ORIGINAL ARTICLE

Long-standing groin pain in sportspeople falls into three primary patterns, a "clinical entity" approach: a prospective study of 207 patients

Per Hölmich

Br J Sports Med 2007;**41**:247–252. doi: 10.1136/bjsm.2006.033373

Background: Groin pain remains a major challenge in sports medicine.
Aim: To examine 207 consecutive athletes (196 men, 11 women) with groin pain using a standardised and reliable clinical examination programme that focused on signs that suggest pathology in (1) the adductors, (2) the ilopsoas and (3) the rectus abdominis.
Patients and methods: Most patients were football players (66%) and runners (18%). In this cohort, the clinical pattern consistent with adductor-related dysfunction, was the primary clinical entity in 58% of the patients and in 69% of the football players. Iliopsoas-related dysfunction was the primary clinical entity in 36% of the patients. Rectus abdominis-related dysfunction was found in 20 (10%) patients but it was associated with adductor-related pain in 18 of these patients. Multiple clinical entities were found in 69 (33%) patients; of these, 16 patients had three clinical entities.
Conclusions: These descriptive data extend previous findings that physical examination for groin pain can be reliable. While underscoring the prevalence of adductor-related physical examination abnormality in football players, the data highlight the prevalence of examination findings localising to the iliopsoas among this cohort. Also, the fact that combinations of clinical entities were present has important implications for treatment. The finding of multiple abnormal clinical entities also raises the possibility that earlier presentation may be prudent; it is tempting to speculate that one clinical entity likely precedes other developing entities. These data argue for the need for a trial where clinical entities are correlated with systematic investigation including MRI and ultrasonography.

Correspondence to:
P Hölmich, Department of Orthopaedic Surgery, Amager University Hospital, Copenhagen DK-2300 S, Denmark; per.holmich@ah.hosp.dk

Accepted 15 January 2007
Published Online First 26 January 2007

Although groin pain was reported as an important athletic injury at least as early as 1980 by Renström and Peterson,[1] it remains a major challenge in contemporary sports medicine. In a prospective 2-year study of injuries among 17 male football teams,[2] groin injuries comprised 5% of all injuries. Ekstrand and Gillquist[3] found in a study of 12 football teams over a 1-year period that 13% of all injuries were localised in the groin. The injury incidence rate was 18 groin injuries per 100 football players per year. Engström *et al*[4] reported 12% groin injuries and a groin injury incidence rate of 16% in a 1-year study of 64 elite football players. Among elite female football players, Engström *et al*[5] observed a groin injury incidence rate of 12%. Groin injuries are also known from other sports such as ice hockey, running, tennis, rugby, American football, basketball and others.[6–19] No comparative prospective studies are published considering matched populations and the rate of exposure between different sports. Renström and Petterson[1] described differential diagnoses among 55 athletes from different sports with groin pain. Adductor longus pain comprised 62%, rectus abdominis pain 22% and other locations 16%. Lovell,[20] in a retrospective review of 189 cases of groin pain in athletes, finds more than one diagnosis accounting for the groin pain in 27% of the patients.

A major limitation in the field of groin pain research is that there is no agreement about a scientific taxonomy. Thus, the literature provides no consensus on diagnostic criteria for the various causes of groin pain among athletes. In fact, the cause of chronic groin pain remains very much in debate and most studies are not based on systematic clinical assessments using reliable examination methods, and well-defined diagnostic entities are not reported.

Therefore, this prospective study aimed to describe the range of clinical syndromes detected when a reliable, standardised physical examination method was used to assess sports-related groin pain among 207 consecutive patients. Although clearly limited by being descriptive in nature, such a study could provide an important perspective as to the structures that warrant thorough physical examination, particularly if more than one structure is commonly found to be abnormal.

MATERIALS AND METHODS

Two hundred and seven athletes with complaints of pain located in the groin during and/or after sports activities and lasting for >2 months were referred to the author from colleagues and physiotherapists. Age, gender and sport activities were recorded.

A thorough and systematic medical history was used to seek the presence of systemic symptoms, joint symptoms, urinary symptoms, gynaecological symptoms or back pain. Data were also recorded regarding the location of pain, how the pain began, whether pain was related to certain activities (ie, certain movements in the sporting activity) or to coughing, sneezing, lifting and so on, and whether pain was present in the night and/or in the morning.

