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# Multidisciplinary Assessment of 100 Athletes With Groin Pain Using the Doha Agreement: High Prevalence of Adductor-Related Groin Pain in Conjunction With Multiple Causes

Rachel Taylor, MBChB,\* Zarko Vuckovic, MD,\* Andrea Mosler, BAppSc (Physio), MAppSc (Sports Physio),† Rintje Agricola, MD, PhD,\*‡ Roald Otten, BPhy,\* Philipp Jacobsen, Dip Phys,\* Per Holmich, MD, DMSc,\*§ and Adam Weir, MBBS, PhD\*

## Abstract

**Objective:** To examine the prevalence of different causes of groin pain in athletes using the recent Doha consensus classification of terminology and definitions of groin pain in athletes. **Design:** Descriptive epidemiological study. **Setting:** Multidisciplinary sports groin pain clinic at Aspetar Orthopedic and Sports Medicine Hospital, Doha, Qatar. **Patients:** The clinical records of 100 consecutive athletes with complaints of groin pain who attended the multidisciplinary sports groin pain clinic between January and December 2014 were analyzed. **Main Outcome Measures:** The causes of groin pain were categorized according to terminology and definitions agreed upon at the Doha consensus meeting on groin pain classification in athletes. The classification system has 3 main subheadings; defined clinical entities for groin pain (adductor-related, iliopsoas-related, inguinal-related, and pubic-related groin pain), hip-related groin pain, and other causes of groin pain in athletes. **Results:** The majority of athletes were male (98%) soccer players (60%). Multiple causes for groin pain were found in 44% of the athletes. Adductor-related groin pain was the most prevalent defined clinical entity (61% of athletes), and pubic-related groin pain was the least prevalent (4% of athletes). **Conclusions:** Adductor-related groin pain is the most commonly occurring clinical entity in this athlete population in mainly kicking and change of direction sports and frequently, multiple causes are found. **Clinical Relevance:** This is the first study to use the Doha agreement classification system and highlights the prevalence of adductor-related groin pain and that often multiple clinical entities contribute to an athlete's groin pain. Consequently, prevention programs should be implemented with these factors in mind.

**Key Words:** entity, sport, hip, injury, soccer

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## INTRODUCTION

Groin pain is common in athletes,<sup>1–3</sup> and it represents a diagnostic challenge due to both the wide potential causes for the pain<sup>4</sup> and that athletes can have multiple causes for their pain.<sup>5,6</sup> A lack of universally agreed terminology and diagnostic criteria for groin pain in athletes adds further complexity. A recent agreement meeting reached consensus on a classification system to be used when describing groin pain in athletes.<sup>7</sup>

Geographical variation in the proportion of different causes of groin pain has been reported. At the time of data collection, more than 50% of athletes studied in Australia<sup>6</sup> had “incipient hernia,” 58% had adductor-related groin pain in Denmark,<sup>5</sup> hip pathology accounted for 50% of

athletic groin pain in the United Kingdom,<sup>8</sup> and 56% of chronic groin pain in athletes in Ireland.<sup>9</sup> These studies preceded the Doha agreement meeting, and each used a different classification system, making comparison difficult. These differences may be due to regional variations in athletes (race/age), type of sports played, referral bias, or taxonomy used to classify the injuries.

To our knowledge, no epidemiological study has investigated the prevalence of the different entities of groin pain as outlined by the new Doha agreement. The aim of this study was to use the Doha agreement classification system to describe the causes of groin pain seen in athletes in the Middle East.

## MATERIALS AND METHODS

### Study Design

Descriptive epidemiological study of the first 100 athletes who met study criteria consecutively attending a multidisciplinary sports groin pain clinic (MDSGPC) at a specialized Orthopedic and Sports Medicine Hospital in Doha, Qatar (Aspetar) in 2014. Each athlete met the eligibility criteria to be included in the study. Ethical approval was obtained from the Anti-Doping Laboratory Qatar ethics board (institutional review board application number X2015000095). The STROBE statement<sup>10</sup> and the

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From the \*Aspetar Orthopedic and Sports Medicine Hospital, Doha, Qatar; †La Trobe Sport and Exercise Medicine Research Centre, La Trobe University, Victoria, Australia; ‡Erasmus University Medical Centre, Rotterdam, the Netherlands; and §Sports Orthopedic Research Center Copenhagen, Department of Orthopedic Surgery, University Hospital of Copenhagen, Amager and Hvidovre, Denmark.

