



OPEN ACCESS

# Doha agreement meeting on terminology and definitions in groin pain in athletes

Adam Weir,<sup>1</sup> Peter Brukner,<sup>2</sup> Eamonn Delahunt,<sup>3,4</sup> Jan Ekstrand,<sup>5</sup> Damian Griffin,<sup>6</sup> Karim M Khan,<sup>1,7</sup> Greg Lovell,<sup>8</sup> William C Meyers,<sup>9</sup> Ulrike Muschaweck,<sup>10</sup> John Orchard,<sup>11</sup> Hannu Paajanen,<sup>12</sup> Marc Philippon,<sup>13,14,15</sup> Gilles Rebol,<sup>1,16</sup> Philip Robinson,<sup>17</sup> Anthony G Schache,<sup>18</sup> Ernest Schilders,<sup>19</sup> Andreas Serner,<sup>21</sup> Holly Silvers,<sup>20</sup> Kristian Thorborg,<sup>21</sup> Timothy Tyler,<sup>22</sup> Geoffrey Verrall,<sup>23</sup> Robert-Jan de Vos,<sup>24</sup> Zarko Vuckovic,<sup>1</sup> Per Hölmich<sup>1,21</sup>

► Additional material is published online only. To view please visit the journal online (<http://dx.doi.org/10.1136/bjsports-2015-094869>).

For numbered affiliations see end of article.

## Correspondence to

Dr Adam Weir, Aspetar Orthopaedic and Sports Medicine Hospital, P.O. Box 29222, Doha, Qatar; [adam.weir@aspetar.com](mailto:adam.weir@aspetar.com)

Accepted 10 April 2015

## ABSTRACT

**Background** Heterogeneous taxonomy of groin injuries in athletes adds confusion to this complicated area.

**Aim** The ‘Doha agreement meeting on terminology and definitions in groin pain in athletes’ was convened to attempt to resolve this problem. Our aim was to agree on a standard terminology, along with accompanying definitions.

**Methods** A one-day agreement meeting was held on 4 November 2014. Twenty-four international experts from 14 different countries participated. Systematic reviews were performed to give an up-to-date synthesis of the current evidence on major topics concerning groin pain in athletes. All members participated in a Delphi questionnaire prior to the meeting.

**Results** Unanimous agreement was reached on the following terminology. The classification system has three major subheadings of groin pain in athletes:

1. Defined clinical entities for groin pain:

Adductor-related, iliopsoas-related, inguinal-related and pubic-related groin pain.

2. Hip-related groin pain.

3. Other causes of groin pain in athletes.

The definitions are included in this paper.

**Conclusions** The Doha agreement meeting on terminology and definitions in groin pain in athletes reached a consensus on a clinically based taxonomy using three major categories. These definitions and terminology are based on history and physical examination to categorise athletes, making it simple and suitable for both clinical practice and research.

## INTRODUCTION

Groin pain in athletes is a common problem and renowned for being a complex issue. The wide variety of possible injuries in numerous anatomical structures and high prevalence of ‘abnormal findings’ in asymptomatic athletes contribute to the complexity. Heterogeneous taxonomy of groin injuries in athletes adds further to the confusion.

Clinical practice is challenging with clinicians using differing groin pain terminology, where even the same term can have multiple interpretations.

A recent systematic review on the treatment of groin pain in athletes included 72 studies, in which 33 different diagnostic terms were used.<sup>1</sup> The need for clear terminology and definitions has been highlighted numerous times.<sup>1–3</sup>

The ‘Doha agreement meeting on terminology and definitions in groin pain in athletes’ was convened to attempt to resolve this problem. Our aim was to agree on a standard terminology, along with accompanying definitions.

## BACKGROUND TO THE MEETING

The First World Conference on Groin Pain in Athletes was held in Doha, Qatar in November 2014. In the lead-up to this conference, 24 experts from a variety of backgrounds were invited to participate in the conference and agreement meeting, and are the authors of this report.

We used a Delphi process to form agreement. Prior to the meeting, several authors were invited to perform systematic reviews to give an up-to-date synthesis of the current evidence on major topics concerning groin pain in athletes. These reviews were presented at the conference as invited lectures and accompany this statement in this issue. Along with the reviews, all members participated in a Delphi questionnaire prior to the meeting. This article presents

- A brief summary of the findings of recent systematic reviews;
- The background and process of the agreement meeting;
- The results of the Delphi questionnaire;
- The results of the agreement meeting;
- Suggestions for future research.

## SYSTEMATIC REVIEWS PROCESS

A literature search for recent reviews identified areas where either an update of a previous review or a new review was needed. The nine reviews all underwent a full peer review prior to publication.

## Current overview of groin pain in athletes—summary of reviews presented at the First World Conference on Groin Pain in Athletes

### Epidemiology of groin injuries in football

This epidemiological review identified 34 articles on the epidemiology of groin injuries in senior football.<sup>4</sup> In general, the sources of risk of bias, identified using a 5-point checklist, were related to participant selection (18 studies), exposure (17 studies) and precision of the estimates given (18 studies).



