JOINT EFFUSION
I	Normal	Normal	Normal
II	High signal intensity	High signal intensity	Fluid is increased

TABLE 3: MRI FINDINGS IN LATERAL EPICONDYLITIS

STRUCTURE INVOLVED	NUMBER OF PATIENTS (%)
COMMON EXTENSOR TENDON	48 (100%)
BONE EDEMA	7 (14.5%)
EXTENSOR MUSCLES	14 (29%)
JOINT EFFUSUION	11 (23%)
LATERAL COLLATERAL LIGAMENT	26 (54.2%)

TABLE 4: MRI FINDINGS IN MEDIAL EPICONDYLITIS

STRUCTURE INVOLVED	NUMBER OF PATIENTS (%)
COMMON FLEXOR TENDON	12 (85.7%)
BONE EDEMA	4 (28.6%)
FLEXOR MUSCLES	3 (21.4%)
JOINT EFFUSUION	3 (21.4%)
MEDIAL COLLATERAL LIGAMENT	3 (21.4%)

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