Sportsman's hernia: an entity to be defined, diagnosed and treated properly?

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Abstract

Athletes and other physically active people often suffer prolonged inguinal pain which can become a serious debilitating condition and may place an athletic career at risk. A sportman's hernia is a controversial cause of this chronic groin pain, being difficult to define. The balance between the adductor and abdominal muscles is of great importance in this entity, as well as the elasticity of the pubic symphysis and the weakness of the posterior abdominal wall of the inguinal area, but different factors have been related to the presence of pain in these patients. A multidisciplinary approach to this entity is recommended, since the present literature does not supply the proper diagnostic studies and the correct treatment that should be performed in these patients, although the endoscopic totally preperitoneal approach (TEP) with mesh has been proposed as a solution to this problem.

Key words: sportman's hernia, groin pain, posterior inguinal wall, imbalance, totally preperitoneal approach.

Definition

Groin pain is defined as tendon enthesitis of the adductor longus muscle and/or abdominal muscles that may lead to degenerative arthropathy of the pubic symphysis in an advanced stage. The pubic region is a point where kinematic forces cross. The balance between the adductor and abdominal muscles is of great importance, as well as the elasticity of the pubic symphysis, which enables movement of up to 2 mm and rotation of up to 3 degrees. Weakness of the abdominal muscle wall, known as sportsman's hernia, is the most common cause of painful groin [1].

Athletes often suffer prolonged inguinal pain which can become a serious debilitating condition and may place an athletic career at risk. As has been said in most cases the pain originates from a musculoskeletal problem [2]. However, for some patients it has been suggested that the aetiology is a weakness of the inguinal canal.

Sportsman's hernia (SH) is a controversial cause of chronic groin pain in athletes [3] and other physically active people. This chronic groin pain in athletes constitutes a major diagnostic and therapeutic challenge; there is no evidence-based consensus available to guide decision-making and most studies are Level IV [4]. The pathology presents in most cases as chronic groin pain that flares with activity and does not hurt during periods of inactivity [5]. The definition of sportsman's hernia is very variable. This term has been used to describe a weakness or disruption of the musculotendinous part of the posterior inguinal wall, which causes persistent groin pain in athletes [6]. Other definitions are an imminent, but not demonstrable, inguinal hernia [7]; a syndrome caused by a distension

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of the posterior inguinal wall, effectively an early direct inguinal hernia [8]; a patient presented with symptoms similar to hernia, but did not have a hernia at the time of surgical exploration [9]; a tear in the transversalis fascia that was not evident in preoperative physical exam [10].

Although there are several reports of SH in women [8], it is almost exclusively found in men [3]. Groin pain was also found to be associated with increasing age in some studies [11].

Approximately 2.5% of all sport-related injuries are in the pelvic area [12]. Sports injuries to the hip and groin region, including SH, occur most commonly in athletes participating in sports involving side-to-side cutting, quick accelerations and decelerations, and sudden directional changes [13]. Most commonly seen in soccer [3, 7, 14-21] and ice hockey players [3, 7, 22, 23], SH can be encountered in a variety of sports and in a variety of age groups, such as Australian footballers [24, 25], runners [18], basketball players [18], baseball players [18], and rugby players [20, 26], but in some series the majority are recreational athletes [18].

Aetiopathology

Most common groin injuries are soft tissue injuries, such as muscular strains, tendinitis, or contusions. But more difficult areas to pinpoint are such entities as osteitis pubis, nerve entrapment, "sports hernia", avulsion fractures, intra-articular hip disorder [10], lumbosacral spine pathology [27] or even the detection of prostatitis.

The most common causes of groin pain include:

- referral of pain from internal organs;
- due to lesions of the symphysis of the pubis; this lesion may be the result of strain of tendons, ligaments and fascias, and this may predispose to an inguinal hernia as well [15]; these avulsion fractures of the apophyses occur through the relatively weaker growth plate in adolescents, most of which will heal with a graduated physical therapy programme and do not need surgery [28], but also this osteitis pubis is characterised by sclerosis and bony changes about the pubic symphysis [28];
- due to stress fractures of the bones of the pelvis, particularly after a sudden increase in the intensity of training; most of these stress fractures will heal with rest, but femoral neck stress fractures can potentially lead to more serious problems, and require closer evaluation and sometimes surgical treatment [28];
- due to nerve compression of the nerves supplying the groin; in cases that do not respond to desensitisation measures, neurolysis can relieve the pain [28];
- due to adductor strains, which are common problems in kicking sports such as soccer;
- or occult hernia, so-called "sports hernia".

