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Reliability of clinical methods in evaluating patellofemoral pain syndrome with malalignment

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ABSTRACT

Background: Diagnosis of patellofemroal pain syndrome has been challenging due to lack of clinical test with better sensitivity and specificity, axial imaging has been considered as the standard modality for evaluation. Patients with anterior knee pain because of patellofemoral pain syndrome can be sub-grouped as those with or without radiological positive parameter for patellar maltracking. The aim of the present study was to evaluate reliability of clinical tests in two subgroups of patients presenting with patellofemoral pain syndrome.
Methods: 45 knees with anterior knee pain without any episode of patellar instability were evaluated clinically using four standard tests (patellar apprehension test (PAT), eccentric step test (EST), active instability test (AIT) and Waldron's test. On the basis of CT scan finding (at least one positive radiological parameter of instability) 28 knees were categorized in Group A (potential patellar instability group) and 17 knees in Group B (PFPS).
Results: All patients with 3 or more than three clinical test positive were cases with potential patellofemroal instability except two. Whereas other true patellofemroal pain patients all except 2 were have less than 3 positive clinical tests.
Conclusions: Clinical test have more diagnostic accuracy in evaluating anterior knee pain due to potential patellofemroal instability in comparison to patellofemroal pain without radiological instability.

Keywords: Patellofemoral pain syndrome, Clinical tests, Maltracking

INTRODUCTION

Anterior or retro-patellar pain which exacerbates during prolonged sitting, kneeling, ascending or descending stairs and squatting, in the absence of other pathology (instabilities, meniscus injury, inflammatory or degenerative osteoarthritis etc.) is defined as patellofemoral pain syndrome (PFPS).[1] It has a multi-factorial etiology and affects most commonly the female population, especially adolescents and young adults.[2,3]

Researchers in the literature have taken mere clinical presentation of anterior knee pain and considered their patients as having PFPS.[4-7] Dejour et al has classified PFPS in to two types i.e. PFPS with malalignment (patellar instability) and the PFPS without malalignment (painful patellar syndrome).[8] This classification was based on positivity of radiological parameters for measuring malalignment of patella with respect to femoral sulcus.

Clinical tests to diagnose the condition of PFPS with maltracking are lacking in the literature. Till now there are no established clinical criteria's for diagnosing PFPS with instability. So in our study we tried to establish some clinical criteria to consider a case of PFPS has having patellar instability and try to reduce the unwanted higher investigation like CT scan which has a higher radiation exposure and cost to the patient.

METHODS

The study was conducted on the patients attending the OPD of Orthopedics Department in our tertiary level referral institute from July 2012 to December 2014 (over a period of 18 month). Out of 200 patients, 45 knees met our inclusion criteria and were included in the study. These 45 knees were considered as having PFPS based on clinical presentation. The inclusion and exclusion criteria are mentioned below as given in Table 1.

Table 1: Showing inclusion and exclusion criteria's taken in the present study.

Inclusion criteria	Exclusion criteria
Age group between 18-50 years.	History of knee injury or knee surgery.
Anterior or retropatellar knee pain from at least two of the following: prolonged sitting, stair-climbing, squatting, running, kneeling and hopping/jumping.	Patients testing positive for ligaments and meniscal injuries.
Full or almost full range of movements.	Significant radiological evidence of any pathologic conditions (Degenerative, inflammatory or infective).
Presence of pain on palpation of the patellar facets.	
Duration of symptoms for 6 weeks or more.	

Plain radiographs (anterio-posterior, lateral and axial views) of the involved knees at 30° knee flexion were obtained and the parameters- sulcus angle, congruence angle, lateral patellofemoral angle, patella alta, trochlear dysplasia and prominence were measured. CT scan of the involved knee was done at 5° knee flexion and following parameters were measured- sulcus angle, congruence angle, lateral patellofemoral angle and tibial tuberosity-trochlear groove (TT-TG) distance.

Patients were divided into two groups i.e. group A (PFPS with maltracking) and group B (PFPS without maltracking) based on the positivity for radiological parameters. Each individual clinical test was done as mentioned in the table and the results were noted down.

The sensitivity and specificity of each standard clinical test was carried out. Then we evaluated how effective a single test or multiple tests in combination to label the case of PFPS as having patellofemoral malalignmemt.

