Working Group 3: The classification of non-arthritic hip-related pain in adults

SUPPLEMENTARY MATERIAL: Summary of the literature review

Themes to explore for consensus include (i) imaging = morphology (threshold values, type and views); (ii) diagnostic tests to use; including symptoms and clinical signs.

SUMMARY: Femoroacetabular Impingement (FAI) Syndrome

Definition

FAI was initially defined as the biomechanical abutment of the femoral head-neck junction against the acetabular rim.[1] The term FAI syndrome was later proposed[2] and subsequently defined as "a motion-related clinical disorder of the hip with a triad of symptoms, clinical signs and imaging findings and represents symptomatic premature contact between the proximal femur and the acetabulum".[3] The specific clinical utility of these three factors has not been clearly outlined previously.

Epidemiology

The prevalence of FAI syndrome in the general and athletic populations are variable and remain unclear.[4-6] The prevalence of morphology typically seen in FAI syndrome is better understood. There are three types of morphology associated with FAI syndrome. These are 1) cam morphology, which refers to extra bone formation on the head neck junction of the femur; 2) pincer morphology, which refers to a deep or retroverted acetabulum; and 3) mixed morphology where both cam and pincer are found [7]. The prevalence of cam morphology has been reported at 23% in asymptomatic non-athletes [5 6], 49% in symptomatic non-athletes[6], and 66% in athletes regardless of symptoms [5 6].

Reiman MP, *et al. Br J Sports Med* 2020;0:1–11. doi: 10.1136/bjsports-2019-101453

Diagnosis – symptoms

The primary symptom of FAI syndrome is motion-related or position-related pain in the hip or groin. Pain may also be felt in the back, buttock or thigh.[8] In addition to pain, patients may also describe clicking, catching, locking, stiffness, restricted range of motion or giving way.[3] Absence of hip or groin pain can help exclude a diagnosis of FAI syndrome. These symptoms may also be related to co-existing labral and chondral pathology (see labral and chondral sections and appendix 2).

Diagnosis – clinical signs

According to the Warwick agreement on FAI syndrome,[3] the "diagnosis of FAI syndrome does not depend on a single clinical sign". Range of motion (ROM) and muscle strength vary and their usefulness in diagnosing FAI syndrome is unclear. Diagnostic accuracy values are limited to clinical special tests.[9]

Clinical special tests are commonly used for diagnostic purposes. The flexion-adduction-internal rotation (FADIR) and flexion-internal rotation tests are more useful for ruling out than ruling in FAI syndrome (high sensitivity, low specificity) in meta-analyses (Table 1).[9]

TABLE 1. Diagnostic accuracy investigating clinical special tests for the diagnosis of FAI syndrome and/or labral tear (data from Reiman et al. 2015[9] except FPAW test).

Measure (Reference Standard)	SN/SP +LR/-LR	Post-test probability shift with a (+) test result	Post-test probability shift with a (-) test result	(+)/(-) probability shift[10]	Study Quality[11]
Meta-analysis					
FADIR (MRA)	0.94/0.09 1.02/0.45	Pretest=84% Posttest=83%	Pretest=84% Posttest=78%	Very small/ Small	Low
FADIR (Surgery)	0.99/0.05 1.04/0.14	Pretest=90% Posttest= 90%	Pretest=90% Posttest=56%	Very small/ Small	Low
Flexion IR (MRA)	0.96/0.25 1.28/0.15	Pretest=87% Posttest=90%	Pretest=87% Posttest= 52%	Very small/ Moderate	Low
Single Studies					
Bilateral LE Squat (maximum depth)	0.75/0.41 1.3/0.61	Pretest=30% Posttest=35%	Pretest=30% Posttest=21%	Very small for both	High