The authors report no conflicts of interest.

Corresponding Author: Rachel Taylor, Ground Floor Sheridan Building, Moore Park Road, Moore Park, Sydney, NSW 2021 (r1tay@hotmail.com).

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minimal reporting standards for groin pain in athletes<sup>11</sup> were consulted when designing and reporting the study.

### Setting

All patients attended the MDSGPC. This clinic consists of a team with expertise in the diagnosis and management of groin pain: a sports medicine physician (A.W.), a general surgeon with a subspecialist expertise in groin surgery (Z.V.), and a rotating team of sports physiotherapists (R.O. and P.J.).

### Eligibility Criteria

Patients were eligible if they were participating in regular sports activities and complained of pain in the groin region. Exclusion criteria were inactive patients and those who were found not to have pain related to the groin region on examination.

### Participants

One hundred consecutive athletes who presented to the MDSGPC between January and December 2014 and met the eligibility criteria participated. A formal power analysis was not conducted to determine sample size requirements because the study is descriptive and epidemiological in nature. Athletes were referred to the clinic via an internal referral system or via the sports club medical staff employed by the National Sports Medicine Program. Athletes also attended the clinic via external referral (overseas medical referral and/or self-referred).

### Demographic Data

The following demographic data were recorded for each athlete: age, gender, duration of symptoms in days, subjective onset of symptoms documented as either acute onset (eg, if a definite mechanism or moment could be described) or gradual onset (if there was no defined point in time when symptoms began), the athletes primary sport, and their participation level. Sports that had only 1 athlete were later grouped together and categorized as “other sports.” Nationality was determined by

the passport on file at the hospital. Athletes were then grouped as being from Qatar, other Gulf Cooperation Council (GCC) states, Africa, Europe, or another country. Athletes were classified as being professional or amateur. Athletes registered with the Qatar Olympic Committee were deemed professional, as were international athletes who stated that they were professional. The frequency and intensity of training was not documented because there was no way of verifying records to ensure data accuracy.

### Clinical Examination and Categorization of Athletes

Clinical notes were obtained for athletes who met the eligibility criteria. A complete data set was available for all but 1 athlete who could not recall the onset of his symptoms. A thorough medical history and clinical examination was performed by either the sports physician (A.W.), or general surgeon (Z.V.). Although the exact physical examination tests performed were not analyzed, both clinicians performed their examination using techniques that have been shown to have acceptable intra-observer and interobserver reliabilities.<sup>12</sup> The team discussed the clinical findings and then classified the cause of groin pain on clinical grounds alone. The athletes were examined and classified before the Doha agreement. However, it should be highlighted that the examiners were working with an almost identical classification system with the same symptom and examination findings used to define the entities as used in the Doha agreement.<sup>5</sup> Athletes were classified prospectively, but the name of the entity in some instances was altered retrospectively when analyzing the notes in accordance with the Doha agreement, for example, “symphyseal joint pain” was changed to pubic-related groin pain and “sport’s hernia” became “inguinal-related groin pain.” The defined clinical entities for groin pain are adductor-related, iliopsoas-related, inguinal-related, and pubic-related groin pain. Hip-related groin pain is a separate entity. The consensus agreement suggested using the category “other” for any cause of groin pain in athletes that cannot be categorized into these entities (Figure 1.).

Table 1 shows the physical examination findings necessary to categorize an athlete with one of the defined clinical entities outlined by the Doha agreement.<sup>7</sup>