Open Access  
Scan to access more  
free content



CrossMark

**To cite:** Weir A, Brukner P, Delahunt E, *et al.* *Br J Sports Med* 2015;**49**:768–774.

Groin injuries in male club football accounted for 4–19% of all injuries, and 2–14% in women. An aggregated data analysis of 29 studies found a higher proportion of groin injuries in men (12.8%) than women (6.9%, absolute difference 5.9%, 95% CI 4.6% to 7.1%). Groin injury rates in males were 0.2–2.1/1000 h and 0.1–0.6/1000 h in women (rate ratio 2.4, 95% CI 2.0 to 2.9). Future studies should instead: include clear definitions of injury classifications; consider using definitions other than only time loss to identify ongoing chronic issues; be performed in regions outside Scandinavia and address the sources of bias mentioned above.

#### Epidemiology of groin injuries in non-soccer elite sports

This review focused on elite non-soccer team sports and summarised 31 papers identified where more than 10 team seasons of groin or groin region injury incidence was reported.<sup>5</sup> These studies used varying injury definitions and also considered varying injury categories from general to specific (all groin/hip region injuries, groin injuries, adductor muscle strains, intra-articular hip injuries). This heterogeneity makes it hard to compare results between studies.

When playing the same sport, males had greater injury incidence of groin injury than females (RR 2.45, 95% CI 2.06 to 2.92). The sports with a high rate of groin injury were ice hockey and the football codes where field kicking is common (Australian football, Gaelic football). Within the football codes, player positions involving more kicking had a higher incidence. Uniform injury classification and definitions would improve comparison of results across studies.

#### Risk factors for groin injuries in athletes

An update of a previous review was performed.<sup>6</sup> There were 29 studies identified and methodological heterogeneity precluded meta-analysis, so a 'levels of evidence' approach was used. The majority of studies were cohort studies and the median quality score (Downs and Black) was 11/33 (range 6–20).

There is level 1 and 2 evidence that previous groin injury, higher level of play, reduced hip adduction (absolute and relative to abduction) strength and lower levels of sport-specific training are associated with an increased risk of groin injury in athletes. To date, there has been virtually no investigation of the relationship between exposure/athletic load and risk. Future studies should be large enough to ensure around 50 cases to examine for moderate to strong associations and include clear injury definitions. Prevention studies on the role of interventions for established risk factors should be performed.

#### Factors associated with hip and groin pain in athletes

While risk factor studies should ideally be prospective in design, cross-sectional and case-control studies allow multiple factors to be examined in smaller populations. While no cause-effect relationship can be determined, these factors can be considered in future studies on risk factors, investigations and treatment. A new systematic review<sup>7</sup> with a meta-analysis examining factors differentiating athletes with and without groin pain was carried out.

There were 17 studies included of which 10 were high quality. In total, 62 different measures were investigated. Eight studies were suitable for meta-analysis. Meta-analysis showed that athletes with hip and groin pain had: pain and lower strength on adductor squeeze test, reduced hip internal rotation and bent knee fallout, but that hip external rotation was the same as controls.

When data could not be pooled, a 'levels of evidence' synthesis was performed. There was strong evidence that athletes with

hip and groin pain have: lower patient-reported outcome (PRO) scores and altered trunk muscle function compared to controls. Moderate evidence was found that bone marrow oedema and secondary cleft signs are associated with hip and groin pain in athletes compared to asymptomatic controls.

#### Diagnostic accuracy of clinical tests for hip-related groin pain

Clinical examination of the hip joint presents a challenge in clinical practice. A systematic review in 2013 identified 25 studies related to the diagnostic accuracy of clinical tests for the hip joint.<sup>8</sup> Ten studies were of high quality. The meta-analysis of 14 papers showed that most tests possess weak diagnostic properties. The patella-pubic percussion test was shown to have excellent sensitivity and good specificity for femoral neck fractures.

There has been increasing interest in hip labral pathology and femoroacetabular impingement in athletes. A new systematic review with meta-analysis on the diagnostic accuracy of clinical tests for the diagnosis of hip femoroacetabular impingement/labral tears was performed.<sup>9</sup> It identified 21 studies, of which only one was of high quality. Few hip tests have been investigated sufficiently in high-quality studies to establish their role in clinical decision-making. Nine studies were suitable for meta-analysis. Meta-analysis showed that flexion-adduction-internal rotation test (FADIR test) and flexion-internal rotation possessed only screening accuracy.

#### Imaging in long-standing groin pain in athletes

A recent review identified 17 articles on imaging in athletes with long-standing adductor-related or symphyseal pain.<sup>2</sup> Twelve articles were on MRI, four on radiography and one on ultrasound. Common methodological weaknesses of the studies included: lack of or inadequate control group, small sample sizes, lack of or incomplete clinical information on participants and unknown reliability of the assessment of the imaging findings reported. Confusing terminology and undefined diagnostic labels were often used, making study interpretation difficult.

Four findings were commonly reported in athletes with long-standing adductor-related or symphyseal groin pain: degenerative changes of the symphyseal joint, adductor muscle insertion pathology, pubic bone marrow oedema and secondary cleft signs. Their exact clinical relevance for treatment or prognosis remains unclear.

#### Patient-reported outcome measures for athletes with hip and groin pain

Very few studies have been performed in which validated outcome measures have been used.<sup>1</sup> A number of measures have been developed to allow reliable and valid assessment of athletes with hip and groin pain. A new systematic review identified 20 studies in which 9 different PRO questionnaires were examined.<sup>10</sup> The quality was determined using the CONsensus-based Standards for the selection of health Measurement INstruments list (COSMIN) and an evaluation of the measurement properties. The Hip And Groin Outcome Score (HAGOS), Hip Outcome Score (HOS), International Hip Outcome Tool-12 (IHOT-12) and IHOT-33 were recommended for the assessment of hip-related groin pain in young and middle-aged athletes. HAGOS was the only PRO aimed at young-aged and middle-aged athletes with groin pain.