A standardised clinical protocol was used to examine all patients; tables 1 and 2 show the details of this protocol. The interobserver and intraobserver reliability of the clinical examination techniques for the adductor, iliopsoas and rectus abdominis muscles, as well as for the symphysis joint, were good in all cases.[42] The author performed all examinations. The protocol was designed to detect one or more pathoanatomical structures associated with symptoms and to exclude urological/gynaecolo-

Table 1 Diagnostic methods used in the clinical examination of 207 consecutive athletes with groin pain

Region	Diagnostic methods
Groin area in general	Inspection and palpation[21]
Iliopsoas and rectus femoris	Palpation,[42] testing against resistance,[22] Thomas' test for flexibility and pain with passive stretching,[23 42] and extension test for snapping psoas[24]
Sartorius and quadriceps femoris	Palpation and testing against resistance[23]
Adductors and rectus abdominis	Palpation of muscle bellies, tendons and insertions, testing against resistance and test for flexibility and pain with passive stretching[23 25 42]
Piriformis	Palpation, and test for flexibility and pain with passive stretching[23]
Area above the inguinal ligament and the inguinal canal	Inspection, palpation for tenderness and/or a cough impulse, in the standing and lying positions[26 27 28]
Spine	Range of motion, palpation, skin-rolling test and springing test[29 30]
Sacroiliac joints	Patrick's test, Gillet's test, sacroiliac joint shear test and forward-bending test[30–32]
Hip joints	Range of motion and pain in the positions of maximal range of motion
Pelvis	Palpation of pubic symphysis,[42] arches and tubercles
Neurology	Sensibility test, palpation for nerve entrapment[33–36]
Others	Palpation of the prostate,[37 38 39] scrotum, sacrotuberal ligament[40] and pelvic floor[41]

gical and other aetiologies. In each case, the clinical findings were compared with the non-symptomatic side. Supplementary radiographic, ultrasonographic and bone scintigraphic examinations were only used when clinically indicated (eg, a clinical suspicion of fracture, stress fracture, hip arthrosis, instability in the symphysis joint, bursitis, cancer or snapping psoas).

When more than one clinical entity was established, the author attempted to evaluate the entity that appear to be clinically responsible for the greatest component of the groin pain (1st clinical entity), and then rank conditions in a descending order of clinical importance (2nd, 3rd entity). This approach was also found to be useful by Lovell.[20]

RESULTS

Demographic variables

There were 11 women and 196 men with sports-related groin pain. The women ranged in age from 16 to 48 years, with a median age of 26 years, and the men ranged in age from 16 to 50 years, with a median age of 28 years.

Football was by far the most common sport among men, whereas running was the most common among women. Football accounted for 135 (69%) and running accounted for 30 (15%) of the men with groin pain. The women athletes included two football players, two long-distance runners, three recreational runners, one orienteering runner, one hurdle-runner, one weight lifter and one volleyball player.

Table 3 shows the distribution of the 207 patients in the different sports in relation to the two major primary clinical entities.

Primary clinical entity

Table 4 shows the distribution of the 13 different clinical entities detected. Adductor-related pain was considered the primary clinical entity in 119 (58%) patients (all men).

Table 2 Diagnostic criteria used in the examination of 207 consecutive athletes with groin pain

Clinical entity	Diagnostic criteria
Adductor-related pain	Palpatory pain at the muscle origin at the pubic bone and pain with adduction against resistance
Iliopsoas-related pain	Palpatory pain of the muscle through the lower lateral part of the abdomen and/or just distal of the inguinal ligament and pain with passive stretching during Thomas' test
Rectus abdominis-related pain	Palpatory pain of the distal tendon and/or the insertion at the pubic bone, and pain at contraction against resistance
Snapping iliopsoas	A painful snapping in the groin when extending the maximally flexed hip and visible snapping with ultrasonography
Piriformis-related pain	Palpatory pain and pain with passive stretching
Pelvic floor-related pain	Palpatory tenderness of the edge of the muscles posteriorly, and painful contraction of the muscles
Sacrotuberal ligament pain	Palpatory pain of the ligament, both through the gluteal region and through the rectum
Sacroiliac joint dysfunction	Positive Gillet's test and/or forward-bending test and pain with the Patrick's test and/or the sacroiliac shear test
Pain of thoracolumbar origin	Pain at the level of thoracic segment 10 to lumbar segment 1 with the skin-rolling test, and the facet joint palpation and the springing test
Hip arthrosis	Radiological signs of arthrosis, subchondral sclerosis, subchondral cysts, narrowed joint space and osteophytes
Stress fracture	Bone scintigraphic signs of a stress fracture and palpatory pain at the corresponding anatomical site
Hernia	The presence of a visible and/or palpable inguinal mass and/or when a massive cough impulse was present
Sports hernia	No hernia present (as described above) 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

Table 3 Major primary clinical entities in relation to sports in 207 consecutive athletes with groin pain