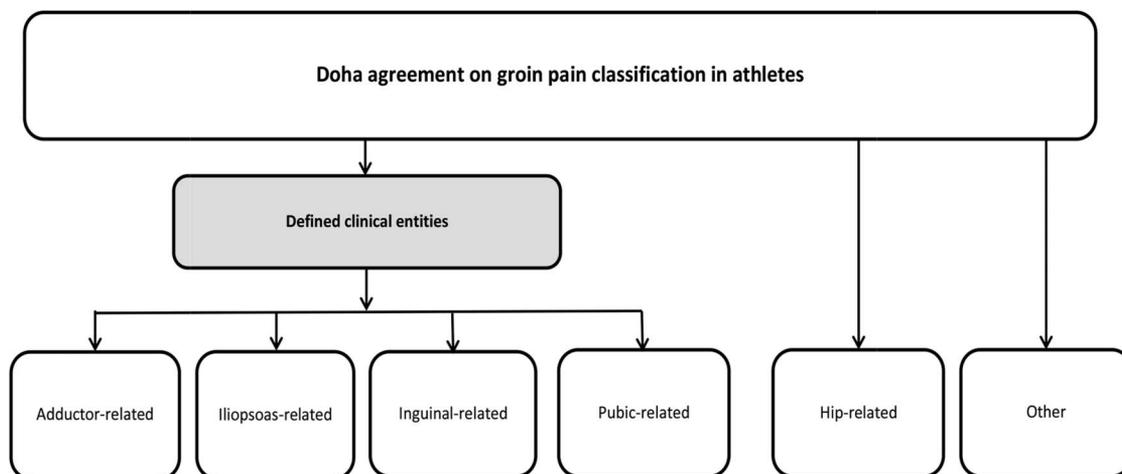


Figure 1. Flow diagram representing the Doha agreement on the classification of groin pain in athletes.

Defined Clinical Entity	Symptoms and Examination Findings
Adductor-related groin pain	Adductor tenderness and pain on resisted adduction testing
Iliopsoas-related groin pain	Iliopsoas tenderness plus, 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 by 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

A full physical examination of the hip was performed in all cases. No single test was used to diagnose an athlete as having hip-related groin pain. In practice, a large number of clinical tests are used, and most have good sensitivity but low specificity.<sup>13</sup> Additionally, there is limited evidence that clinical tests can differentiate athletes with hip or groin pain from those without.<sup>14</sup> Where hip-related groin pain was suspected, investigations were ordered as deemed appropriate. Hip-related groin pain is categorized as a separate entity in this study.

There are many other possible causes of groin pain. The examiners maintained a high index of suspicion for these while performing their physical examination. All other causes of groin pain were documented after the physical examination in conjunction with any imaging performed and coded as “other.” Specific diagnostic criteria used for other causes were not defined.

**Multiple Causes**

An athlete can have more than one cause for their groin pain. Bilateral defined entities were documented as a single entity. For example, an athlete with right-sided and left-sided adductor-related groin pain was categorized once as having adductor-related groin pain. An athlete could also have multiple defined entities contributing to their pain. For example, an athlete with bilateral adductor-related groin pain and left-sided inguinal-related groin pain is described as having 2 defined clinical entities: adductor-related groin pain and inguinal-related groin pain. In cases where an athlete had a defined entity plus an other cause for their groin pain, for example, iliopsoas-related groin pain and testicular pain, they were described as having 2 causes for their groin pain: a defined entity plus an other cause. If an athlete had multiple other causes of groin pain, for example, neuralgic pain and a rectus femoris strain, this was categorized simply as a single other cause for the purposes of analysis. All contributing causes to the athlete’s groin pain were noted. Clinical entities were not categorized according to perceived importance of contribution to the clinical presentation.

**Investigations**

Diagnostic investigations were ordered as deemed clinically necessary. Investigations before attendance at the MDSGPC are not registered in our study. Clinical entities were defined based upon history and clinical examination independent of imaging.

**Statistics**

All data were coded and analyzed using SPSS software (version 21.0; IBM Corp, Armonk, NY). Descriptive statistics were presented as mean and standard deviation, with a range

for continuous variables. For categorical variables, frequency, percentage, and confidence intervals were reported. Non-normally distributed data are presented as medians with interquartile range. As the number (n) = 100, percentage reporting is equal to n.

**RESULTS**

**Demographics**

Nearly all athletes (98%) were male. The mean age of the athletes was 27.8 (±8.4) years (range, 15-52 years). Athletes came from 31 different countries: 40% Qatar, 25% Africa, 14% other countries, 11% other GCC countries, and 7% Europe.

Athletes participated in 16 different sports. The complete list of sports is shown in Table 2.

**Level of Sports Participation**

Sixty-eight athletes were professional, of whom, 16 played for Qatar’s National teams, 2 Olympic teams, and 11 international athletes. Of the 11 international athletes, 2 also played for their National team, the remainder played at local club or recreational level.

