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ORIGINAL RESEARCH

Validity of Combining History Elements and Physical Examination Tests to Diagnose Patellofemoral Pain

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Abstract

Objective: To assess the validity of diagnostic clusters combining history elements and physical examination tests to diagnose or exclude patellofemoral pain (PFP).

Design: Prospective diagnostic study.

Settings: Orthopedic outpatient clinics, family medicine clinics, and community-dwelling.

Participants: Consecutive patients (N=279) consulting one of the participating orthopedic surgeons (n=3) or sport medicine physicians (n=2) for any knee complaint.

Interventions: Not applicable.

Main Outcome Measures: History elements and physical examination tests were obtained by a trained physiotherapist blinded to the reference standard: a composite diagnosis including both physical examination tests and imaging results interpretation performed by an expert physician. Penalized logistic regression (least absolute shrinkage and selection operator) was used to identify history elements and physical examination tests associated with the diagnosis of PFP, and recursive partitioning was used to develop diagnostic clusters. Diagnostic accuracy measures including sensitivity, specificity, positive and negative predictive values, and positive and negative likelihood ratios with associated 95% confidence intervals (CIs) were calculated.

Results: Two hundred seventy-nine participants were evaluated, and 75 had a diagnosis of PFP (26.9%). Different combinations of history elements and physical examination tests including the age of participants, knee pain location, difficulty descending stairs, patellar facet palpation, and passive knee extension range of motion were associated with a diagnosis of PFP and used in clusters to accurately discriminate between individuals with PFP and individuals without PFP. Two diagnostic clusters developed to confirm the presence of PFP yielded a positive likelihood ratio of 8.7 (95% CI, 5.2−14.6) and 3 clusters to exclude PFP yielded a negative likelihood ratio of .12 (95% CI, .06−.27).

Conclusions: Diagnostic clusters combining common history elements and physical examination tests that can accurately diagnose or exclude PFP compared to various knee disorders were developed. External validation is required before clinical use.

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Patellofemoral pain (PFP) is a common condition accounting for 25% to 40% of all knee disorders.[1] *PFP*, which includes conditions previously referred to as chondromalacia patellae, runner's knee, or PFP syndrome, is defined as pain around or behind the patella aggravated by activities that increase loading and compressive forces of the patellofemoral joint such as squatting, ascending and descending stairs, jumping, or running.[1,2] Recent evidence suggests that PFP is not a simple self-limiting condition with >50% of individuals developing chronic pain.[1,3-7] A valid initial diagnosis of PFP is therefore vital for early appropriate management and prevent persistence of symptoms.[8,9]

The diagnosis of PFP is mainly based on patients' history elements and physical examination tests, because there are no specific imaging findings either on radiographs or on magnetic resonance imaging to confirm PFP.[10-12] A clinical examination is considered by experts the cornerstone to make a valid diagnosis, yet the evidence on the diagnostic validity of different physical examination tests for PFP remains limited.[13] Most published diagnostic studies have low to moderate methodological quality[13-15] and suffer from biases likely resulting in an overestimation of the diagnostic validity of the studied tests.[16] The evidence shows that clinical tests may not be able to accurately diagnose PFP when used individually.[13-15]

Because no single test alone may accurately diagnose PFP, a combination of tests has been proposed, which better reflect the diagnostic process of clinicians. Two diagnostic studies evaluated the combination of selected tests for PFP and presented somewhat greater diagnostic accuracy, but without reaching sufficient posttest probability to diagnose PFP. The study by Cook et al[17] based on a cohort of 76 (72%) participants of whom 52 (68%) were considered to have PFP concluded that combining a painful patellar facet palpation, pain during squatting, or pain during resisted knee extension led to a positive likelihood ratio (LR+) of 4.0 (95% confidence interval [CI], 1.8−10.3). The study of Sweitzer et al[18] based on a cohort of 82 participants of whom 59 were considered to have PFP concluded that combining 4 patellar mobility tests led to an LR+ of only 1.9 (95% CI, 0.5−7.7). To our knowledge, there is no study that specifically combined multiple patients' history elements with physical examination tests to formally evaluate the diagnostic validity of this approach and in effort to better guide clinicians in the differential diagnosis of PFP.[13] Therefore, using predictive clustering statistical methods, our objective was to assess the validity of diagnostic clusters combining history elements and physical examination tests to diagnose or exclude PFP in a cohort of participants presenting with various knee disorders.

Methods

Study design and settings

This was a prospective multicenter diagnostic study aimed at developing a series of diagnostic clusters for various common knee disorders. The present article reports result specific to PFP. We recruited consecutive new patients consulting one of the participating physicians for a current knee complaint. Recruitment took place in 2 outpatient orthopedic clinics and 2 primary care family medicine clinics between November 2014 and August 2016 (supplemental appendix S1, available online only at http://www.archives-pmr.org/). Also, participants from the university community were invited to participate via an e-mail sent in September 2015 if they needed care for a current knee complaint.

The present study conforms to the Standards for Reporting Diagnostic Accuracy Studies 2015.[19,20] The study was approved by the ethics committees of all recruiting institutions, and participants signed an informed consent form.

List of abbreviations:

CI	**confidence interval**
KOOS	**Knee Injury and Osteoarthritis Outcome Score**
LR+	**positive likelihood ratio**
LR−	**negative likelihood ratio**
PFP	**patellofemoral pain**

Participants

Potential participants were initially screened by telephone to assess preliminary eligibility. Patients aged 18 years or older who were consulting or referred to one of the participating clinical settings for a knee complaint and who were able to understand and speak French were included. Patients previously treated by the participating physicians were excluded, as well as patients who had undergone lower limb surgery in the past 6 months, patients who underwent knee arthroplasty, patients who presented with ≥2 other lower limb disorders, or if they suffered from any systemic inflammatory disorder related to their knee complaint.

Data collection

Patients' characteristics and history elements

Selected history elements collected included sex, age, education level, employment status, comorbidities, affected side, duration of knee symptoms, knee pain location (anterior, posterior, medial, lateral, or diffuse knee pain), traumatic or atraumatic onset, and use of a walking aid. Patients also completed the Knee Injury and Osteoarthritis Outcome Score (KOOS), a 42-item questionnaire composed of 5 domains: pain, symptoms, function in daily living, function in sport and recreation, and knee-related quality of life.[21] Because mental health may influence the response to clinical examination, psychological distress was assessed using the K6 screening scale.[22]

Physical examination data collection procedure

Before the start of the study, clinicians met with the research personnel to standardize techniques and interpretation of the physical examination tests as well as the definition of a PFP diagnosis compared to other knee diagnoses. Each participant was independently assessed by 2 evaluators on the day of their visit: a physiotherapist and one of the participating physicians. The physiotherapist possessed a master's degree in physiotherapy and had 1 year of clinical experience. The 5 participating physicians (3 orthopedic surgeons and 2 sports medicine physicians) each had >20 years of experience. The physiotherapist always completed data collection before the physician's examination of the patient. Both the physiotherapist and the physicians were blinded to each other's results and any other clinical information from the start of their respective evaluation.

Physical examination tests

A complete standardized physical examination was independently performed by the 2 evaluators. We selected tests on the basis of