#### Treatment of groin injuries in athletes

A new systematic review on the treatment of groin pain in athletes identified 72 studies, which were assessed for their methodological quality.<sup>1</sup> The majority of studies (90%) were case

series, of which 80% were retrospective. Twenty-five per cent reported on conservative treatment and 75% on surgical treatment for groin pain. Only four studies were of high quality. Blinding of the participants was not performed in any study and only two studies blinded the outcome assessor or concealed treatment allocation. Thirty-three different diagnostic terms were used, often with different interpretations for the same term between studies.

A significant association was found with methodologically weaker studies reporting higher treatment success percentages. There has been no significant improvement in the quality of studies published over the past 30 years. A level of evidence approach was used to synthesize the results.

There is moderate evidence that for long-standing adductor-related groin pain:

1. Supervised active physical training results in a higher success and percentage of athletes returning to play than passive physical therapy modalities.
2. Multimodal treatment including manual adductor manipulation can result in a faster return to play, but not a higher treatment success, than a partially supervised active physical training programme.
3. Partial release of the adductor longus tendon is effective for return to sport over time.

Additionally, there is moderate evidence that, for athletes with inguinal-related groin pain, laparoscopic hernia repair results in lower pain and a higher percentage returning to play than conservative treatment.

#### Prevention of groin injuries in athletes

A new systematic review with a meta-analysis of randomised controlled trials on the prevention of groin injuries in sports was performed.<sup>11</sup> Seven trials, with six on football and one on handball, were identified. Two studies used an adductor strengthening programme, two studied the FIFA '11' preventive programme and two looked at balance training. The final study used a presentation to educate players.

In total, there were 4191 participants included in the prevention studies and they sustained 157 injuries. After data pooling, no significant groin injury prevention effect was found (relative risk 0.81; 95% CI 0.60 to 1.09). A potentially clinically relevant, but not statistically significant, reduction of 19% was found on meta-analysis. Future studies should focus on high-risk sports such as football or ice hockey and be adequately powered.

#### Return to sports after hip surgery for femoroacetabular impingement in athletes

A new systematic review identified 18 moderate to high-quality case series reporting on return to sports after surgery for femoroacetabular impingement.<sup>12</sup> In total, 977 athletes were included with 738 (76%) undergoing arthroscopy, 180 (18%) open surgery and 59 (6%) using a mini-direct anterior approach. There is limited evidence that, on average, 87% of the athletes returned to sport after hip surgery with 82% attaining the pre-injury level of sport. However, these relatively high rates of return to sport are not always maintained with longer term follow-up. As all available studies are case series (Level of Evidence IV), and many have a retrospective design, the outcomes should be interpreted with caution. There is a clear need for high-quality studies, and a recent Cochrane review identified four ongoing trials on surgery and conservative treatment for femoroacetabular impingement.<sup>13</sup>

## Background and process of the agreement meeting

### Selection of members

Members were invited to ensure representation of different countries, specialties and opinions. Where possible, members were chosen who had previously published on groin pain in athletes. The names and affiliations can be found in the authors' list. They did not represent specific organisations but were selected for their expertise.

### Expert group demographics

The group comprised 24 international experts from 14 different countries. There were 7 sports medicine physicians, 6 physiotherapists, 5 general surgeons, 4 orthopaedic surgeons, 1 radiologist and 1 combined orthopaedic and general surgeon. The members had been practising for an average of 22.8 (SD  $\pm 8.9$ ) years since qualifying. Twenty-one members had clinical practice roles and three had full-time research and education posts. The clinicians estimated that they saw a median of 150 (IQR 30–400) patients with groin pain in a year, of which 90 (IQR 30–150) were athletes. One expert (RJdV) was brought in for his expertise on research and reviews, and to present a summary of current terminology.

### Delphi procedure

Prior to the meeting, one member of the expert group (AW) prepared two clinical cases in which the history, physical examination and selected imaging findings were sent to the members of the groin expert group ( $n=23$ ).<sup>14</sup> They all completed a standardised questionnaire and provided their preferred terms to describe the diagnoses. The results were returned to the coordinator (AW) with the members being blinded to each other's answers. Once all members had completed the questionnaire, and in advance of the meeting itself, a summary of the results was circulated to the members. The full process and results are published by Weir, *et al.*<sup>15</sup>

A short summary of the history and clinical findings of both cases is included in online supplementary appendix 1.

#### Case 1—First diagnostic term

For case 1, the frequency of the 9 different terms used to describe the first possible diagnosis was:

Six adductor-related groin pain, 6 adductor tendinopathy, 4 adductor enthesiopathy, 2 femoro-acetabular impingement (FAI), 1 adductor tendinitis, 1 adductor strain, 1 pubic bone stress injury, 1 pubic bone fibrocartilage separation and 1 chronic low grade capsular/enthesiopathy stress.

#### Case 1—Second diagnostic term

Thirteen experts gave a second term to describe the diagnosis for case 1:

Two osteitis pubis, 2 adductor tendinopathy, 1 FAI, 1 CAM lesion, 1 adductor strain, 1 osteoarthritis of pubic symphysis, 1 adductor tear, 1 pubic bone marrow oedema, 1 pubic ring failure, 1 adductor longus teno-osseous defect and 1 combination of multiple ( $>2$ ) diagnostic terms.

