

Posterior hip capsular tenderness test improved the sensitivity and positive predictive value of FADIR test in diagnosing femoroacetabular impingement

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To the Editor: Many physical examination tests are used to diagnose femoroacetabular impingement (FAI). The sensitivity and specificity of the flexion, abduction, and external rotation (FABER) test and the flexion, adduction, and internal rotation (FADIR) test for FAI diagnosis are quite different. Therefore, based on clinical practice, we proposed the possibility of adding a physical examination test to improve the accuracy of the traditional physical examinations.

Hip arthroscopic surgery is being increasingly used for the treatment of FAI, and despite the availability of a total of 18 different physical tests to diagnose FAI/labral pathology,^[1-4] the accuracy of these tests has not been compared, and no single test has been identified to be superior to another.^[1] The comparative usefulness of these tests in diagnosing FAI remains unclear because of the significant variability in reporting sensitivity and specificity values between studies.^[4] In our practice, many patients with FAI reported posterior hip capsular tenderness (PHCT). Therefore, this study aimed to compare the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of PHCT with those of other physical examination tests and determine whether the inclusion of PHCT test could improve the accuracy of other physical examination tests.

We evaluated consecutive patients who underwent hip arthroscopy at our hospital between December 2020 and April 2021. The inclusion criteria were as follows: (1) patients who underwent hip arthroscopy in our hospital; (2) those underwent a thorough and systematic physical examination; and (3) those with records of pre-operative modified Harris Hip Score (mHHS) and visual analog scale (VAS). Patients with previous hip surgery were excluded from the study. All participants or their legal guardians provided informed consent. The Ethics Committee of our hospital approved this study (No. M2019193).

All patients underwent a thorough and systematic physical examination, including specific tests previously described for diagnosing hip pathology.^[5] The FADIR or FABER test is considered to show positive results if the pain is elicited (operation method: The hip is placed in 90° flexion and then adduction and internal rotation or abduction and external rotation is applied).^[3] Palpation of the greater trochanter, groin, anterior inferior iliac spine (AIIS), posterior superior iliac spine, quadratus femoris muscle, sacroiliac joint, and ischial tuberosity as well as the subspine impingement test and ischiofemoral impingement test (hip extension, external rotation, and adduction) were conducted. After the patient had fully relaxed in the lateral decubitus position with 20° of hip flexion, posterior hip capsular palpation was performed in the posterior superior area of the greater trochanter (5 cm posterior and 2 cm superior to the greater trochanter) [Figure 1]. PHCT is considered to be present if the patient experienced pain in the pressed area.

All patients underwent standard hip joint arthroscopy, using a standard supine approach as described in previous studies.^[5] Cartilage damage was categorized according to the Outerbridge classification system. Arthroscopic diagnoses were regarded as the gold standard to calculate sensitivity, specificity, PPV, and NPV. All patients also underwent supine anteroposterior hip radiography, cross-table lateral radiography, computed tomography (CT), and magnetic resonance imaging (MRI) pre-operatively, and cross-table lateral radiography and CT post-operatively. The pre-operative alpha angle and lateral center-edge angle (LCEA) were measured as described previously.^[6] Pre-operative patient-reported outcomes, including the VAS score and mHHS, were recorded.

The sensitivity, specificity, PPV, and NPV of FABER, FADIR, PHCT test, combined PHCT test with FADIR,

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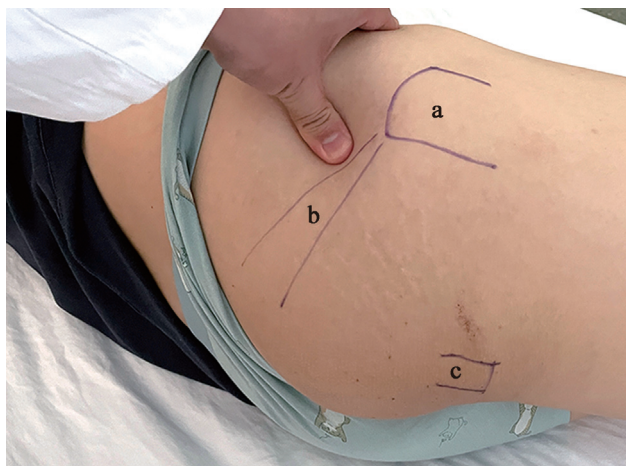


Figure 1: PHCT test was performed in the posterior superior area of the greater trochanter of FAI patients. a: Greater trochanter; b: Piriformis; and c: Ischial tuberosity. FAI: Femoroacetabular impingement; PHCT: Posterior hip capsular tenderness.

and combined PHCT test with FABER for FAI diagnosis were calculated using arthroscopic surgery findings.