Sport	Diagnosis			Total (%)
	Adductor-related pain	Iliopsoas-related pain	Other clinical entities	
Football	94	35	8	137 (66.2)
Running	7	25	5	37 (17.9)
Badminton	3	4	0	7 (3.4)
Handball	3	2	0	5 (2.4)
Karate, Taekwondo	2	2	0	4 (1.9)
Tennis	3	0	0	3 (1.4)
Rugby	2	0	0	2 (1.0)
Volleyball	0	2	0	2 (1.0)
Football referee	0	1	0	1 (0.5)
Ice hockey	1	0	0	1 (0.5)
Basketball	1	0	0	1 (0.5)
Decathlon	1	0	0	1 (0.5)
Cricket	0	1	0	1 (0.5)
Weight lifting	0	0	1	1 (0.5)
Horseback riding	1	0	0	1 (0.5)
Hockey	1	0	0	1 (0.5)
Long-distance bicycling	0	1	0	1 (0.5)
Triathlon	0	0	1	1 (0.5)
Total (%)	119 (57.5)	73 (35.3)	15 (7.2)	207 (100)

Iliopsoas-related pain was the primary clinical entity in 73 (35%) patients. Other primary clinical entities were relatively rare. Among women, iliopsoas-related pain was the primary clinical entity in nine cases, one woman had a snapping psoas and one had a stress fracture of the inferior pubic bone. Although prevalent among men, adductor-related pain was uncommon among female athletes (one case, secondary to iliopsoas-related pain).

Secondary and tertiary clinical entity

A secondary and, at times tertiary, clinical entity was found in 69 (33%) patients. Iliopsoas-related pain was the most frequent of these additional clinicial entities, but pain related to the rectus abdominis muscle was also found. In all, 16 (8%) patients had a tertiary clinical entity. Table 4 shows the distribution of secondary and tertiary entities. A total of 48 patients had iliopsoas-related pain as secondary or tertiary clinical entity, 46 of these had the adductors as the primary origin of pain. This systematic approach never revealed more than three clinical entities in any patient explaining the groin pain.

Among football players, specifically, adductor-related pain was the most common primary entity (69%), and iliopsoas-related pain was the major secondary clinical entity (60%; table 5). In this population, iliopsoas-related pain was the primary origin of pain in 26%. Pain related to the rectus abdominis was found in 20 patients, 15 of whom were football players. In 18 patients, the rectus abdominis-related pain was considered to be a secondary clinical entity, and in 17 patients, it was secondary to adductor-related pain. In all, 37 runners were examined (long distance, middle distance, recreational, orienteering, hurdles and sprint), and among these, iliopsoas was the most prevalent clinical entity accounting for two-thirds. In all, seven of the 11 female patients examined in this study were runners and six of these had iliopsoas as their primary origin of pain.

DISCUSSION

This prospective assessment of 207 consecutive athletes with groin pain used a reliable method of physical examination,[42] which extends previous comparable clinical studies in number and in method. An innovation in this study is the approach to determine ''clinical entities'' rather than to make a diagnosis of the tissue. This approach has been used successfully in other clinical settings where it is difficult to ascertain the pathology clinicially (eg, lumbar back pain).

Adductor-related pain was the most prevalent finding; importantly, over 40% of the patients in this study had more than one abnormal clinical entity. Thus, iliopsoas-related pain, pain in the lower abdomen radiating into the groin and other multiple clinical entities also seemed to contribute to the symptoms, even though they were most often not considered the primary clinical entity.

Adductor-related pain and osteitis pubis

The author eschews the use of the term ''osteitis pubis''; that term should be reserved for describing a diagnosis of a complication due to surgery in the retropubic and parapubic regions.[43–49] In multiple studies, mainly case reports, osteitis pubis has been used as the diagnostic term for groin pain in athletes[15 50–54] when the radiological findings are similar to those found in the original osteitis pubis. In many of the studies describing osteitis pubis as a diagnosis of groin pain in athletes, adductor-related symptoms are at least present, and often dominant.[20 50 51 55–58]

The current literature is not in agreement with the definition relating to the term ''osteitis pubis''. Lloyd-Smith *et al*[57] retrospectively assessed 204 patients with hip and pelvic injuries, and suggest that osteitis pubis is a diagnosis that should be considered with adductor-strain pain that is severe or atypical. Fricker *et al*[58] retrospectively assessed 59 patients diagnosed as osteitis pubis, the majority being classified as sport related. The most-frequent symptoms and signs used to describe these patients were tenderness at the symphysis pubis and adductor pain, either as tenderness at the origin or as pain when tested for adductor strength. Harris *et al*,[55] in a radiological study of the pubic symphysis mainly in football players, reported radiological abnormalities claimed to be ''diagnostic'' of traumatic osteitis pubis. The symptoms were pain produced by stretching of the adductors, tenderness over the symphysis pubis and at the ischiopubis ramus (the insertion of the adductor longus and gracilis). Lovell *et al*[59] reported a high prevalence of bone marrow oedema at the pubic symphysis with MRI in a group of asymptomatic football players. There was no clear relation between the amount of oedema and groin symptoms. McCarthy and Dorfman[56] describe osteitis pubis as ''a broader diagnostic category that encompasses several different aetiological entities in or near the