#### Case 1—Third diagnostic term

Three experts gave a third term to describe the diagnosis for case 1:

1 adductor tendinopathy, 1 FAI and 1 pubic plate tear.

#### Case 2—First diagnostic term

For case 2, the frequency of the 11 different terms used to describe the first possible diagnosis was:

Nine inguinal-related groin pain, 3 sports hernia, 2 incipient hernia, 2 inguinal disruption, 1 Gilmore's groin, 1 pubic bone fibrocartilage separation, 1 inguinal canal aponeurosis strain, 1 ilioinguinal disruption, 1 enthesopathy inguinal ligament,

1 posterior wall weakness, 1 core muscle injury and 1 hip chondral surface damage.

#### Case 2—Second diagnostic term

Ten experts gave a second term to describe the diagnosis in case 2:

Two hip labral tear, 1 posterior wall weakness, 1 superficial inguinal ring insufficiency, 1 enthesopathy of the conjoined tendon, 1 rectus abdominus strain, 1 pubic symphysis pathology, 1 adductor tendinopathy, 1 FAI and 1 combination of multiple (>2) diagnostic terms.

#### Case 3—Third diagnostic term

Four experts gave a third term to describe the diagnosis in case 2:

One pubic cleft arthritis, 1 transversus abdominis strain, 1 tear of the posterior inguinal wall and 1 combination of multiple (>2) diagnoses.

In total, 18 different terms were used to describe the diagnosis for the first case, while 22 different terms were used for the second case.

The results of the Delphi procedure confirmed the disparity in current terminology and demonstrated the need for the meeting. The results were presented briefly at the meeting, along with an overview of the terminology and definitions used in the treatment studies identified in the review.<sup>1</sup> Prior to the meeting, all members were given the opportunity to present the use of certain preferred terms or classification systems. Five members offered to present at the meeting. The meeting itself is described in the following section.

### Agreement meeting process

Aspetar Orthopaedic and Sports Medicine Hospital, Doha, Qatar hosted the Agreement Meeting on 4 November 2014. During the meeting, the panel chairperson (PB) did not adopt an advocacy position for any specific terminology. The chairperson was responsible for directing the agreement meeting itself. Two members (AW, KMK) noted the terms suggested and summarised these for the members. Five members (WM, GV, PH, HP and PR) gave short presentations to the group. Two members (RJDV, AS) also presented data of the currently used terminology in intervention studies for long-standing groin pain and acute groin injuries, respectively. A discussion then followed during which a single set of terms and definitions were agreed on. During the day when there was disagreement on some points, a voting system was used. For example, on the issue of inguinal-related groin pain, there was discussion that the use of 'inguinal' as a term may give the impression of the presence of an occult inguinal hernia, while there was unanimous agreement that there is no occult inguinal hernia present. Unanimous agreement was reached on the following terms and definitions.

There were some important considerations that are presented here as a preamble to the terms.

#### Groin pain in athletes

Groin pain in athletes was the group's preferred umbrella term ahead of others such as athletic pubalgia, athletic groin pain, sports groin pain, athletes' groin, etc because it is clearly descriptive. It cannot be misunderstood to be a diagnostic term. The group did not specifically define the term athlete.

#### Clinical examination based classification system preferable

To ensure that the system proposed would be both generalisable and straightforward for use in everyday practice, a clinically based classification system was preferred by the group. This

means that a thorough history and physical examination are essential. The fact that the role of imaging is yet to be fully clarified was also felt to be a reason to opt for a system based solely on history and physical examination findings. The group recognised that there is no currently accepted gold standard for history, examination or imaging, with regard to diagnosis. In addition, the high prevalence of findings in asymptomatic athletes makes the use of imaging to diagnose groin pain in athletes difficult.

The group also emphasised that palpation is important to identify the painful structures. Palpation must be precise as numerous structures in the groin are in close proximity, and can refer pain to overlapping areas. The term tenderness is defined in this system as discomfort or pain when the area is palpated, and the athlete recognises this to be their specific injury pain.

#### Long-standing groin pain

The main focus of the day was on the entities in long-standing groin pain and the majority of the published literature also concerns long-standing groin pain. The group did not specify the exact duration they considered to be long-standing. Long-standing groin pain can start either gradually or suddenly and does not refer to the mechanism of onset, but refers only to the duration of symptoms.

#### Acute groin injuries

The group briefly considered acute groin injuries. Acute injuries refer to the manner in which the athlete first felt the pain, that is, sudden onset. This is a descriptive term and does not refer to the underlying risk factors or aetiology of these injuries. The group considered acute groin injuries to be those with a specific inciting event. It was noted that there is a lack of evidence pertaining to acute groin injuries. The group felt that in general the system proposed below could potentially be used to classify the majority of acute groin injuries into entities.

Consequently, a careful history along with clinical examination and assessment comprising palpation, stretching and resistance testing is critical. In cases with severe pain, it may be hard to perform a thorough physical examination.

More studies are needed to examine the roles of examination and further investigations in acute groin injuries. The group recognised that some acute groin injuries such as proximal rectus femoris injuries would not readily fit into the classification system currently proposed. Further work will be needed to refine this system to fully encompass the entire spectrum of acute groin injuries.

The classification system has three major subheadings of groin pain in athletes.