(MRI or MRA)[12]					
FABER Test[13] (IA injection>50% relief)	0.60/0.18/ 0.73/2.2	Pretest=32% Posttest=26%	Pretest=32% Posttest=51%	Very small for both	Low
Scour Test (IA injection≥80% relief)	0.50/0.29/ 0.71/1.72	Pretest=22% Posttest=16%	Pretest=22% Posttest=33%	Very small for both	Low
Thomas Test[14] (Arthroscopy)	0.89/0.92/ 11.1/0.12	Pretest=59% Posttest=94%	Pretest=59% Posttest=15%	Large/ Moderate	Low
FPAW Test[15] (History, PE, radiographs)	0.61/0.56/ 1.4/0.7	Pretest=55% Posttest=63%	Pretest=55% Posttest=46%	Very small for both	High

IR, internal rotation; FADIR, flexion adduction internal rotation; MRA, magnetic resonance arthrography; MRI, magnetic resonance imaging; LE, lower extremities; SN, sensitivity; SP, specificity; +LR, positive likelihood ratio; -LR, negative likelihood ratio; FPAW, foot progression angle walking; PE, physical examination; IA, intra-articular; (+), positive; (-), negative

Diagnosis – imaging

Radiographs (anteroposterior pelvis and lateral femoral head-neck views) are used to evaluate bony morphology, while cross-sectional imaging, such as magnetic resonance imaging (MRI), magnetic resonance arthrography (MRA) and computed tomography (CT), is used to examine both morphology and co-existing labral and chondral pathology (see sections below). There is currently no agreement on a threshold value to define either cam morphology or pincer morphology. Pincer morphology is often quantified by the centre edge angle (LCEA) and cam morphology is mostly quantified by the alpha angle (AA). Alpha angle threshold values of 50^0 to 55^0 were the most commonly utilised values in surgical indication[16] and outcome studies[17] while larger threshold values (e.g. $>60^0$) are suggested to be more representative of FAI syndrome (Table 2).[18 19]

TABLE 2. Diagnostic accuracy of single studies investigating diagnostic imaging for the diagnosis of FAI syndrome (data from Reiman et al. 2017[20]). All studies were of High quality.[11]

Measure	SN/SP +LR/-LR	Post-test probability shift with a (+) test result	Post-test probability shift with a (-) test result	(+)/(-) probability shift[10]

FAI syndrome Diagnosis (Cross-table Lateral Radiographic Imaging)				
Yamamoto et al. (2014)[21] (Cam: α angle > 68.2^0)	87/89 7.9/0.15	Pretest=46% Posttest=87%	Pretest=46% Posttest=11%	Moderate for both
FAI syndrome Diagnosis (1.5T MRA)				
Aprato et al (2013)[22] (Cam defined as α angle >50^0)	99/94 16.5/0.02	Pretest= 83% Posttest= 98%	Pretest= 83% Posttest=10%	Large for both
FAI syndrome Diagnosis (3.0T MRA)				
González Gil et al. (2015)[23] (Cam definition NR)	98/32 1.4/0.07	Pretest= 72% Posttest= 78%	Pretest= 72% Posttest=15%	Very small/ Large
FAI syndrome of Dynamic Mechanical Impingement During Testing (4D CT)				
Wassilew et al. (2013)[24]	*Anterior Impingement* 95/88 7.9/0.05 *Posterior Impingement* 97/75 3.9/0.04	Pretest= 90% Posttest= 98% Pretest= 70% Posttest= 90%	Pretest= 90% Posttest= 31% Pretest= 70% Posttest= 9%	Moderate/ Large Small/ Large

NR, not reported; MRA, magnetic resonance arthrography; MRI, magnetic resonance imaging; CT, computed tomography; α, alpha; SN, sensitivity; SP, specificity; +LR, positive likelihood ratio; -LR, negative likelihood ratio; (+), positive; (-), negative;

Future prospective studies should determine the value of quantifying imaging morphology outcome measures (e.g. alpha angle as continuous variable in prognosis research) or with arbitrary cut-off values.

For FAI syndrome:

- The ability of symptom reports from the active adult to help rule in or out this condition is unknown.

