## **Diagnostic Accuracy of Ultrasonography in the Assessment of Anterior Knee Pain.**

### **Dr.Tarek Ghandour Professor of Orthopaedics. Ain Shams University-Egypt.**





### Disclosure

• This work has not received any funding..



# Background:

- Anterior knee pain (AKP) is a problematic complaint, considered to be the most frequent cause of orthopedic consultancy for knee problems.
- This study aimed to highlight diagnostic accuracy of ultrasonography as a fast imaging technique in assessment of patients with AKP.
- Ultrasonography has become more popular because it is safe, quick, inexpensive, and reliable. It has the ability to assess soft tissues in the anterior aspect of the knee, which could be the main source of pain.
- □ Many authors linked AKP to the patellofemoral pathology, especially the patellofemoral instability, while others clearly reported that structural anomalies did not provide a complete explanation of the pain.
- Structural anomalies were found to be minor among AKP patients, and there was no obvious correlation between patellofemoral malalignment and long-term results of AKP treatment.



# Materials and Methods:

A prospective study was conducted on 143 patients with clinically confirmed AKP. All patients underwent ultrasonography and MRI examinations of the knee. The diagnostic accuracy of

ultrasonography compared to MRI for evaluating different findings of possible causes of AKP were analyzed using receiver operating characteristic (ROC) curve and judged by area under curve (AUC).

A total of 155 knees were included in the study; 26 knees showed no abnormalities, 19 knees showed positive MRI only, and 110 knees showed positive ultrasonography and MRI. Ultrasonography and MRI reported 11 different findings of possible causes of AKP or related to it.



## **Results:**

Joint effusion was the most common finding (38%) followed by trochlear cartilage defect (20.6%) and superficial infrapatellar subcutaneous edema (20%). □ The overall accuracy of ultrasonography was 85.3% sensitivity and 100% specificity.  $\Box$  The ultrasonography provided the highest sensitivity (100%) in detecting bipartite patella, followed by 91.5% for joint effusion, and 87.5% for quadriceps tendinopathy. The ROC curve analysis of overall accuracy of ultrasonography showed an AUC of 0.93. The overall Kappa agreement between ultrasonography and MRI was good (k = 0.66).



## **DISCUSSION:**

Diagnostic accuracy of ultrasonography findings using MRI as the gold reference standard

	Sensitivity (%)	Specificity (%)	PPV	NPV	AUC (ROC)	Kappa agreement (Cohen's Kappa)
Joint effusion	91.5	95.8	93.1	94.8	0.93***	0.87***
Trochlear cartilage defect	71.9	98.4	92	93.1	0.85***	0.76***
Superficial infrapatellar tissue edema	77.4	100	100	94.7	0.88***	0.83***
Synovial plica	78.6	100	100	95.5	0.88***	0.84***
Patellar tendinopathy	84	100	100	97	0.92***	0.89***
Patellar cartilage defect	0	100	-	85.2	0.5#	0 <sup>¥</sup>
Suprapatellar fat impingement	84.2	100	100	97.8	0.92***	0.9***
Hoffa's fat pad impingement	66.7	100	100	95.8	0.83***	0.775***
Quadriceps tendinopathy	87.5	100	100	98.6	0.94***	0.93***
Infrapatellar bursitis	66.7	100	100	98.4	0.83 <sup>¥¥</sup>	0.79***
Bipartite patella	100	100	100	100	1***	1***
Overall validity	85.3	100	100	57.8	0.93***	0.66***

MRI magnetic resonance imaging, PPV positive predictive value, NPV negative predictive value, CI confidence interval, AUC area under curve, ROC receiver operating characteristic curve

June 8-11

\*\*\**p* value < 0.001

<sup>#</sup>p value > 0.05 (non-significant)

<sup>¥</sup>No p value can be calculated

 $^{44}p$  value = 0.002



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A 45-year-old female with right patellar tendinopathy and infrapatellar plica. a Long axis ultrasound image through the patellar tendon shows a focal thickening of the proximal part of the patellar tendon with a localized hypoechoic area sparing the anterior fibers. (White thick arrow). b and c Two subsequent sagittal PDFS MRI images through intercondylar notch show focal proximal tendon thickening and increased signal intensity (red arrow) sparing the anterior tendon fibers. Infrapatellar plica (white arrow) appears as a curvilinear high signal passing through Hoffa's fat pad (not detected by ultrasound). P, patella; PT, patellar tendon









A 31-year-old male with a bipartite patella, joint effusion, and medial patellar plica. a Short axis ultrasound image illustrates the cleft between the patella and bipartite fragment at the superolateral pole of the patella. b Short axis ultrasound image illustrates joint effusion and medial patellar plica (arrow). c Axial T2WI MRI illustrates bipartite patella, joint effusion, and medial patellar plica. P, patella; E, effusion; B, bipartitepatellar fragment









A 54-year-old male with focal patellar and trochlear partial thickness cartilage loss, mild joint effusion, and anterior infrapatellar subcutaneous edema of the left knee. a Long axis ultrasound image of the left knee illustrates a focal thinning of the anteroinferior aspect of the trochlear cartilage. b Sagittal PDFS MRI illustrates partial thickness cartilage loss of the patella (white arrow), partial-thickness cartilage loss of the anteroinferior surface of the trochlear cartilage with subchondral bone marrow changes (green arrow), joint effusion, and anterior subcutaneous edema. QT, quadriceps tendon







A 22-year-old male with left patellar tendinopathy. a Long axis ultrasound image demonstrates the thickened proximal part of the patellar tendon with cystic changes (\*). Color Doppler mapping shows increased vascularity in and around the tendon. b Sagittal PDFS shows thickened proximal patellar tendon with fluid signal (\*). P, patella



## Limitations:

- There was a wide variety of findings; some of these findings may not be the actual cause of the AKP, and the others had no previously published results in the literature There was higher sensitivity of ultrasonography in detecting joint effusion, which was at the same time the most common finding in the current study. The perfection of ultrasonography in detecting joint effusion
- Increased the overall sensitivity of ultrasonography in the detection of pathological findings in the AKP patients and masked its weakness in detecting other entities like patellar cartilage defect and infrapatellar plica.
- All the ultrasonography examinations were performed by one radiologist. Hence, there

was no chance to make the intra- and interobserver agreement.





## Conclusion:

Ultrasonography can be used to diagnose patients with AKP; it showed high diagnostic accuracy in detecting most of the findings.

Although MRI is the gold standard technique for AKP imaging, ultrasonography can be used to make a swift screening and assessment of the painful anterior knee and can be used as an alternative to MRI when MRI is unavailable or contraindicated.

**MRI** may be warranted if a patellar cartilage defect is clinically suspected or the ultrasonography yielded negative results.



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