Sensitivity = Population of true positive/(population of true positive+population of false negative)×100%. Specificity = Population of true negative/(population of true negative+population of false positive) × 100%. PPV = Population of true positive/(population of true positive + population of false positive) × 100%. NPV = Population of true negative/(population of true negative+population of false negative) × 100%.

Continuous variables of the baseline data with normal distribution were examined using the independent-sample *t* test. The chi-squared test was used to compare the gender distribution between PHCT-positive and PHCT-negative patients. $P < 0.05$ was considered statistically significant. All statistical analyses were performed using SPSS Statistics, version 22 (IBM, Chicago, IL, USA).

A total of 116 patients (61 males and 55 females) were included in this study, aged 37.0 ± 10.7 years (ranging from 15–63 years). The mean body mass index was 23.0 kg/m^2 (ranging from $16.6\text{--}31.2 \text{ kg/m}^2$). Before surgery, the mean mHHS was 67.4 ± 11.5 (ranging from 45–81) and mean VAS score was 3.8 ± 1.9 (ranging from 1–7), with no significant differences between PHCT-positive and PHCT-negative patients, respectively (both $P > 0.05$). The mean pre-operative alpha angle and LCEA were $61.3^\circ \pm 11.9^\circ$ (ranging from $50.2^\circ\text{--}77.6^\circ$) and $31.4^\circ \pm 4.7^\circ$ (ranging from $22.1^\circ\text{--}41.6^\circ$), respectively, and showed no significant difference between PHCT-positive and PHCT-negative patients ($P > 0.05$). The FADIR and FABER tests showed positive results in 98 (84.5%) and 89 (76.7%) patients, respectively. Eighty-two (70.7%) patients experienced positive PHCT, while 87 (75.0%), 45 (38.8%), 2 (1.7%), 3 (2.6%), 8 (6.9%), and 3 (2.6%) patients experienced tenderness in the groin area, over the greater trochanter, and in the sacroiliac joint, ischial tuberosity, AIIIS and posterior superior iliac spine, respectively.

The sensitivity, specificity, PPV, and NPV of the different approaches for FAI diagnosis were as follows: 85.6%, 33.3%, 96.0%, and 11.1%, respectively in FADIR; 77.4%, 16.7%, 94.5%, and 3.8%, respectively in FABER; 71.8%, 33.3%, 95.2%, and 6.1%, respectively in PHCT test; 91.8%, 33.3%, 96.2%, and 18.2%, respectively in combined FADIR and PHCT test (using parallel testing); and 80.8%, 33.3%, 94.5%, and 6.1%, respectively in combined FABER and PHCT test (using parallel testing).

Among these 116 patients, 104 (89.7%), 64 (55.2%), 105 (90.5%), and 20 (17.2%) patients were diagnosed with cam-type FAI, pincer-type FAI, labral tear, and borderline developmental dysplasia of the hip, respectively. There were 21 (18.1%), 3 (2.6%), 18 (15.5%), and 49 (42.2%) patients who had Outerbridge I or II femoral cartilage damage, Outerbridge III or IV femoral cartilage damage, Outerbridge I or II acetabular cartilage damage, and Outerbridge III or IV acetabular cartilage damage, respectively. PHCT-positive and PHCT-negative patients showed no significant difference in femoral or acetabular cartilage damage ($P > 0.05$).