As has been analyzed, nerve entrapment could also be involved in chronic inguinal pain, on the ventral surface of the scrotum and the proximal ventro-medial surface of the thigh. However, since few reports discuss the detailed course of the nerves in association with the pain, Akita *et al.* [29] examined the cutaneous branches in the inguinal region in 54 halves of 27 adult male cadavers. From their results, in addition to the cutaneous branches from the ilioinguinal nerve (in 49 of 54, 90.7%), cutaneous branches originating from the genital branches of the genitofemoral nerve were found in the inguinal region in 19 of 54 halves (35.2%). In 7 cases (in 7 of 54, 13.0%) the genital branch and the ilioinguinal nerve united in the inguinal canal. In 6 cases the genital branch pierced the inguinal ligament to enter the inguinal canal, and in three cases the genital branch pierced the border between the ligament and the aponeurosis of the m. obliquus externus to be distributed to the inguinal region. Therefore, the courses of the genital branches vary considerably, and may have a very important role in chronic groin pain produced by groin hernia. In addition, entrapment by the ligament may be a reasonable candidate for the cause of chronic groin pain.

On the other hand, sportsman's hernias are unique because the injury is not identifiable on physical exam or imaging [5]. The basic pathology of a sportsman's hernia varies from one author to another, including the presence of an occult hernia, a tear in the transversalis fascia [5, 10] or a muscle strain [9].

Diagnosis

Diagnosis of chronic groin pain is difficult, but early diagnosis is very important since morbidity will be reduced. These groin injuries are some of the most challenging injuries in the field of sports medicine, and the literature provides no consensus on definitions of or diagnostic criteria for groin pain in athletes [12].

Management of groin injuries can be challenging, and diagnosis can be difficult because of the degree of overlap of symptoms between the different problems [28]. This clinical setting demands the recruitment of a team with experience of different aspects of groin pain. Ekberg *et al.* [30] established a multidisciplinary investigation in order to reveal the underlying cause. These examinations included general surgeons for detection of inguinal hernia and neuralgia, orthopaedic surgeons for detection of adductor tenoperiostitis and symphysitis, a urologist for detection of prostatitis, a radiologist for performing different imaging tests, and nuclear medicine for isotope studies. In this study, in 19 out of 21 patients, there was a positive diagnosis for 2 or more of the diseases (10 patients had 2 diseases, 6 patients had 3 diseases, 3 patients had 4 diseases), and two patients had only signs of symphysitis. These results show the complexity of longstanding groin pain in athletes. For all these reasons, SH is largely a clinical diagnosis of exclusion [3].

This condition (SH) must be distinguished from the more common osteitis pubis and musculotendinous injuries [6]. But the first step is to determine the differential diagnosis of hip and groin pain with respect to the high frequency of referred pain from the lumbar spine, lower abdomen, and pelvis [31], which is very difficult in some cases. A systematic approach to the hip and groin area is important to identify the origin of pain. Both the history and quality of symptoms and the physical exam are the basis of the diagnostic algorithm, completed in some cases with diagnostic work-up with roentgenograms and possibly an injection with a local anaesthetic to the suspected origin of pain [31]. There are clinical signs in the diagnosis of nerve pathologies, such us obturator neuropathies. These patients usually show clinical symptoms and signs of post-exercise groin, lower abdominal or medial tight pain and adductor muscle weakness and paraesthesia in cutaneous distribution of the medial thigh. Apart from clinical signs in the diagnosis of obturator neuropathy, diagnostic local anaesthetic block and electromyography have been used [32].

History of chronic groin pain that is non-responsive to treatment should raise the suspicion of SH, but physical examination findings are subtle and most diagnostic tests do not definitively confirm the diagnosis [3]. Prior to surgery, patients could be assessed by history, clinical examination, pelvic X-ray, bone scanning with technetium, ultrasound of the inguinal region [14], computed tomography, or magnetic resonance.

Physical examination

Physical examination is the first step in the diagnosis of groin pain, although symptoms are often vague and diffuse [12]. When active, sportsmen start to feel a dull pain in the groin region. The clinical assessment of groin pain in athletes is difficult, with the lack of specific clinical tests being in part responsible. The examinations could include evaluation of adductor muscle related pain and strength, iliopsoas muscle related pain, strength, and flexibility, abdominal muscle related pain, and strength and pain at the symphysis joint, but the only test without acceptable inter-observer reliability was the strength test for iliopsoas muscle [33].