#### Classification system

1. Defined clinical entities for groin pain: Adductor-related, iliopsoas-related, inguinal-related and pubic-related groin pain
2. Hip-related groin pain
3. Other causes of groin pain in athletes

The majority of the day was spent discussing and defining these four entities. The term entity was chosen to reflect the recognisable pattern of symptoms and signs exhibited by the athlete.

In the history, in all cases the athlete should report pain in the affected region that worsens on exercise.

Palpation, resistance testing and stretching of affected muscle groups are used to categorise athletes into these entities. The pain reported by the athlete on resistance testing should also be

felt in the affected structure. For example, in adductor-related groin pain, the pain on resisted adduction testing should reproduce the athlete's recognisable pain in the adductors. Pain felt in a different location—for example, the inguinal region on resisted adduction testing—would not signify adductor-related groin pain.

The exact technique of physical examination was not discussed during the meeting. Such detail went beyond the scope of the one-day meeting to achieve this level of detail. The intraobserver and interobserver reliability of several elements of the physical examination has been explored previously and found to be acceptable for use in practice.<sup>16</sup> An athlete can have more than one entity, in which case multiple entities can be diagnosed.

### 1. Defined clinical entities for groin pain

#### *Adductor-related groin pain*

Adductor tenderness AND pain on resisted adduction testing.

#### *Iliopsoas-related groin pain*

Iliopsoas tenderness

The group agreed that iliopsoas-related groin pain is more likely if there is pain on resisted hip flexion AND/OR pain on stretching the hip flexors.

#### *Inguinal-related groin pain*

Pain location in the inguinal canal region AND tenderness of the inguinal canal. No palpable inguinal hernia is present.

The group agreed that inguinal-related groin pain is more likely if the pain is aggravated with resistance testing of the abdominal muscles OR on Valsalva/cough/sneeze.

#### *Pubic-related groin pain*

Local tenderness of the pubic symphysis and the immediately adjacent bone.

The group felt that there was no particular resistance test that specifically provoked symptoms related to pubic-related groin pain that could be used in conjunction with palpation.

The location of the four entities above is shown in [figure 1](#).

### 2. Hip-related groin pain

There was agreement that pain from the hip joint should always be considered as a possible cause of groin pain.

History should focus on the onset, nature and location of the pain and mechanical symptoms such as catching, locking, clicking or giving way. It was acknowledged that hip-related groin pain can be hard to distinguish from other causes and that it may coexist with other types of groin pain. The group recommended that physical examination including a passive range of motion and hip special tests (Flexion-abduction-external rotation (FABER) and Flexion-adduction-internal rotation (FADIR) test) should be performed in all cases when athletes present with groin pain.

The expert group found it hard to recommend single discriminatory clinical tests to identify the hip as a cause of groin pain in athletes. Previous studies demonstrated that while hip surgeons often do perform certain special tests, there are a large number used in clinical practice.<sup>17</sup> Most clinical tests for the hip joint have good sensitivity but poor specificity.<sup>6, 7</sup> This means that clinical tests can be useful in practice for excluding hip-related groin.

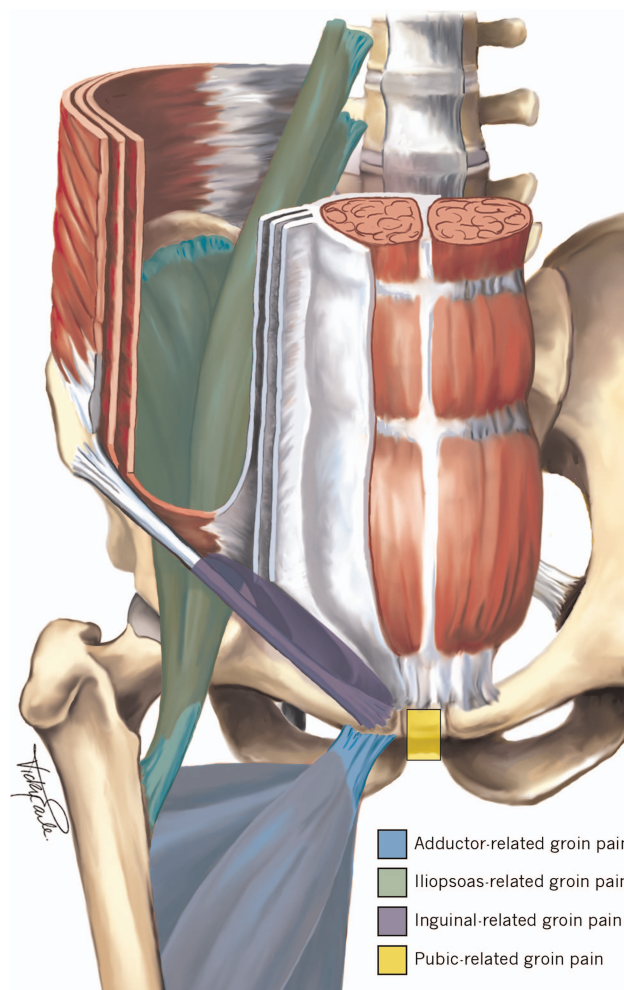
Hip joint pathologies are difficult to rule in using clinical tests alone, as when there is a high clinical suspicion, a positive test does not greatly increase the post-test likelihood of hip joint

pathology being present. The general value of hip examination in the athlete is unknown as most studies investigating the value of hip joint special tests included a highly selected, pre-screened and referred population seen in specialised orthopaedic practice settings.