Clinical evaluation

Active instability test procedure

Patient positioned supine with the lower extremity in neutral and the knee flexed at 15°. Patellar tracking was assessed during isometric quadriceps contraction. Any lateral patellar motion was noted and recorded in millimeters. The test was considered positive (i.e. suggesting patellar instability) if the patella moved laterally more than 3 mm as shown in Figure 1.[5]

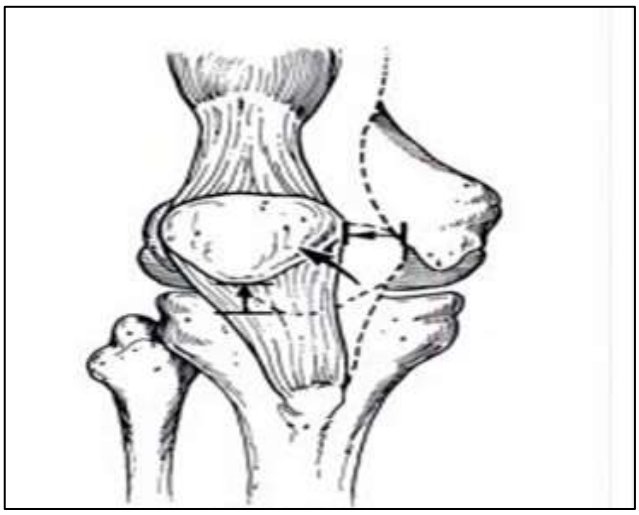

Figure 1: The picture shows lateral subluxation of patella due to patellar instability.

Eccentric step test procedure

Patients wore shorts and the test was done in bare feet. Apart from the step height and the video analysis, the eccentric step test was performed as described by Selfe et al.[9] A step was made of a stool 15 cm high. Briefly, each patient was given a standard demonstration of the test followed by standardized verbal instructions: 'stand on the step, put your hands on your hips, and step down from the step as slowly and as smoothly as you can'. Patients were asked to keep their hands on their hips throughout the test performance. After each patient performed the test with one leg, the procedure was repeated using the other leg. A warm-up or practice attempt was not allowed. The eccentric step test was considered positive when the patients reported knee pain during the test performance as seen in Figure 2.

Figure 2: Clinical photograph showing the method of eliciting eccentric step test.

Patellar apprehension test/ fair banks apprehension test procedure

Patient lay supine and relaxed. The examiner used one hand to push the patient's patella as lateral as possible, in order to obtain a lateral patellar glide. Starting with the knee flexed at 30°, the examiner grasps the leg at the ankle/heel with the other hand and performs a slow, combined flexion in the knee and hip. This lateral glide was sustained throughout the test. The test was considered positive when it reproduced the patient's pain or when apprehension was present. The apprehension can manifest itself in a number of ways, ranging from verbal expressions of anxiety over grabbing the knee to involuntary quadriceps muscle contractions (to prevent further knee flexion) as given in Figure 3.[10]

Figure 3: Clinical photograph showing the method of eliciting patellar apprehension test.

Figure 4: Clinical photographs showing the method of eliciting Waldron's test (phase I and II).

Waldron's test (phase I and II) procedure

For phase I of Waldron's test, patient lay supine, the examiner pressed the patella against the femur while simultaneously performing a passive knee flexion with the other hand. Crepitus and pain during a particular part of the range of motion were considered signs of patellofemoral pain disorders. For phase II, the standing patient was asked to perform a slow, full squat, again with the examiner performing a gentle compression of the patella against the femur. As with the case of Waldron's test phase I, pain and crepitus helps in interpreting the test as depicted in Figure 4.[10]

Statistical analysis

The statistical analysis was carried out using Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, version 15.0 for Windows). All qualitative data were tested using Chi-square test and the quantitative data were tested using paired t-tests. In addition, student t test and Kappa statistics were applied depending upon the data. Sensitivity, specificity, NPV, PPV and kappa value were calculated for individual clinical tests and radiological parameters.

RESULTS

Among the standard clinical tests, patellar apprehension test was most sensitive (86.7%) and specific (86.7) for diagnosing PFPS. NPV, PPV and Kappa values were also high. Eccentric step test was more sensitive (86.7%) than specific (53.3%) for diagnosing PFPS. Active instability test was more specific (86.7%) than sensitive (73.3%) for diagnosing PFPS as given in Table 2. By combining the various standard physical tests, the sensitivity for diagnosing PFPS becomes 100% but at the cost of specificity (33.3%) for diagnosing PFPS as shown in Table 3.

Table 2: Showing the sensitivity, specificity, NPV, PPV and kappa values of individual clinical tests.

Clinical Tests	Sensitivity	Specificity	Positive predictive value (PPV)	Negative predictive value (NPV)	Kappa value
Active instability test	73.3%	86.7%	91.7%	61.9%	0.545
Eccentric step test	86.7%	53.3%	78.8%	66.7%	0.421
Patellar apprehension test	86.7%	86.7%	92.9%	76.5%	0.710
Waldron's test phase-1	60.0%	80.0%	85.7%	50.0%	0.348
Waldron's test phase-2	66.7%	60.0%	76.9%	47.4%	0.250

Table 3: Showing sensitivity, specificity, NPV, PPV and kappa values of various combination of clinical tests.