- The ability of clinical signs favors ruling out versus ruling in FAI syndrome in studies of primarily low quality and are a caution recommendation.
- Diagnostic imaging:
    - 1.5T MRA (with a positive test) and, to a lesser extent, cross-table lateral radiographs are recommended imaging modalities for FAI syndrome.
- High pre-test probability (due to the populations studied – e.g. surgical populations), large post-test probability confidence intervals and low study quality limit the confidence of any recommendations[9] regarding the clinical utility of FAI syndrome symptoms, clinical tests or diagnostic imaging.
- Future high-quality studies in non-surgical cohorts are necessary to determine the value of the use of ***symptoms, clinical signs and diagnostic imaging*** to determine the actual presence/absence of FAI syndrome in patients suspected to have this condition.

Box 1. Literature consensus regarding clinical utility of ***symptoms, clinical signs and diagnostic imaging*** for the determination of ***FAI syndrome*** presence/absence.

SUMMARY: Acetabular dysplasia and/or hip instability

Definition

In the context of this review, acetabular dysplasia and/or hip instability addresses the dysplastic appearance of the acetabulum in active adults. Acetabular dysplasia refers to misalignment between the femoral head and the acetabulum secondary to changes in their shape, size, and orientation,[25] which may result in instability and overload of the acetabular rim during normal activities.[26 27] Acetabular dysplasia was traditionally defined by imaging cut-off values that have lacked consistency.

Hip instability is defined as extra-physiological hip motion that is associated with pain and functional impairment.[28] It is a multi-factorial entity and encompasses a broad range of causes including trauma, generalized ligamentous laxity, collagen disorders, bone abnormalities and soft tissue laxity.[29] Diagnosing hip instability can be challenging due to

lack of specific signs and symptoms as well as subtle presentations.[30] At present, there is no established objective or radiological signs specific to hip instability.[31]

Epidemiology

The prevalence of acetabular dysplasia in adults is 4 to 31% in symptomatic populations and 1.7 to 20% in the general population.[32] Prevalence varies according to gender (2 to 4 times increased relative risk in females), ethnicity or which imaging threshold values are used. [33-37]

Diagnosis – symptoms

Symptoms of acetabular dysplasia and/or hip instability are not well defined, but include insidious onset of groin and lateral hip pain and a loss of function (e.g. descending/ascending stairs, squatting activities, sport- and work-related activities).[38]

> The clinical utility of symptoms is currently unknown for determination of acetabular dysplasia and/or hip instability existence/non-existence; even anecdotal evidence regarding symptoms is limited.

Box 2. Literature consensus regarding clinical utility of ***symptoms*** for the determination of ***acetabular dysplasia and/or hip instability*** presence/absence.

Diagnosis – clinical signs

Clinical special tests are commonly used to diagnose acetabular dysplasia and/or hip instability; however, their clinical utility is limited when investigated in high quality studies. (Table 3)

TABLE 3. Diagnostic accuracy of single studies investigating clinical special tests for diagnosis of dysplasia/instability (data from Reiman et al. 2018 (in press))

Measure (Reference Standard)	SN/SP	+LR/-LR	Post-test probability shift with a (+) test result	Post-test probability shift with a (-) test result	(+)/(-) probability shift[10]	Study Quality[11]
AB-HEER test						
Hoppe (2017)[39] (Surgery)	80/ 89	7.6/0.22	Pretest=57% Posttest=91 %	Pretest=57% Posttest=22 %	Moderate/ Small	Low
Prone Instability Test						

Hoppe (2017)[39] (Surgery)	34/ 98	15.9/0.68	Pretest=57% Posttest=95 %	Pretest=57% Posttest=47 %	Large/ Very small	Low
HEER Test						
Hoppe (2017)[39] (Surgery)	71/ 85	4.8/0.34	Pretest=57% Posttest=86 %	Pretest=57% Posttest=31 %	Small for both	Low
Foot Progression Angle Walking Test						
Ranawat (2017)[15]*	67/70	2.2/0.5	Pretest=27% Posttest=45 %	Pretest=27% Posttest=15 %	Small for both	High
FABER Test						
Ranawat (2017)[15]	54/90	5.4/0.5	Pretest=27% Posttest=67 %	Pretest=27% Posttest=16 %	Moderate/ Small	High