A detailed classification of the possible causes of hip-related groin pain in athletes, such as femoroacetabular impingement or labral tears, was outside the scope of this agreement process. Where there is a clinical suspicion, either through history or clinical examination, of hip-related pain, this should be investigated and treated appropriately.

### 3. Other conditions causing groin pain in athletes

The group emphasised that there are many other possible causes for groin pain in athletes. A high index of clinical suspicion is needed to identify these and clinicians need to be alert to the possibilities, especially when the symptoms cannot be easily classified into one of the commonly defined clinical entities.



**Figure 1** Defined clinical entities for groin pain. *Adductor-related*

*groin pain*: Adductor tenderness AND pain on resisted adduction testing. *Iliopsoas-related groin pain*: Iliopsoas tenderness+more likely if pain on resisted hip flexion AND/OR pain on hip flexor stretching. *Inguinal-related groin pain*: Pain in inguinal canal region AND tenderness of the inguinal canal. No palpable inguinal hernia is present. More likely if aggravated with abdominal resistance OR Valsalva/cough/sneeze. *Pubic-related groin pain*: Local tenderness of the pubic symphysis and the immediately adjacent bone. No particular resistance tests to test specifically for pubic-related groin pain.

There are numerous possible causes and a number are listed in table 1. The main categories are orthopaedic, neurological, rheumatological, urological, gastrointestinal, dermatological, oncological and surgical, but this list is not exhaustive as many rare conditions could possibly cause pain in the groin region.

A careful history and physical examination covering more than only the musculoskeletal system and appropriate additional investigations or referral are critical for identifying other possible causes.

**Taxonomy and nomenclature: recommendation of terms to avoid using in groin pain in athletes**

The group discussed and chose not to recommend a number of popular terms, including terms previously used by several members of the group. It was felt that it was not appropriate to incorporate such terms into the new classification system. There were differing reasons including a lack of specificity, uncertainty about the suggested underlying pathology, inappropriate or incorrect term or large degree of variation in how they have been used historically.

The terms that the group chose not to recommend were: adductor and iliopsoas tendinitis or tendinopathy, athletic groin pain, athletic pubalgia, biomechanical groin overload, Gilmore’s groin, groin disruption, Hockey-goalie syndrome, Hockey groin, osteitis pubis, sports groin, sportsman’s groin, sports hernia, sportsman’s hernia.

**Medicolegal considerations**

The content of this agreement meeting statement reflects the opinions of the members of the group and all authors approved the final manuscript prior to publication. The content will need to be updated in the future and the group aims to update it again prior to 1 December 2018. The statement endeavours to present a way of classifying groin pain in athletes based on history and physical examination. It is not intended to be a standard of care and should not be interpreted as such. Healthcare providers must continue to base individual

treatments on the specific facts and circumstances of individual cases.

**Future directions**

The systematic reviews included in this statement, along with the members of the group identified a number of areas that need further investigation.

The expert group recommends the following priorities for further research.

**Epidemiology**

Future epidemiology studies should aim to specifically categorise groin pain in athletes. Studies should clearly state how the terms used are defined. The system provided here could be used to clinically differentiate groin pain to allow for a better understanding of the epidemiology. Future studies should: consider using definitions other than only time loss to identify ongoing chronic issues; be performed in regions outside Scandinavia; and address the sources of bias such as participant selection, exposure and precision of the estimates given. Studies can further explore the relationships between hip and groin pain.

**Risk factors**

Future studies investigating risk factors for groin pain in athletes should include clear definitions of the injuries recorded. Until now, the majority of studies have focused on intrinsic risk factors. Studies on extrinsic risk factors, such as training and match load, the relationships between hip and groin pain, and age of sports specification are needed. The relationship between groin pain in athletes and sports specific movements should be investigated further.

**Clinical examination and classification**

The reliability of a number of tests that could be used to classify athletes according to the new classification system has already been established. There is little known about the reliability of examination, for pain and bulging, of the inguinal region in athletes with groin pain. Now that agreement has been reached on

**Table 1** An overview of some of the possible causes of groin pain in athletes

Entities defined during the meeting	Other musculoskeletal causes	Not to be missed
Adductor-related groin pain	Inguinal or femoral hernia	Stress fracture
Iliopsoas-related groin pain	Posthernioplasty pain	▶ Neck of femur
Inguinal-related groin pain	Nerve entrapment	▶ Pubic ramus
Pubic-related groin pain	▶ Obturator	▶ Acetabulum
Hip-related groin pain	▶ Ilioinguinal	Hip joint
	▶ Genitofemoral	▶ Slipped capital femoral epiphysis (adolescents)
	▶ Iliohypogastric	▶ Perthes’ disease (children and adolescents)
	Referred pain	▶ Avascular necrosis/transient osteoporosis of the head of the femur
	▶ Lumbar spine	▶ Arthritis of the hip joint (reactive or infectious)
	▶ Sacroiliac joint	Inguinal lymphadenopathy
	Apophysitis or avulsion fracture	Intra-abdominal abnormality
	▶ Anterior superior iliac spine	▶ Prostatitis
	▶ Anterior inferior iliac spine	▶ Urinary tract infections
	▶ Pubic bone	▶ Kidney stone
		▶ Appendicitis
		▶ Diverticulitis
		Gynaecological conditions
		Spondyloarthropathies
		▶ Ankylosing spondylitis
		Tumours
		▶ Testicular tumours
		▶ Bone tumours
		▶ Prostate cancer
		▶ Urinary tract cancer
		▶ Digestive tract cancer
		▶ Soft tissue tumours

the new terminology, the performance of this system in clinical practice needs to be examined. Athletes with groin pain should be examined independently by multiple clinicians to see if they can be reliably classified in practice.