Basically three pain provocation tests are described in the diagnosis of chronic groin pain [34], called the single adductor, squeeze and bilateral adductor tests. The adductor test is of great importance for physical examination; the patient should be lying supine with his hips abducted and flexed at 80 degrees [1]. The test is positive if the patient, while attempting to pull his/her legs against pressing in the opposite direction, feels a sharp pain in the groin. Gradual physical therapy combined with pharmacotherapy should be effective in most cases and should be part of the diagnostic process. This process includes non-steroid anti-inflammatory drugs and muscle relaxants. A physical therapy programme usually involves stretching and strengthening of adductor muscles, abdominal wall muscles, iliopsoas muscle, quadriceps, and hamstrings. If physical therapy and pharmacotherapy fail, different tests should be performed.

Ultrasound

Ultrasound is a useful adjunct in evaluating the groin for hernia. The overall accuracy in finding a hernia of any kind by ultrasound is 92% and, on the other hand, this imaging test identifies the pathology in a groin without a palpable bulge at an accuracy of 75% [35]. Dynamic ultrasound examination is able to detect inguinal canal posterior wall deficiency in young males with no clinical signs of hernia with chronic groin pain. Orchard *et al.* [11] found a correlation between bilateral deficiency

of the posterior wall and groin pain, although a temporal relationship between the clinical and ultrasound findings was not established by this study. Ultrasound seems to show promise as a diagnostic tool in athletes with chronic groin pain who are considered possible candidates for hernia repair.

Computed tomography scan and magnetic resonance imaging

Other authors has proposed the use of other diagnostic techniques, but the costs of computed tomography (CT) and magnetic resonance imaging (MRI) are such that their routine use for assessment of patients with groin pain cannot be justified [6]. The use of CT scans could help to identify posterior inguinal wall deficiencies and hernias in some cases [36] and they may be employed in difficult cases to help define the anatomical extent of a groin injury [6].

Magnetic resonance imaging provided an accurate depiction of pubic bone alterations and of adjacent myotendinous structures [25, 37], being also very useful to determine the presence of inguinal hernias [37], since it allows the direct visualization of the hernial sac within the inguinal canal. Athletes with groin pain and tenderness of the pubic symphysis and/or superior pubic ramus have clinical features consistent with the diagnosis of osteitis pubis. The increased signal intensity seen on MRI is due to pubic bone marrow oedema. An association exists between the clinical features of osteitis pubis and the MRI finding of pubic bone marrow oedema and degenerative features, such as subchondral cyst formation, fluid signal within the pubic symphysis disc, and irregularity of the pubic symphysis; other finds are myotendinous posttraumatic changes, such us haematomas of the psoas muscle and injuries of the abductor muscles of the thigh, or isolated dysmetria of rectus abdominis muscles, with possible involvement of the sacroiliac joint [37]. A stress injury to the pubic bone is the most likely explanation for these MRI findings and may be the cause of the clinical entity osteitis pubis.

Osteitis pubis, intended as reactive intraspongious oedema of the pubic bones, is the most frequent cause of groin pain in athletes. In the early diagnostic phases, both plain films and CT may be negative or unspecific. On the other hand, MRI has always proved to be a valuable diagnostic technique in detecting the osteitic change as an area of low signal intensity on T1-w images and of high and homogeneous signal intensity on T2-w scans without fat suppression [37]. Dysmetria of the straight muscles of the abdomen, which may be associated, is always well depicted by MRI on axial planes. Both posttraumatic and dysmetric changes of the muscular structures adjacent to the pubis are well documented by ultrasound and MRI. The latter, however, thanks to its multiplanar capabilities, allows better spatial assessment of the alteration, especially if located at the peri-insertional level. Possible associated diseases such as the involvement of the sacroiliac joints are also well shown by MRI. In conclusion, only MRI can permit an accurate and early diagnosis of the different sport-related pubic conditions, being also a valuable tool in monitoring the alterations with reference to their response to treatment, which may also help bring the athletes back to their activities.

Nuclear medicine

Technetium-99m bone scan could show in patients with chronic pain an increased uptake at the symptomatic pubic tubercle, and also an increased uptake at other sites in the groin [36].