Table 4 Primary, secondary and tertiary clinical entities in 207 consecutive athletes with groin pain

Clinical entity	Primary, n (%)	Secondary, n (%)	Tertiary, n (%)
Adductor-related pain	119 (57.5)	7 (3.4)	
Iliopsoas-related pain	73 (35.3)	40 (19.3)	8 (3.9)
Sports hernia	3 (1.4)		1 (0.5)
Snapping Iliopsoas	2 (1)		
Pelvic floor-related pain	2 (1)		
Rectus abdominus-related pain	2 (1)	12 (5.8)	6 (2.9)
Sacrotuberal ligament pain	1 (0.5)	6 (2.9)	1 (0.5)
Sacroiliac joint dysfunction	1 (0.5)	1 (0.5)	
Hip arthrosis	1 (0.5)	2 (1)	
Pain of thoracolumbar origin	1 (0.5)		
Hernia	1 (0.5)		
Piriformis-related pain		1 (0.5)	
Stress fracture	1 (0.5)		
Total	207 (100)	69 (33.3)	16 (7.7)

Table 5 Primary, secondary and tertiary clinical entity in 137 consecutive football players with groin pain

Clinical entity	Primary, n (%)	Secondary, n (%)	Tertiary, n (%)
Adductor-related pain	94 (68.6)	4 (2.9)	
Iliopsoas-related pain	35 (25.5)	31 (22.6)	6 (4.4)
Sports hernia	2 (1.5)		1 (0.7)
Snapping Iliopsoas	1 (0.7)		
Pelvic floor-related pain	1 (0.7)		
Rectus abdominus-related pain	1 (0.7)	11 (8)	3 (2.2)
Sacrotuberal ligament pain	1 (0.7)	4 (2.9)	1 (0.7)
Sacroiliac joint dysfunction	1 (0.7)		
Hip arthrosis		1 (0.7)	
Pain of thoracolumbar origin			
Hernia	1 (0.7)		
Piriformis-related pain		1 (0.7)	
Stress fracture			
Total	137 (100)	52 (38)	11 (8)

symphysis''. These positions suggest that athletes with ''groin pain related to the adductors'' and athletes diagnosed as having osteitis pubis may, at least in part, be having diagnostically overlapping entities. Robinson *et al*[60] have shown that the symptoms and abnormalities in the pubic bone on MRI correlates significantly and reproducibly with the symptomatic adductor enthesis. Therefore, this author contends that the term ''osteitis pubis'' should be reserved to describe a radiological sign rather than a diagnostic entity in this group of patients.

Iliopsoas-related pain

Iliopsoas-related pain was the primary clinical entity found in one-third of the patients and the secondary and tertiary clinical entity in 55% of patients; it was the major problem among the group of runners. This prevalence is consistent with that reported among runners,[57] in which iliopsoas injury proved to be the most common soft-tissue injury cause of groin pain. A major hip flexor, the iliopsoas is a very important muscle in the process of running and, as such, at risk of being over-used.[9 18 61 62] The high incidence of adductor-related and iliopsoas-related pains in the same patients could indicate a high degree of dependence between these two muscles in relation to pelvic stability.[18 63 64] Iliopsoas-related pain can mimic other conditions such as gynaecological disorders, appendicitis or hernia.[62 65]

Hernia and lower abdominal pain

Hernias in the classic sense and sports hernia were seen in one and four patients, respectively. The sports hernia or sportsman's groin or sportsman's hernia[26 66 67] has been described as a common diagnosis in otherwise-unexplained groin pain. The signs are tenderness above the inguinal ligament, lateral and superior to the pubic tubercle and/or lower abdominal pain radiating into the upper medial aspect of the thigh. The operative findings are a deficient posterior inguinal wall[26], in some cases with a split conjoint tendon.[27 67 68] A number of patients diagnosed with iliopsoas injury in the present study complained of lower lateral abdominal pain and palpatory pain of the psoas in the lower abdomen. In all, 20 patients had rectus abdominis pain with contraction against resistance and tenderness at the distal insertion of the rectus abdominis. The similarity of the symptoms found in patients with iliopsoas pain, rectus abdominis pain and sports hernia calls for an evaluation of the diagnostic methods used in these cases.

What is already known on this topic

- Long-standing groin pain is a hot topic in sports medicine because it prevents many active people from following their recreational and professional pursuits.
- Systematic physical examination in patients with activity-related groin pain is reliable both within and between trained assessors.