SN, sensitivity; SP, specificity; (+)LR, positive likelihood ratio; -LR, negative likelihood ratio; AB-HEER, abduction–hyperextension–external rotation; HEER, hyperextension–external rotation; FABER, flexion, abduction, external rotation; *, reference standard=combination of patient history, physical examination and radiographs; (+), positive; (-), negative;

- Various clinical tests are reported for determination of hip instability presence/absence. No tests were reported specifically for acetabular dysplasia.
    - A positive prone instability test, with high magnitude and precision, is capable of providing good clinical decision making, although it was assessed in one low quality study, and so caution is recommended when using this test.
    - A positive abduction-hyperextension-external rotation (AB-HEER) and flexion-abduction-extern rotation (FABER) test have moderate magnitude and high precision, again assessed in low quality studies (caution recommendation).
        - As all included studies were of low quality, we suggest exercising caution when interpreting their clinical utility until findings are replicated in high quality studies.

Box 3. Literature consensus regarding clinical utility of ***clinical signs*** for the determination of ***hip instability*** presence/absence. [40]

Diagnosis – imaging

There are varying imaging definitions of acetabular dysplasia. The lateral and/or anterior centre-edge angle (CEA), acetabular index and Shenton line sign have been used. There is no agreement on threshold values to define acetabular dysplasia. A lateral CEA of <20˚ and <25˚ are the most widely used radiographic cut-off values to define acetabular dysplasia and borderline dysplasia, respectively.[40] Studies examining the diagnostic utility of imaging for acetabular dysplasia most commonly use AP pelvic radiographs.[41] (Table 4)

TABLE 4. Diagnostic accuracy of single studies investigating diagnostic imaging for diagnosis of dysplasia/instability (data from Reiman et al 2018 (in press))

Measure (Reference Standard)	SN/SP	+LR/-LR	Post-test probability shift with a (+) test result	Post-test probability shift with a (-) test result	(+)/(-) probability shift[10]	Study Quality[11]
Crossover Sign						
Bellaïche (2010)[42] (Arthroscan and/or MRI)	23/84	1.4/0.92	Pretest=45% Posttest=55%	Pretest=45% Posttest=44%	Very small for both	Low
Iliofemoral Line [borderline dysplasia (15 to 22% medialization)]						
Kraeutler (2017)[43] (AP Pelvis radiograph)	62/89	5.6/0.43	Pretest=19% Posttest=56%	Pretest=19% Posttest=9%	Moderate/ Small	Low
Iliofemoral Line [frank dysplasia (>22% medialization)]						
Kraeutler (2017)[43] (AP Pelvis radiograph)	77/94	13/0.24	Pretest=17% Posttest=73%	Pretest=17% Posttest=5%	Large/ Small	Low
Shenton Line [borderline dysplasia (15 to 22% medialization)						
Kraeutler (2017)[43] (AP Pelvis radiograph)	4/97	1.2/0.99	Pretest=19% Posttest=22%	Pretest=19% Posttest=18%	Very small for both	Low
Shenton Line [frank dysplasia (>22% medialization)						
Kraeutler (2017)[43] (AP Pelvis radiograph)	16/99	16/0.85	Pretest=17% Posttest=77%	Pretest=17% Posttest=15%	Large/ Very small	Low
Shenton Line (acetabular dysplasia)						
Rhee (2011)[44]	83/98	53/0.17	Pretest=50% Posttest=91%	Pretest=50% Posttest=22%	Large/ Moderate	Low