**Onset and Duration of Symptoms**

Gradual onset was reported by 68 athletes and acute by 31. One athlete could not provide an accurate account of symptom onset. The median duration of symptoms was 62 days (interquartile range, 30-198 days).

Sport	%
Football	60
Futsal	7
Athletics	6
Handball	5
Fitness	4
Running	3
Volleyball	3
Basketball	2
Swimming	2
Weightlifting	2
Others	6

**TABLE 3. Clinical Causes of Groin Pain Diagnosed for the 100 Consecutive Cases**

Clinical Cause of Groin Pain	Single Clinical Cause	Two Clinical Causes			Three Clinical Causes					Four Clinical Causes	
		Iliopsoas	Inguinal	Other	Iliopsoas + Inguinal	Iliopsoas + Pubic	Iliopsoas + Hip	Iliopsoas + Other	Inguinal + Pubic	Iliopsoas + Inguinal + Hip	Iliopsoas + Inguinal + Other
Adductor-related (n = 61)	25	9	10	1	7	1	2	1	2	1	2
Inguinal related (n = 40)	13	—	—	—	—	—	—	—	—	—	—
Iliopsoas related (n = 31)	2	—	5	1	—	—	—	—	—	—	—
Hip related (n = 7)	2	—	—	2	—	—	—	—	—	—	—
Pubic-related (n = 4)	1	—	—	—	—	—	—	—	—	—	—
Other related (n = 20)	13	—	—	—	—	—	—	—	—	—	—
Total	56	28			13					3	

### Causes of Groin Pain in Athletes

A single clinical cause of groin pain was documented in 56 athletes, 2 clinical causes in 28, 3 clinical causes in 13, and 4 clinical causes in 3 athletes (Table 3). Multiple clinical causes were documented in 44% of athletes.

In this cohort of 100 athletes, a total of 163 clinical causes of groin pain were documented (Table 3). There were 61 cases of adductor-related groin pain, 40 inguinal-related groin pain, 31 iliopsoas-related groin pain, 4 pubic-related groin pain, 7 hip-related groin pain, and 20 other categories of groin pain. Of the 61 cases of adductor-related groin pain, 36 occurred in conjunction with another cause. All of the defined clinical entities occurred more frequently in conjunction with another clinical cause of groin pain than as a single entity (Table 3).

Of the female athletes, 1 had inguinal and iliopsoas-related groin pain and the other had adductor, iliopsoas, and hip-related groin pain.

There were 7 cases of hip-related groin pain. Table 4 shows that in our cohort of athletes, hip-related groin pain is usually seen concomitant with other causes for groin pain.

Table 5 shows the breakdown of the other clinical causes documented as contributing to the athlete's groin pain. Twenty-four diagnoses were documented, but only 20 athletes are noted as having an other cause for their groin pain because multiple other causes were categorized as a single other cause for statistical purposes.

### Causes of Groin Pain by Sport

Table 6 shows the prevalence patterns by sport. The majority of athletes were involved in kicking sports. Adductor-related groin pain was the most prevalent entity across all sports. Inguinal-related groin pain was the second most common entity in both kicking and change of direction sports.

### Investigations

Additional radiological investigations were requested in 54% of athletes; 44% were referred for an x-ray (hip, pelvis, lumbosacral spine), 32% for a magnetic resonance scan (groin, pelvis, or hip), 26% for an ultrasound scan (hip or groin), 3% for a magnetic resonance arthrogram of the hip, and 3% for a computed tomographic scan (hip or pelvis).

### DISCUSSION

This descriptive epidemiological study of 100 athletes attending a MDSGPC in the Middle East showed that the majority of athletes were male soccer players. Adductor-related groin pain was the most common entity, and 44% of athletes had multiple clinical causes.