What this study adds

- An attempt to classify long-standing groin pain in athletes into diagnostic entities related to various anatomical structures.
- The use of a standardised and reliable examination programme finds multiple diagnostic entities in one-third of patients.
- In football, adductor-related groin pain was the most common primary entity, and in runners the most common was iliopsoas-related groin pain.
- Iliopsoas-related groin pain was found in 58% of the athletes in this prospective series of 206 athletes and is important diagnostic entity to consider.

Multiple clinical entities

Multiple origins of the groin pain were found in several patients, 34% had two clinical entities and 8% had three clinical entities. Whether this extent of pathology reflects chronicity of cases or the referral bias to the author cannot be known. Nevertheless, it is consistent with Ekberg *et al*[37] who speculated that long-standing groin pain in athletes can be the result of more than one disease, and needs a multidisciplinary approach. The diagnoses of prostatitis or hernia were found in 50% of their patients. In this study, there were no patients with prostatitis and few (5) patients with hernia or sports hernia. Most of the diagnoses were instead associated with the pelvis and with the muscles and ligaments connected to the pelvis.

The pelvis contributes greatly within sports biomechanics[63 69–71] as most movements depend to some degree on a well-balanced pelvis that requires the complex orchestration of different muscle groups, ligaments and joints. It is tempting to speculate that if one of these structures is injured and not functioning optimally, the balance around the pelvis will be disturbed and place other pelvis-related structures at risk.[55 64 72–75] This might explain why more than one origin of pain was found in more than one-third of the patients. But the study design does not allow for any conclusions to be drawn. In some patients, a secondary clinical entity was found that might be a precipitating factor for the entity considered to be the primary. This could be the case in the two patients with hip arthrosis, perhaps leading to the development of a pain of thoracolumbar origin and iliopsoas-related pain, respectively.

Limitations of the study have been outlined and include the fact that there is no ''gold standard'' against which the diagnostic entities can be validated. Also, the referral pattern to the author may not reflect the one in Denmark or in other parts of Europe and the world. Thus, the sample is at risk of ascertainment bias. Future studies will reveal the degree of homogeneity in the diagnostic entities among patients with chronic groin pain in various nations worldwide. Also, it is acknowledged that the ranking of primary, secondary and

tertiary clinical entities has not been formally tested. For this reason, the main conclusions are independent of this ranking.

In summary, this clinical study extends previous work because of its size, prospective nature and validated examination protocol. It provides the first attempt to move the clinical evaluation of long-standing groin pain from a ''diagnostic label'' paradigm to one where ''diagnostic entities'' are considered. This may, more accurately, reflect diagnostic limits, but further studies using a gold standard are needed to address that question fully. A major clinical implication of this study is the fact that multiple entities are present in well over one third of patients. This behoves clinicians to thoroughly examine the iliopsoas and other regions, even when one cause has been found for a patient's long-standing groin pain. The author also argues against the continued use of the term ''osteitis pubis''. Along with terms like ''shin splints'', this term may be permanently poisoned because of the range of meanings attributed to it. In the future taxonomy, there may not be room for the term ''osteitis pubis'' per se. Future research that adopts a similar ''clinical entity'' approach to patients, and also systematically images them (eg, MRI and ultrasonography) would be very useful.

ACKNOWLEDGEMENTS

This study was supported by grants from the Danish Research Council of Sport, The Danish Sports Federation (DIF) and The Scientific Commission of Team Denmark.

I thank Kim Krogsgaard and Christian Gluud for their helpful suggestions during the preparation of the manuscript.

Competing interests: None declared.