### Imaging

The high prevalence of radiological changes in athletes has been well documented. The reliability of various imaging modalities should be investigated. There is little known on the predictive value of these changes in asymptomatic populations with regard to the onset of groin pain. The role of imaging in the prediction of treatment response or prognosis in those with groin pain should be explored. This information will enable a better understanding of the clinical relevance of findings observed when imaging is performed for athletes with groin pain. Imaging studies should use suitable and larger control groups, clear descriptions of the clinical findings, reliable and reproducible imaging protocols and clear terminology. Standard imaging protocols should be developed for the investigation of hip-related groin pain.

### Outcome measures

The use of validated outcome measures should be encouraged. HAGOS appears to be the only PRO aimed at young to middle-aged adults, including athletes, that addresses pain and dysfunction in the groin area. It (HAGOS)<sup>18</sup> can therefore be recommended for assessment in this population. HAGOS,<sup>18</sup> HOS,<sup>19</sup> IHOT-12<sup>20</sup> and IHOT-33<sup>21</sup> can be recommended in the assessment of young to middle-aged adults with hip-related groin pain. There is insufficient evidence to recommend other PRO instruments at present.

Larger studies, including item response theory (IRT) models, would improve the understanding of these measures and their clinimetric properties, for their use on the individual level, and across different groin conditions, sports, age groups, genders, nationalities and cultures.

### Treatment

More high-quality randomised controlled trials comparing different treatments are needed. Establishing minimal reporting criteria was recommended, and these recommendations accompany are published in the paper by Delahunt, *et al.*<sup>22</sup> These standards are a resource for all who plan to undertake treatment studies. Improved reporting quality and homogeneity will ensure quality and assist in interpreting and understanding studies in clinical practice. The combination of a uniform terminology and minimal reporting standards should help to ensure better quality studies.

### Prevention

The recent meta-analysis of randomised trials did not show significant reductions in the number of groin injuries. Future studies should focus on high-risk sports such as football or ice hockey and be adequately powered. Until now, studies have focused on strengthening, balance training and education; other interventions could also be studied. For hip-related groin pain, the role of screening and prevention should be investigated, with special attention given to the adolescent period.

### Acute groin injuries

Very few studies on acute groin injuries have been performed. Epidemiological studies including a description of the mechanism of onset and location are needed. Injury mechanisms, treatment and prognosis have never been evaluated in detail and should also be investigated.

## CONCLUSION

The Doha Agreement Meeting on terminology and definitions in groin pain in athletes reached a consensus on a clinically based taxonomy. Groin pain in athletes was divided into three major categories:

1. Defined clinical entities for groin pain: adductor-related, iliopsoas-related, inguinal-related and pubic-related groin pain.
2. Hip-related groin pain.
3. Other causes of groin pain in athletes.

These definitions and terminology are based on history and physical examination to categorise athletes, making it simple and suitable for both clinical practice and research.

### Author affiliations

<sup>1</sup>Aspetar Orthopaedic and Sports Medicine Hospital, Doha, Qatar

<sup>2</sup>Latrobe University, Melbourne, Victoria, Australia

<sup>3</sup>School of Public Health, Physiotherapy and Population Science, University College Dublin, Dublin, Ireland

<sup>4</sup>Institute for Sport and Health, University College Dublin, Dublin, Ireland

<sup>5</sup>Football Research Group, Department of Medicine and Health, University of Linköping, Linköping, Sweden

<sup>6</sup>Warwick Medical School, University Hospitals of Coventry and Warwickshire NHS Trust, Coventry, UK

<sup>7</sup>Department of Family Practice, University of British Columbia, Vancouver, British Columbia, Canada

<sup>8</sup>Australian Institute of Sport, Bruce, Australian Capital Territory, Australia

<sup>9</sup>Vincera Institute, Philadelphia, Pennsylvania, USA

<sup>10</sup>Hernia centre Dr. Muschaweck, Munich, Germany

<sup>11</sup>School of Public Health, University of Sydney, Sydney, New South Wales, Australia

<sup>12</sup>Kuopio University Hospital and University of Eastern Finland, Kuopio, Finland

<sup>13</sup>The Steadman Clinic, Steadman Philippon Research Institute, Vail, Colorado, USA

<sup>14</sup>McMaster University, Hamilton, Ontario, Canada

<sup>15</sup>University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania, USA

<sup>16</sup>Hernia Center, Clinique du Sport, Merignac, France

<sup>17</sup>Leeds Musculoskeletal Biomedical Research Unit, Leeds Teaching Hospitals, University of Leeds, Leeds, UK

<sup>18</sup>Department of Mechanical Engineering, The University of Melbourne, Melbourne, Victoria, Australia

<sup>19</sup>Fortius Clinic, Leeds Beckett University, The Wellington Hospital, London, UK

<sup>20</sup>Santa Monica Sports Medicine Foundation & Institute for Sports Science, University of Delaware, Delaware, USA

<sup>21</sup>Sports Orthopedic Research Center – Copenhagen (SORC-C), Department of Orthopedic Surgery, Amager-Hvidovre Hospital, Copenhagen, Denmark

<sup>22</sup>The Nicholas Institute of Sports Medicine & Athletic Trauma @ Lenox Hill Hospital, New York, New York, USA

<sup>23</sup>SPORTSMED.SA Sports Medicine Clinic, Adelaide, South Australia, Australia

<sup>24</sup>Department of orthopaedics, Erasmus University Medical Centre, Rotterdam, The Netherlands

**Contributors** AW was involved in the idea, he designed and developed the process, coordinated the process, wrote the drafts and arranged all amendments. PH was involved in the idea, as well as in the design, development and coordination of the project. KT, PB and KMK were involved in the design and development of the project. All authors contributed to the development of the content of the agreement statement by participating in the meeting or discussions afterwards. All authors gave feedback at each round of writing and approved the final version for submission.