As in our series, sex disparities in athletes presenting with groin pain have been previously reported, ranging from 1.6%<sup>6</sup> to 27%<sup>9</sup> in female athletes. The discrepancy in our study may be related to the low participation rates of female athletes in

**TABLE 4. Detailed Description of the Athletes With Hip-Related Groin Pain**

Cases	Age, years	Cause of Hip-Related Groin Pain	Associated Causes of Groin Pain
Case 1	34	Bilateral osteoarthritis	Nil
Case 2	45	Unilateral osteoarthritis	Urological condition
Case 3	47	Unilateral osteoarthritis	Lumbosacral spine degeneration
Case 4	52	Unilateral osteoarthritis	Nil
Case 5	27	Labral tear	Adductor and iliopsoas-related groin pain
Case 6	19	Labral tear	Adductor and iliopsoas-related groin pain
Case 7	28	Labral tear	Adductor, iliopsoas and inguinal-related groin pain

**TABLE 5. Detailed Description of Other Causes of Groin Pain in Athletes**

Clinical Diagnoses	No. of Cases
Inguinal hernia	9
Pubic apophysitis	2
Rectus femoris proximal rupture	2
Urological (testicular)	1
Pectineus partial tear	1
Umbilical hernia	1
Lumbosacral spine degeneration	1
Ilioinguinal nerve entrapment	1
Proximal rectus femoris tendinopathy	1
Trochanter minor apophysitis	1
Lytic lesion ischial tuberosity	1
Sartorius-related pain	1
Postoperative neuralgic pain	1
Unclassifiable	1
Total	24

regular physical activity and competitive sports in Qatar. There is also moderate evidence that men are at a higher risk of groin injury than women when playing the same sport.<sup>15</sup>

Adductor-related groin pain is the most commonly occurring clinical entity across all sports in this study (Table 6). Holmich<sup>5</sup> also found adductor-related groin pain to be the most common clinical entity seen in soccer players (68%). In contrast, Bradshaw et al<sup>8</sup> found pubic pathology (57%) to be the most common entity in kicking sports. Therefore, the variation in the prevalence of causes of groin pain in athletes cannot be fully explained by the sport played. However, the variation in the diagnostic approach and definitions between the study by Bradshaw et al<sup>8</sup> and Holmich<sup>5</sup> might explain some of this variation.

Inguinal-related groin pain (40% of athletes) was the second most common entity found. This is higher than in other series. Rankin et al<sup>9</sup> observed abdominal wall-related groin pain in 11% (defined as tender rectus abdominis on palpation and resisted sit-up, positive “sportsman’s hernia,” tender conjoint tendon, dilated superficial ring, pain and cough impulse on invagination of scrotum, presence of inguinal or femoral hernia). Holmich<sup>5</sup> found “sports hernia” in less than 2% of athletes (defined as no hernia present as well as tenderness of the external inguinal ring and tenderness in the

area of the conjoint tendon and close to its insertion at the pubic tubercle). Due to the discrepancy in nomenclature, what was referred to as abdominal wall-related groin pain in the study by Rankin et al<sup>9</sup> would be categorized as inguinal-related groin pain and an other cause (inguinal hernia) in this study, in accordance with the Doha agreement.

Pubic-related groin pain was the least commonly seen defined clinical entity (4% of athletes) in contrast to previous studies, which have found this entity to occur up to 5 times as frequently.<sup>8,9</sup> However, the examination criteria used to diagnose pubic-related pain in previous studies differs from that stated in the Doha agreement. For example, Rankin et al<sup>9</sup> used the following clinical criteria to diagnose pubic bone stress-related injury: tender over central pubic symphysis, central pain on adductor squeeze (diagnosis based on the presence of all clinical criteria independent of imaging). This discrepancy in definitions may explain the variation in the prevalence seen between studies.

Hip-related groin pain was infrequently seen (7% athletes) and was frequently associated with other causes. These findings contrast those of Bradshaw et al<sup>8</sup> and Rankin et al<sup>9</sup> where more than 50% of athletes had hip-related groin pain. This difference could be due to many factors including the differing ethnicity in our cohort, a narrower age range in our study, low level of participation in contact sports,<sup>16</sup> referral bias, and differences in diagnostic methodology. Interestingly, this low prevalence of hip-related groin pain is observed in our cohort despite a high prevalence of cam deformity (72%) reported in professional soccer players in Qatar.<sup>17</sup> The soccer players included in that large cohort study were of varying ethnicity, but the majority (59%) were of Arabic ethnicity.

Inguinal hernia was the most common other clinical cause contributing to groin pain in athletes and has been previously cited as a common cause.<sup>6</sup> However, no direct comparison can be made between these studies due to differences in nomenclature and diagnostic approach.