(AP Pelvis radiograph)						
Iliocapsularis-to-rectus femoris ratio (cross-sectional area)						
Haefeli (2015)[45] (MRI)	71/90	7.1/0.32	Pretest=53% Posttest=89%	Pretest=53% Posttest=26%	Moderate/ Small	Low
FEAR Index (5^0)						
Wyatt (2017)[46] (AP Pelvis radiograph and MRA)	78/80	3.9/0.27	Pretest=80% Posttest=94%	Pretest=80% Posttest=51%	Small for both	Low

SN, sensitivity; SP, specificity; LR: likelihood ratio; NPV/PPV: negative and positive predictive value; NR= not reported; CI, confidence interval; FEAR, femoro-epiphyseal acetabular roof; AP, anteroposterior; MRI, magnetic resonance imaging; MRA, magnetic resonance arthrography; (+), positive; (-), negative;

- Imaging has greater capability to help rule in acetabular dysplasia than rule it out.
- The Shenton line and iliofemoral line signs have the strongest diagnostic utility, with high magnitude and precision.
    - As all included studies were of low quality, we suggest exercising caution when interpreting their clinical utility until findings are replicated in high quality studies.

Box 4. Literature consensus regarding clinical utility of ***diagnostic imaging*** for the determination of ***acetabular dysplasia*** presence/absence. [40]

SUMMARY: LABRAL CONDITIONS

Definition

The anterior and superior portions of the acetabular labrum are the most innervated portions, producing deep hip-related pain and pressure sensation.[47] The labrum functions as a sensitive shock absorber, joint lubricator, seal to improve stability and pressure distributor, resisting motion of the femoral head within the acetabulum.[47] These motions potentially disrupt the labrum, which may destabilize the hip joint.[48 49] Labral lesions are classified according to their location, morphology, etiology and histological analysis of cadaveric specimens.[47]

Epidemiology

Labral pathology (often incidental findings) include tears, degeneration, and hypertrophy and are common in people with hip pain [62%, 95% CI (47% to 75%)] and without hip pain [54%, 95% CI (41% to 66%)].[4] Low quality of evidence, lack of direct comparison between asymptomatic and symptomatic groups, and large confidence intervals reduce the certainty of these estimates. Labral pathology was present in 79% of patient hips in post FAI syndrome-surgical outcome studies.[17] Labral pathology can exist in isolation, but commonly co-exist with both FAI syndrome and acetabular dysplasia and/or hip instability.

Diagnosis – symptoms

Mechanical symptoms such as groin pain with clicking or locking may indicate labral pathology/are common in patients with labral pathology.[17]

The clinical utility (ability of a particular symptom to shift pre- to post-test probability) is currently unknown despite widespread acceptance and recommendation of use for pathology existence/non-existence.

Box 5. Literature consensus regarding clinical utility of ***symptoms*** for the determination of ***labral findings*** presence/absence.

Diagnosis – clinical signs

The same clinical special tests that are used to diagnose FAI syndrome are commonly used to diagnose labral conditions, as these conditions often co-exist. The FADIR and flexion-internal rotation tests can be useful to rule out a labral condition (high sensitivity), however high pre-test probability due to populations studied, and low study quality limits confidence.[9] Future high quality studies in non-surgical cohorts are necessary. Refer to Figure 1 for magnitude and precision of Thomas test (patient supine on the examination table and holds the knee of the uninvolved limb to their chest, while allowing the involved limb to lie flat).

• The Thomas test has strong diagnostic utility, especially with a positive test result (recommended).

- Single study examination in a surgical setting may limit its clinical utility and we suggest further investigation of this test to determine actual clinical utility.

Box 6. Literature consensus regarding clinical utility of ***clinical signs*** for the determination of ***labral conditions*** presence/absence.