**Competing interests** None declared.

**Patient consent** Obtained.

**Provenance and peer review** Not commissioned; internally peer reviewed.

**Open Access** This is an Open Access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>

## REFERENCES

- 1 Serner A, van Eijck CH, Beumer BR, *et al.* Study quality on groin injury management remains low: a systematic review on treatment of groin pain in athletes. *Br J Sports Med* 2015;49:813.

- 2 Branci S, Thorborg K, Nielsen MB, *et al.* Radiological findings in symphyseal and adductor-related groin pain in athletes: a critical review of the literature. *Br J Sports Med* 2013;47:611–19.
- 3 Holmich P, Renstrom PA. Long-standing groin pain in sportspeople falls into three primary patterns, a “clinical entity” approach: a prospective study of 207 patients. *Br J Sports Med* 2007;41:247–52.
- 4 Waldén M, Hägglund M, Ekstrand J. The epidemiology of groin injury in senior football: a systematic review of prospective studies. *Br J Sports Med* 2015;49:792–7.
- 5 Orchard JW. Men at higher risk of groin injuries in elite team sports: a systematic review. *Br J Sports Med* 2015;49:798–802.
- 6 Whittaker JL, Small C, Maffey L, *et al.* Risk factors for groin injury in sport: an updated systematic review. *Br J Sports Med* 2015;49:803–9.
- 7 Mosler AB, Agricola R, Weir A, *et al.* Which factors differentiate athletes with hip/groin pain from those without? A systematic review with meta-analysis. *Br J Sports Med* 2015;49:810.
- 8 Reiman MP, Goode AP, Hegedus EJ, *et al.* Diagnostic accuracy of clinical tests of the hip: a systematic review with meta-analysis. *Br J Sports Med* 2013;47:893–902.
- 9 Reiman MP, Goode AP, Cook CE, *et al.* 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.
- 10 Thorborg K, Tijssen M, Habets B, *et al.* Patient-reported outcome (PRO) questionnaires for young-aged to middle-aged adults with hip and groin disability: a systematic review of the clinimetric evidence. *Br J Sports Med* 2015;49:812.
- 11 Esteve E, Rathleff MS, Bagur-Calafat C, *et al.* Prevention of groin injuries in sports: a systematic review with meta-analysis of randomised controlled trials. *Br J Sports Med* 2015;49:785–91.
- 12 Casartelli NC, Leunig M, Maffiuletti NA, *et al.* Return to sport after hip surgery for femoroacetabular impingement: a systematic review. *Br J Sports Med* 2015;49:819–24.
- 13 Wall PD, Brown JS, Parsons N, *et al.* Surgery for treating hip impingement (femoroacetabular impingement). *Cochrane Database Syst Rev* 2014;9:CD010796.
- 14 Hasson F, Keeney S, McKenna H. Research guidelines for the Delphi survey technique. *J Adv Nurs* 2000;32:1008–15.
- 15 Weir A, Hölmich P, Schache AG, *et al.* Terminology and definitions on groin pain in athletes: building agreement using a short Delphi method. *Br J Sports Med* 2015;49:825–7.
- 16 Holmich P. Clinical examination of athletes with groin pain: an intraobserver and interobserver reliability study. *Br J Sports Med* 2004;38:446–51.
- 17 Martin HD, Kelly BT, Leunig M, *et al.* The pattern and technique in the clinical evaluation of the adult hip: the common physical examination tests of hip specialists. *Arthroscopy* 2010;26:161–72.
- 18 Thorborg K, Holmich P, Christensen R, *et al.* The Copenhagen Hip and Groin Outcome Score (HAGOS): development and validation according to the COSMIN checklist. *Br J Sports Med* 2011;45:478–91.
- 19 Martin RL, Philippon MJ. Evidence of reliability and responsiveness for the hip outcome score. *Arthroscopy* 2008;24:676–82.
- 20 Griffin DR, Parsons N, Mohtadi NG, *et al.* Multicenter Arthroscopy of the Hip Outcomes Research Network. A short version of the International Hip Outcome Tool (iHOT-12) for use in routine clinical practice. *Arthroscopy* 2012;28:611–16; quiz 616–8.
- 21 Mohtadi NG, Griffin DR, Pedersen ME, *et al.* Multicenter Arthroscopy of the Hip Outcomes Research Network. The Development and validation of a self-administered quality-of-life outcome measure for young, active patients with symptomatic hip disease: the International Hip Outcome Tool (iHOT-33). *Arthroscopy* 2012;28:595–605; quiz 606–10.e1.
- 22 Delahunt E, Thorborg K, Khan KM, *et al.* Minimum reporting standards for clinical research on groin pain in athletes. *Br J Sports Med* 2015;49:775–81.