Combination of clinical tests	Sensitivity	Specificity	Positive predictive value (PPV)	Negative predictive value (NPV)	Kappa value
AIT+PAT+EST	100.0%	33.3%	75.0%	100.0%	0.400
PAT+EST	100.0%	46.7%	78.9%	100.0%	0.538

DISCUSSION

The problem with PFPS is the accuracy of its diagnosis. Physical examination and radiology (X-ray and CT scan) play a pivotal role in the diagnosis of patellofemoral pain syndrome, yet the literature contains limited publications focused on the diagnostic value of these parameters.[4,8,11]

Most of the studies have taken clinical presentation of anterior knee pain as a reference standard for suspecting PFPS and some have used knee arthroscopy as a reference standard.[4-7,12,13] We proposed that just a mere presentation of the anterior knee pain without other identifiable causes cannot label a patient as having PFPS. Arthroscopy for a condition like PFPS which is treated mostly by physiotherapy is not routinely justifiable as it is an invasive procedure and has its own complications.[14-16] So, we chose a radiological and reproducible reference standard, and after going through the literature, we found that CT is perhaps the nearest to the gold standard for evaluating femoral sulcus and patellofemoral alignment.[17] It is also evident in the literature that abnormalities in patellar position are detected best with the knee between full extension and lesser degrees of flexion, before the patella becomes engaged in the trochlear groove with continuing flexion.[18] In this critical range the patella is not well seated and guided by the femoral condyles and its stability rests solely on muscle tension.[19] So we thought that images of CT scan at 5° knee flexion could be the most appropriate reference standard as it also maintains homogeneity of the sample and minimizes false positive subjects; this is more reliable and reproducible than mere clinical presentation as a reference standard for suspecting PFPS.

The sensitivity of patellar apprehension test was more in our study (86.7%) in contrast to the studies of Haim et al (7%), Nijis et al (32%) and Niskanen et al (37%).[4,5,12] The specificity of this test in our study (86.7%) was more in contrast to the study by Niskanen et al (70.0%), was similar to the study by Nijis et al (86.0%) and less in contrast to the study by Haim et al (92.0%).[4,5,12] Active instability test in our study had more sensitivity and less specificity in contrast to the study by Haim et al.[4]

Eccentric step test in our study had more sensitivity and less specificity in contrast to the study by Nijis et al.[5] Wadron's test 1&2 in our study had more sensitivity and less specificity in contrast to the study by Nijis et al as given in Table 4.[5]

Table 4: Showing comparison of clinical tests among various clinical studies for evaluating PFPS.

Clinical test	Study	PFPS group	Non-PFPS group	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Patellar apprehension test	Haim et al[18]	61	25	7	92	93	40
	Nijis et al[19]	31	28	32	86	71	53
	Niskanen et al[23]	52	33	37	70	66	41
	Our study	30	15	86.7	86.7	91.7	61.9
Active instability test	Haim et al[18]	61	25	25	100	100	35
	Our study	30	15	73.3	86.7	91.7	61.9
Eccentric step test	Nijis et al[19]	31	28	42	82	72	56
	Our study	30	15	86.7	53.3	78.8	66.7
Waldron's test-1	Nijis et al[19]	31	28	45	68	61	53
	Our study	30	15	60.0	80.0	85.7	50.0
Waldron's test-2	Nijis et al[19]	31	28	23	79	54	48
	Our study	30	15	66.7	60.0	76.9	47.4

By having a critical look at literature, we feel that the other studies have in fact calculated the sensitivity and specificity of the clinical tests for anterior knee pain (which according to them was PFPS). With a better understanding about PFPS over the evolving years, we now understand that PFPS is a subcategory of those undiagnosed anterior knee pain and there may be other causes of anterior knee pain after excluding PFPS which can be labeled idiopathic (and needs future studies). We, in our study have evaluated the sensitivity and specificity of these clinical tests for diagnosing PFPS and not anterior knee pain in contrast to other studies. So the sensitivity and specificity measured in our study is a better indicator of these clinical tests in diagnosing PFPS.

Combination of clinical tests

In the literature, due to lack of accuracy of individual tests, a combination of tests has been proposed to improve the diagnostic accuracy of PFPS. Cook et al and Sweitzer et al were the two studies to consider a combination of tests to evaluate PFPS.[7,21]

In our study, we also combined the clinical tests to see whether it had any influence on diagnostic accuracy of PFPS.

In our study, by combining the tests we noted that sensitivity was increased and specificity was decreased.

The reason for increase in the sensitivity of the tests may be attributed to multi-factorial etiology of PFPS (for instance the patellar apprehension test is based on the pathophysiology of patellar maltracking whereas Eccentric step test detects pathophysiology based on concentric overload of patellofemoral joint; hence a combination of test will automatically increase the sensitivity). The decrease in the specificity of tests may be due to the symptomatic control group (they also have anterior knee pain), which may have chances for showing the clinical patellofemoral tests positive than in asymptomatic group taken in other studies.

We can infer from this that by combining the tests no cases of PFPS will be missed, however to improve the accuracy (specificity) in diagnosing PFPS it should be combined with radiology.

Limitations of the study

In spite of our best efforts to attain homogeneity in the assessment of radiological parameters, inter observer variability must be considered. The reference standard taken in our study for considering the subjects as PFPS with maltracking may not detect all the etiology described in the literature for PFPS (the reference gold standard is still not clear in the literature). Our study had a limited sample size of 45 knees.

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