According to previous studies, the sensitivity of FADIR with reference to radiograph and MRI and CT scans ranged from 8.0% to 96.1%, and its specificity was 11.0%.^[4] The accuracy and the validity of physical examination tests for FAI have been reported in a systematic review, which concluded that the reported sensitivity and specificity of FABER were 41.1% to 97.2% and 18.1% to 100.0%, respectively.^[2] The reported sensitivity and specificity values of FADIR and FABER for FAI diagnosis were quite different in recent studies. Therefore, we proposed to add the PHCT test to improve the accuracy of physical examinations. In this study, the sensitivity, specificity, PPV, and NPV of PHCT test for FAI diagnosis were 71.8%, 33.3%, 95.2%, and 6.1%, respectively. PHCT test showed lower sensitivity than FADIR and FABER, but had higher specificity, PPV, and NPV than FABER. The combination of FADIR and PHCT using parallel testing showed a sensitivity and PPV of 91.8% and 96.2%, respectively. Thus, PHCT test can be added as a physical examination test to diagnose FAI, especially combining with FADIR.

We thought that FAI-induced posterior capsular inflammation was a potential mechanism underlying PHCT. A contrecoup lesion caused by the leverage effect is another important factor that is worth considering.^[5] The posterior hip joint capsule inflammation suggested by PHCT can indirectly prove the leverage effect caused by cam deformity. Another possibility is deposition of inflammatory effusion in the supine position near the low point, and the inflammation of the posterior joint capsule may be obvious in such cases. Some patients with FAI may present with posterior hip pain, which may also be an effect of posterior hip capsule inflammation.^[5,7] The combination of FADIR and PHCT showed a sensitivity and PPV of 91.8% and 96.2% using parallel testing in this study. Therefore, we suggest that FADIR and PHCT should be combined in routine physical examination to improve sensitivity.

In this study, 87 (75.0%) patients experienced tenderness in the groin area, which is a high proportion. However, many asymptomatic volunteers also reported discomfort on groin compression. Therefore, groin tenderness may not be as accurate as PHCT. Thus, we chose PHCT to diagnose FAI. The PHCT test may improve the sensitivity and PPV of the FADIR test for FAI diagnosis and should be considered to add to physical examination for FAI.

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Conflicts of interest

None.

References

1. Reiman MP, Goode AP, Cook CE, Holmich P, Thorborg K. Diagnostic accuracy of clinical tests for the diagnosis of hip femoroacetabular impingement/labral tear: a systematic review with meta-analysis. *Br J Sports Med* 2015;49:811. doi: 10.1136/bjsports-094302.
2. Tjissen M, van Cingel R, Willemsen L, de Visser E. Diagnostics of femoroacetabular impingement and labral pathology of the hip: a systematic review of the accuracy and validity of physical tests. *Arthroscopy* 2012;28:860–871. doi: 10.1016/j.arthro.2011.12.004.
3. Byrd JW. Evaluation of the hip: history and physical examination. *N Am J Sports Phys Ther* 2007;2:231–240.
4. Shanmugaraj A, Shell JR, Horner NS, Duong A, Simunovic N, Uchida S, *et al.* How useful is the flexion-adduction-internal rotation test for diagnosing femoroacetabular impingement: a systematic review. *Clin J Sport Med* 2020;30:76–82. doi: 10.1097/JSM.0000000000000575.
5. Gao GY, Fu Q, Wu RQ, Liu RG, Cui LG, Xu Y. Ultrasound and ultrasound-guided hip injection have high accuracy in the diagnosis of femoroacetabular impingement with atypical symptoms. *Arthroscopy* 2021;37:128–135. doi: 10.1016/j.arthro.2020.08.013.
6. Anderson LA, Gililland J, Pelt C, Linford S, Stoddard GJ, Peters CL. Center edge angle measurement for hip preservation surgery: technique and caveats. *Orthopedics* 2011;34:86. doi: 10.3928/01477447-20101221-17.
7. Levy DM, Cvetanovich GL, Kuhns BD, Greenberg MJ, Alter JM, Nho SJ. Hip arthroscopy for atypical posterior hip pain: a comparative matched-pair analysis. *Am J Sports Med* 2017;45:1627–1632. doi: 10.1177/0363546517692983.

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