REFERENCES

1 **Renström P**, Peterson L. Groin injuries in athletes. *Br J Sports Med* 1980;**14**:30–6.
2 **Renström P**, Peterson L. Fotbollsskador - frekvens och art. *Läkartidningen* 1980;**77**:3621–30.
3 **Ekstrand J**, Gillquist J. Football injuries and their mechanisms: a prospective study. *Med Sci Sports Exerc* 1983;**15**:267–70.
4 **Engström B**, Forssblad M, Johansson C, *et al*. Does a major knee injury definitely sideline an elite football player? *Am J Sports Med* 1990;**18**:101–5.
5 **Engström B**, Johansson C, Törnkvist H. Football injuries among elite female players. *Am J Sports Med* 1991;**19**:372–5.
6 **Emery CA**, Meeuwisse WH, Powell JW. Groin and abdominal strain injuries in the National Hockey League. *Clin J Sport Med* 1999;**9**:151–6.
7 **Simonet WT**, Saylor III HL, Sim L. Abdominal wall muscle tears in hockey players. *Int J Sports Med* 1995;**16**:126–8.
8 **Lysholm J**, Wiklander J. Injuries in runners. *Am J Sports Med* 1987;**15**:168–71.
9 **Balduini FC**. Abdominal and groin injuries in tennis. *Clin JSport Med* 1988;**7**:349–57.
10 **Ashby EC**. Chronic obscure groin pain is commonly caused by enthesopathy: 'tennis elbow' of the groin. *Br J Surg* 1994;**81**:1632–4.
11 **Dixon M**, Fricker P. Injuries to elite gynmnasts over 10 yr. *Med Sci Sports Exerc* 1993;**25**:1322–9.
12 **O'Connor D**. Groin injuries in professional rugby league players: a prospective study. *J Sports Sci* 2004;**22**:629–36.
13 **Rizio L III**, Salvo JP, Schurhoff MR, *et al*. Adductor longus rupture in professional football players: acute repair with suture anchors: a report of two cases. *Am J Sports Med* 2004;**32**:243–5.
14 **Orchard JW**, Read JW, Neophyton J, *et al*. Groin pain associated with ultrasound finding of inguinal canal posterior wll deficiency in Australian Rules Football. *Br J Sports Med* 1998;**32**:134–9.
15 **Major NM**, Helms CA. Pelvic stress injuries: the relationship between osteitis pubis (symphysis pubis stress injury) and sacroiliac abnormalities in athletes. *Skeletal Radiol* 1997;**26**:711–17.
16 **Howse AJG**. Osteitis pubis in an olympic road-walker. *Proc R Soc Med* 1964;**57**:88–90.
17 **Grote K**, Lincoln TL, Gamble JG. Hip adductor injury in competitive swimmers. *Am J Sports Med* 2004;**32**:104–8.
18 **C Bradshaw PH**. Longstanding groin pain. In: P Brukner, Khan K, eds. *Clinical sports medicine*. Sydney: McGraw-Hill, 2006:405–26.
19 **Weiss BD**. Nontraumatic injuries in amateur long distance bicyclists. *Am J Sports Med* 1985;**13**:187–92.
20 **Lovell G**. The diagnosis of chronic groin pain in athletes : a review of 189 cases. *Aust J Sci Med Sport* 1995;**27**:76–9.
21 **Lewis MM**, Reilly JF. Sports tumors. *Am J Sports Med* 1987;**15**:362–5.
22 **Mozes M**, Papa MZ, Zweig A, *et al*. Iliopsoas injury in football players. *Br J Sports Med* 1985;**19**:168–70.
23 **Kendall FP**, McCreary EK. Lower extremity muscles. In: Kendall FP, McCreary EK, eds. *Muscles—testing and function*. Baltimore, MD: Williams and Wilkins, 1983:158–79.
24 **Taylor GR**, Clarke NMP. Surgical release of the ''snapping iliopsoas tendon''. *J Bone Joint Surg* 1995;**77b**:881–3.
25 **Kendall FP**, McCreary EK. Trunk muscles. In: Kendall FP, McCreary EK, eds. *Muscles—testing and function*. Baltimore, MD: Williams and Wilkins, 1983:189–204.
26 **Malycha P**, Lovell G. Inguinal surgery in athletes with chronic groin pain: the ''sportsman's'' hernia. *Aust N Z J Surg* 1992;**62**:123–5.
27 **Polglase AL**, Frydman GM, Farmer KC. Inguinal surgery for debilitating chronic groin pain in athletes. *Med J Aust* 1991;**155**:674–7.
28 **Williams P**, Foster ME. ''Gilmore's groin''—or is it? *Br J Sports Med* 1995;**29**:206–8.
29 **Maigne R**. Low back pain of thoracolumbar origin. *Arch Phys Med Rehabil* 1980;**61**:389–95.
30 **Greenman PE**. Principles of manual medicine. In: Butler JP, eds. *Principles of manual medicine*. Baltimore, MD: Williams & Wilkins, 1996.
31 **Lidgren L**, Andrén-Sandberg Å. Akut bäckenosteomyelit orsakad av Staphylococcus aureus hos handbolls-och fotbollsspelare. *Läkartidningen* 1981;**78**:3601–2.
32 **Bernard TN**, Cassidy JD. The sacroiliac joint syndrome. In: Frymoyer JW, eds. *The adult spine, principles and practice*. New York: Raven, 1991:2107–30.
33 **Pecina M**, Bojanic I, Markiewitz AD. Nerve entrapment syndromes in athletes. *Clin J Sport Med* 1993;**3**:36–43.
34 **Mumenthaler A**, Mumenthaler M, Luciani G, *et al*. Das Ilioinguinalis-syndrom. *Deutsche Med Wschr* 1965;**24**:1073–8.
35 **Westman M**. Ilioinguinalis och genitofemoralis neuralgi. *Läkartidningen* 1970;**67**:5525–30.
36 **Kopell HP**, Thompson WAL, Postel AH. Entrapment neuropathy of the ilioinguinal nerve. *N Engl J Med* 1962;**266**:16–19.
37 **Ekberg O**, Persson NH, Abrahamsson P-A, *et al*. Longstanding groin pain in athletes - a multidisciplinary approach. *Sports Med* 1988;**6**:56–61.
38 **Abrahamsson PA**, Westlin N. Symphysitis and prostatitis in athletes. *Scand J Urol Nephrol* 1985;**19**:42.
39 **Stamey TA**. Prostatitis. *J Royal Soc Med* 1981;**74**:22–40.
40 **Midttun A**, Træden JB, Bojsen-Møller F. Syndroma ligamenti sacrotuberalis. *Danske Fysioterapeuter* 1983;**1**:7–11.
41 **Sim FH**, Scott SG. Injuries of the pelvis and hip in athletes:anatomy and function. In: Nicholas JA, Hershmann EB, eds. *The lower extremity and spine in sports medicine*. St Louis, MO: CV Mosby, 1986:1119–69.
42 **Hölmich P**, Hölmich LR, Bjerg AM. Clinical examination of athletes with groin pain: an intraobserver and interobserver reliability study. *Br J Sports Med* 2004;**38**:446–51.
43 **Peirson EL**. Osteochondritis of the symphysis pubis. *Surg Gynecol Obstet* 1929;**49**:834–7.
44 **Merimsky E**, Canetti R, Firstater M. Osteitis pubis: treatment by heparinisation. *Br J Urol* 1981;**53**:154–6.
45 **Nissenkorn I**, Servadio C, Lubin E. The treatment of osteitis pubis with heparin. *J Urol* 1981;**125**:528–9.
46 **Rosenthal RE**, Spickard WA, Markham RD, *et al*. Osteomyelitis of the symphysis pubis: a separate disease from osteitis pubis. *J Bone Joint Surg* 1982;**64-A**:123–8.
47 **Steinbach HL**, Petrakis NL, Gilfillan RS, *et al*. The pathogenesis of osteitis pubis. *J Urol* 1955;**74**:840–6.
48 **Bouza E**, Winston DJ, Hewitt WL. Infectious osteitis pubis. *Urology* 1978;**12**:663–9.
49 **Coventry MB**, Mitchell WC. Osteitis pubis. *JAMA* 1961;**178**:898–905.
50 **Batt ME**, McShane JM, Dillingham MF. Osteitis pubis in collegiate football players. *Med Sci Sports Exerc* 1995;**27**:629–33.
51 **Hanson PG**, Angevine M, Juhl JH. Osteitis pubis in sports activities. *Physician Sportsmed*, 1978;111–14..
52 **Julsrud ME**. Osteitis pubis. *J Am Podiatr Med Assoc* 1986;**76**:562–5.
53 **Eismann H-J**, Riedeberger J, Büttner K, *et al*. Zur ätiologie, symptomalogie, differentialdiagnose, therapie und prophylaxe des ''leistenschmerzes'' bei jugendlichen fussballspielern. *Med U Sport* 1972;**12**:80–4.
54 **Holt MA**, Keene JS, Graf BK, *et al*. Treatment of osteitis pubis in athletes, results of corticosteroid injections. *Am J Sports Med* 1995;**23**:601–6.
55 **Harris NH**, Murray RO. Lesions of the symphysis in athletes. *BMJ* 1974;**4**:211–14.
56 **McCarthy B**, Dorfman HD. Pubic osteolysis - a benign lesion of the pelvis closely mimicing a malignant neoplasm. *Clin Orthop* 1990;**251**:300–7.
57 **Lloyd-Smith R**, Clement DB, McKenzie DC, *et al*. A survey of overuse and traumatic hip and pelvic injuries in athletes. *Physician Sportsmed* 1985;**13**:131–41.
58 **Fricker PA**, Taunton JE, Ammann W. Osteitis pubis in athletes. *Sports Med* 1991;**12**:266–79.
59 **Lovell G**, Galloway H, Hopkins W, *et al*. Osteitis pubis and assessment of bone marrow edema at the pubic symphysis with MRI in an elite junior male football squad. *Clin J Sport Med* 2006;**16**:117–22.
60 **Robinson P**, Barron DA, Parsons W, *et al*. Adductor-related groin pain in athletes: correlation of MR imaging with clinical findings. *Skeletal Radiol* 2004;**33**:451–7.
61 **Zimmerman G**. Groin pain in athletes. *Aust Fam Physician* 1988;**17**:1046–52.
62 **Dawson DJ**, Khan AN, Shreeve DR. Psoas muscle hypertrophy: mechanical cause for ''jogger's trots?''. *BMJ* 1985;**291**:787–8.
63 **Morrenhof JW**. *Stabilisation of the human hip-joint* [Dissertation]. Rijksuniversiteit te Leiden, 1989:1–78.