Diagnosis – imaging

TABLE 5: Diagnostic accuracy (meta-analyses) investigating diagnostic imaging for diagnosis of acetabular labral tear (data from Reiman et al. 2017[20]) (All studies were of High quality)[11] and with reference standard of surgery

Measure	SN/SP +LR/-LR	Post-test probability shift with a (+) test result	Post-test probability shift with a (-) test result	(+)/(-) probability shift[10]
MRI (1.5T)	0.71/0.60/ 1.18/0.78	Pretest=90% Posttest=95%	Pretest=90% Posttest=81%	Very small for both
MRI (3.0T)	0.72/0.76/ 2.03/0.51	Pretest=76% Posttest=90%	Pretest=76% Posttest=54%	Small/ Very small
MRA (1.5T)	0.88/0.59/ 1.91/0.20	Pretest=76% Posttest=88%	Pretest=76% Posttest=39%	Very small/ Small
MRA (3.0T)	0.89/0.79/ 3.21/0.15	Pretest=75% Posttest=93%	Pretest=75% Posttest=71%	Small/ Moderate
CTA	0.91/0.89/ 6.3/0.11	Pretest=70% Posttest=95%	Pretest=70% Posttest=20%	Moderate for both
US	0.66/0.65/ 1.86/0.56	Pretest=67% Posttest=79%	Pretest=67% Posttest=48%	Very small for both

SN, sensitivity; SP, specificity; (+)LR, positive likelihood ratio; -LR, negative likelihood ratio; T, tesla; CI, confidence interval; MRI, magnetic resonance imaging; MRA, magnetic resonance arthrography; CTA, computed tomography arthrogram; US, ultrasound; (+), positive; (-), negative

- All included studies examining imaging for labral conditions were of high quality and were limited to surgical populations. [20]

Box 7. Literature consensus regarding clinical utility of ***imaging*** for the determination of ***labral conditions*** presence/absence.

SUMMARY: CHONDRAL CONDITIONS

Definition

The femoral head and acetabular articular surfaces are covered by a thin layer of hyaline cartilage that provides a low friction environment for hip joint movement.[50] Chondral pathology refers to lesions in the intra-articular cartilage lining of the acetabulum and/or the femoral head.

Epidemiology

Chondral pathology are common findings in patients undergoing surgery for hip-related pain. However, the prevalence has been variable ranging from 37% to 88%.[17 51 52] Chondral pathology are more prevalent in individuals with hip pain [64%, 95%CI (59% to 69%)] compared to those without pain [12%, 95%CI (7% to 21%)],[4] suggesting a relationship between pain and chondral pathology. Little is known of the relationship between chondral pathology and future development of hip osteoarthritis (OA).

Diagnosis – symptoms

- The relationship between symptoms and isolated chondral pathology is unclear.
- The clinical utility (ability of a particular symptom to shift pre- to post-test probability) is currently unknown for determining the existence / non-existence of chondral pathology.
- Current knowledge relates to FAI syndrome with co-existing chondral pathology, where symptoms are similar to that of isolated FAI syndrome (hip and groin pain with possible mechanical symptoms).

Box 8. Literature consensus regarding clinical utility of ***symptoms*** for the determination of ***chondral conditions*** presence/absence.

Diagnosis – clinical signs

- The relationship between clinical signs and chondral pathology is also unclear, but is likely to reflect that of FAI syndrome and labral pathologies as these conditions often co-exist.[17 51 52]

Box 9. Literature consensus regarding clinical utility of ***clinical signs*** for the determination of ***chondral conditions*** presence/absence.

Diagnosis – imaging

TABLE 6: Diagnostic accuracy (meta-analyses) investigating diagnostic imaging for diagnosis of chondral findings (data from Saied et al. 2017[53])

Measure (Reference Standard)	SN/SP	+LR/-LR	Post-test probability shift with a (+) test result	Post-test probability shift with a (-) test result	(+)/(-) probability shift[10]	Risk of bias[5 4]
Direct MRA (Surgery)	0.75 (0.69-0.80)/0.79(0.73-0.85)	3.6/0.32	Pretest=54 % Posttest=81 %	Pretest=54 % Posttest=27 %	Small for both	High
Indirect MRA (Surgery)	0.72 (0.47-0.90)/0.92 (0.62-1.00)	9.0/0.30	Pretest=60 % Posttest=93 %	Pretest=60 % Posttest=31 %	Moderate/small	High
MRI (Surgery)	0.76 (0.65-0.85)/0.72 (0.57-0.84)	2.71/0.33	Pretest=64 % Posttest=87 %	Pretest=64 % Posttest=37 %	Small for both	High