Multiple clinical causes for an athlete’s groin pain were frequently seen (44% of athletes). Two previous case series have also described this observation. Holmich<sup>5</sup> found multiple clinical causes in 33% of his cohort, and Rankin et al<sup>9</sup> found 2 or more causes in more than 50%. However, Lovell<sup>6</sup> found that multiple causes were only present in 27% of athletes. This discrepancy in observations can be partly explained by the advancement in both the understanding of groin pain in athletes and imaging technology. The high incidence of multiple causes could also reflect the chronicity of the cases,

**TABLE 6. Prevalence Patterns of the Causes of Groin Pain by Sport**

Cause of Groin Pain	Kicking Sports* (n = 67), n (%)	Change of Direction Sports† (Without Kicking) (n = 11), n (%)	Other Sports‡ (n = 22), n (%)
Adductor-related (n = 61)	42 (64)	9 (82)	9 (40)
Inguinal-related (n = 40)	28 (43)	4 (36)	7 (32)
Iliopsoas-related (n = 31)	20 (31)	3 (27)	7 (32)
Hip-related (n = 7)	2 (5)	0 (0)	4 (18)
Pubic-related (n = 4)	3 (6)	0 (0)	0 (0)
Other-related (n = 20)	11 (16)	1 (9)	8 (36)

\*Football, futsal.

†Basketball, tennis, handball, volleyball.

‡Triathlon, equestrian, athletics, running, wrestling, weightlifting, swimming, fitness, martial arts, golf.

given the median duration of symptoms was 62 days at presentation.

The interrelationship between the various entities and other causes is not fully understood. The high incidence of multiple coexisting causes highlights the complexity of the problem and the need for a multidisciplinary approach to treatment and a complete examination of all athletes with groin pain.

Unsurprisingly, the majority of athletes were professional soccer players because soccer is the most widely played professional and recreational sport in Qatar. Soccer was also the most commonly played sport by men in previous series.<sup>5,8,9</sup>

The high prevalence of adductor-related groin pain in sports that involve kicking or change of direction is in keeping with previous studies.<sup>5,9</sup> Preparticipation screening should aim to identify the potential risk factors such as previous adductor injury, hip adductor strength, and flexibility, which are either associated with or risk factors for adductor injury.<sup>14,18,19</sup>

Supplementary radiological investigations were ordered in 54% of athletes. This was done when the diagnosis was not clear or to satisfy the need from professional sports clubs. There is no standard imaging workup for groin pain in athletes. The Doha agreement is a clinically based classification system, and as such, radiological imaging is not required for the initial classification.

The epidemiological nature of this study has obvious limitations. However, it should be noted that the data on the causes of groin pain were collected prospectively, thereby limiting recall bias. This study is at risk of ascertainment bias, which may favor referral of more chronic injuries to secondary care, which is shown by the limited numbers of acute groin injuries seen. This is reflective of the referral process to the clinic. Most athletes had been previously seen by another medical practitioner and attended for a second opinion or because they were not responding to treatment as expected. This referral pattern might not reflect presentations seen in other parts of the world. However, the multidisciplinary nature of the clinic should help limit referral bias toward a single clinician diagnosing a particular entity in which they are most interested or specialized. Soccer is the largest sport in terms of participation in the country, which will have influenced the proportion of soccer players in our study. More data are needed on female athletes with groin pain in this region before prevalence patterns can be established. Seventy-six percent of athletes were from GCC countries or Africa. This ethnic diversity is unique to this region and may be reflected in the pathologies observed.

This study is the first, to our knowledge, to use the terminology and definitions of groin pain in athletes according to the recent Doha agreement meeting.<sup>7</sup> It is also the first epidemiological study of groin pain in athletes in the Middle East. Adductor-related groin pain is the most common entity across all sports, particularly in kicking and change of direction sports. Our findings reinforce the importance of a systematic clinical examination in athletes with groin pain, as

multiple clinical entities frequently coexist. Prevention programs should be implemented with these factors in mind.

Future prospective epidemiological studies using the Doha agreement classification system are needed in other regions. These studies would help ascertain whether the geographical variation in the prevalence of clinical entities of groin pain in athletes can be explained by a previous lack of universally accepted terminology.

Universal taxonomy should improve communication between clinicians and allow true comparisons of findings between groups publishing in this field, thus improving the overall management of this complex problem.

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