64 **Andersson E**, Oddsson L, Grundström H, *et al*. The role of the psoas and iliacus muscles for stability and movement of the lumbar spine, pelvis and hip. *Scand J Med Sci Sport* 1995;**5**:10–16.
65 **Bonde B**, Svith M. The effect of two physiotherapy treatments on the iliopsoas muscle. [Effekten af to fysioterapeutiske behandlingsformer på m. iliopsoas.] *Danske Fysioterapeuter*, 1985;**11**:4–11.
66 **Thomas JM**. Groin strain versus occult hernia: uncomfortable alternatives or incompatible rivals. *Lancet* 1995;**345**:1522–3.
67 **Edelman DS**, Selesnick H. ''Sports'' hernia: treatment with biologic mesh (Surgisis): a preliminary study. *Surg Endosc* 2006;**20**:971–3.
68 **Taylor DC**, Meyers WC, Moylan JA, *et al*. Abdominal musculature abnormalities as a cause of groin pain in athletes. *Am J Sports Med* 1991;**19**:239–42.
69 **Cristofolini L**, Viceconti M, Toni A, *et al*. Influence of thigh muscles on the axial strains in a proximal femur during early stance in gait. *J Biomech* 1995;**28**:617–24.
70 **Neumann DA**, Hase AD. An electromyographic analysis of the hip abductors during load carriage: implications for hip joint protection. *J Orthop Sports Phys Ther* 1994;**19**:296–304.
71 **Hess H**. Leistenschmerz - ätiologie, differentialdiagnose und therapeutische möglichkeiten. *Orthopäde* 1980;**9**:186–9.
72 **Leetun DT**, Ireland ML, Willson JD, *et al*. Core stability measures as risk factors for lower extremity injury in athletes. *Med Sci Sports Exerc* 2004;**36**:926–34.
73 **Willson JD**, Dougherty CP, Ireland ML, *et al*. Core stability and its relationship to lower extremity function and injury. *J Am Acad Orthop Surg* 2005;**13**:316–25.
74 **LaBan MM**, Meerschaert JR, Taylor RS, *et al*. Symphyseal and sacroiliac joint pain associated with pubic symphysis instability. *Arch Phys Med Rehabil* 1978;**59**:470–2.
75 **Schwarzer AC**, Aprill CN, Bogduk N. The sacroiliac joint in chronic low back pain. *SPINE* 1995;**1**:31–7.