- There are semi-quantitative methods of measuring chondral pathology for research purposes, using MRI.[55 56]
- The diagnostic accuracy of MRI and MRA has been examined in a single meta-analysis including high risk of bias studies.
- The diagnostic utility of imaging for the determination chondral findings relative to pathology is limited.[53]

- Similar to previous disease entities discussed, these studies were conducted in high prevalence populations.

Box 10. Literature consensus regarding clinical utility of ***imaging*** for the determination of ***chondral conditions*** presence/absence.

SUMMARY: LIGAMENTUM TERES CONDITIONS

Definition

The ligamentum teres is an intra-articular pyramidal-shaped ligament with unknown nociceptive capacity.[57 58]

Epidemiology

Limited evidence suggests ligamentum teres pathology are more prevalent in those with pain than those without, with half of patients undergoing arthroscopy for hip-related pain having ligamentum teres pathology as an incidental finding.[4]

Diagnosis – symptoms

- The clinical utility of a particular symptom is currently unknown for determination of ligamentum teres conditions existence/non-existence.
- Limited evidence suggests pain and mechanical symptoms (popping, locking, catching and occasional giving way) are present in those with ligamentum teres tears.[4]

Box 11. Literature consensus regarding clinical utility of ***symptoms*** for the determination of ***ligamentum teres conditions*** presence/absence.

Diagnosis – clinical signs

TABLE 7: Diagnostic accuracy (single study) investigating diagnostic imaging for diagnosis of ligamentum teres tear

Measure (Reference Standard)	SN/SP	+LR/-LR	Post-test probability shift with a (+) test result	Post-test probability shift with a (-) test result	(+)/(-) probability shift[10]	Study Quality[11]
Ligamentum teres test						
O'Donnell (2014)[59] (Surgery)	90/ 85	6.5/0.11	Pretest=47% Posttest=83 %	Pretest=47% Posttest=9%	Moderate for both	High

SN, sensitivity; SP, specificity; (+)LR, positive likelihood ratio; -LR, negative likelihood ratio; (+), positive; (-), negative

- A positive and negative ligamentum teres (LT) test are both useful to rule in and rule out the presence of pathology; albeit limited to moderate magnitude.
    - These results were from a single, high quality study.

Box 12. Literature consensus regarding clinical utility of ***clinical signs*** for the determination of ***ligamentum teres conditions tear*** presence/absence."[59]

Diagnosis – imaging

TABLE 8: Diagnostic accuracy (meta-analyses) investigating diagnostic imaging for diagnosis of ligamentum teres tear (data from Shakoor et al. 2018)[60]

Measure (Reference Standard)	SN/SP	+LR/-LR	Post-test probability shift with a (+) test result	Post-test probability shift with a (-) test result	(+)/(-) probability shift	Risk of bias[5] [4]
MRI (surgery)	0.55-0.57/0.34-0.75	1.0-2.23/0.6-1.0	Pretest=26-71% Posttest=44-71%	Pretest=26-71% Posttest=17-71%	Very small to small/very small	High
MRA (surgery)	0.88 (0.77-0.94)/0.91(0.82-0.96)	9.8/0.13	Pretest=19% Posttest=70 %	Pretest=19 % Posttest=3 %	Moderate for both	High

SN, sensitivity; SP, specificity; (+)LR, positive likelihood ratio; -LR, negative likelihood ratio; MRI, magnetic resonance imaging; MRA, magnetic resonance arthrography; CI, confidence interval; (+), positive; (-), negative;

- Currently, there are no imaging measures or modalities recommended for determining the presence/absence of ligamentum teres condition.

Box 13 Literature consensus regarding clinical utility of ***diagnostic imaging*** for the determination of ***ligamentum teres conditions*** presence/absence.[60]

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