COMMENTARY

Groin pain is today a major and probably an increasing problem in several sports that require cutting and change of direction activities, such as football (soccer), ice hockey, team handball and rugby. This may be related to more frequent match playing, increased training intensity and shorter time for recovery. The increasing importance of preventive action has been pointed out by many.

The problems associated with long-standing groin pain are often related to the fact that the symptoms seen in athletes with groin pain are often vague and diffuse. It is often difficult to identify the exact cause for the groin pain. The complex anatomy of the hip and groin region, combined with the frequently varying symptoms, makes an accurate diagnosis and appropriate management difficult. It is often a challenge to make the correct diagnosis. This requires clinical experience and a sound knowledge of possible differential diagnoses and of evidence-based medicine in the field. This paper by Hölmich is therefore a very timely paper of a very complex and difficult clinical problem. The author presents an innovative and well thought-out approach to make a correct diagnosis, which can be instrumental and valuable for sport physicians.

Because of the difficulties in making a correct diagnosis and with the complex aetiology of the injury causing groin pain, there is a clear trend for both athletes and the physicians to loose their patience and look for a quick solution. This has resulted in a changed management, especially in professional sports as many today recommend the use of early surgery. This is done sometimes before the physician has secured a well-founded diagnosis. This fact makes the Hölmich study even more valuable.

It is important to be well educated and to have a good knowledge and experience of different differential diagnoses around the groin. Multiple tissues may be involved in generating the injury causing the pain in the groin. The authors have used a very standardised and validated approach to making the diagnosis. This technique is very valuable for locating the specific muscle–tendon problems around the groin. These are important to exclude. The muscle–tendon problems are often associated with other common causes of groin pain, such as incipient sports hernia associated with insufficient posterior inguinal wall and osteitis pnbis. In these cases, the history combined with a directed and systematic clinical examination may be very helpful. This article by Hölmich is a valuable step forward in the management of the very difficult and increasing clinical problem of long-standing groin pain.

Per A Renström
Stockholm Center for Sports Trauma Research, Karolinksa Institute, Stockholm, Sweden; per.renstrom@ki.se