Herniography

On the other hand, in patients with chronic groin pain, herniography or peritoneography is a seldom-used yet available technique that can detect an occult inguinal hernia that is not detectable clinically. This technique is usually performed using a midline or paraumbilical approach, and radiographs are obtained with patients in prone and prone oblique positions with the head elevated 20 degrees to 25 degrees, both with and without provocative manoeuvres [38]. Heise *et al.* [38] showed how 36 (45%) patients out of 80 who underwent a herniography were diagnosed radiographically to have inguinal hernias that were not detectable clinically, and 27 of these patients subsequently underwent inguinal exploration, and a hernia was confirmed in 24 (89%). Mäkelä *et al.* [39] also showed how 38 patients (36%) out of 106 patients with obscure groin pain were diagnosed with inguinal hernias using this technique, with only one false positive and two false negative hernias. On the other hand, Smedberg *et al.* [40] performed a herniography in 101 painful groin sides in 78 athletes, finding a hernia in 84.2% of the symptomatic groin sides and in 49.1% of the asymptomatic groin sides. Kesek *et al.* [41] performed a study using

herniography to find out the prevalence of symptomatic non-palpable groin hernias in women under 40 years old with undiagnosed chronic groin pain, considering this technique a useful tool to detect occult hernias in women, which were present in 24% of the 116 women included in this study.

All these results show that herniography may help in situations of obscure chronic groin and pelvic pain [6], but when herniography is used consistently in the diagnostic process of these patients, it could be observed how in some series, 49% of cases of hernias are also demonstrated on the opposite, asymptomatic groin side [40, 42]. But the important issue is that herniography is highly reliable for detecting these clinically occult inguinal hernias and has a low complication rate, being related in most cases to needle colon puncture, all of them usually managed conservatively [43]. Its usefulness has been shown in prospective consecutive series for detection of occult hernias in patients with chronic inguinal pain [38]. In conclusion we can establish that herniography is a safe and useful diagnostic test in the setting of persistent inguinal pain and a negative clinical examination.

Conclusions

Van den Berg *et al*. [44] tried to determine the diagnostic accuracy of physical examination, ultrasound, and dynamic MRI in patients with inguinal hernia. In this study 82 groins, in 41 patients with clinically evident herniations, were evaluated using a standard ultrasound and MRI protocol, the latter including T1- and T2-weighted sequences as well as two dynamic sequences. These ultrasound examinations and MRI scans were reviewed without knowledge of clinical findings and, in all cases, a correlation with findings from laparoscopic surgery was made, in which 55 inguinal herniations were found. Physical examination revealed only 42 herniations, with one false-positive finding, whereas ultrasound made the diagnosis of a hernia in 56 cases (five false-positive and four false-negative findings) and MRI diagnosed 53 herniations (one false-positive and three false-negative findings). Thus, sensitivity and specificity figures were 74.5 and 96.3% for physical examination, 92.7 and 81.5% for ultrasound, and 94.5 and 96.3% for MRI. The conclusion of this study showed that in patients with clinically uncertain herniations, MRI is a valid diagnostic tool with a high positive predictive value.

The final analysis shows that plain radiography, ultrasonography and scintigraphy should be the usual first-line investigations to supplement clinical assessment [6], but magnetic resonance imaging appears to have excellent diagnostic potential for athletic hernia [4], being recommended in a multidisciplinary approach to groin pain in the athlete. In conclusion, the final diagnosis often reflects the speciality of the doctor and the present literature does not supply proper studies that should be performed in these patients.

Treatment

Conservative treatment

Many cases of groin pain due to problems related to the musculoskeletal system are a self-limiting disease that can take several months to resolve. Corticosteroid injection can sometimes hasten the rehabilitation process [28]. Most of these will respond to a graduated stretching and strengthening programme, but these can sometimes take a long time to completely heal. When this entity is related to adductor-related groin pain a prospective randomized trial performed by Hölmich *et al*. [45] demonstrated that an active training programme is superior to physiotherapy treatment without active training. In this sense, an active training programme aimed at improving strength and coordination of the muscles acting on the pelvis, in particular the adductor muscles, is very effective in the treatment of athletes with long-standing adductor-related groin pain.

Surgical treatment

However, surgical treatment of chronic symphysis syndrome is successful and can salvage the career of athletes. Surgery of these cases is performed by spreading the lateral border of the sheath of the rectus abdominis muscle together with an epimysial adductor release, or by the reconstruction of the rectus abdominis muscle [46].

On the other hand, in cases in which a neuropathy is diagnosed surgical neurolysis could provide in most cases a definitive cure of pain [32]. There are some groups of patients [47] in whom chronic groin pain is related to nerve entrapment in the external oblique aponeurosis. In these cases, defects have been found in the external oblique aponeurosis through which neurovascular bundles containing terminal branches

of the iliohypogastric nerve passed, and these tears must be repaired after division of the bundles.

Other authors, such as Topol *et al*. [20], have proposed simple dextrose prolotherapy in athletes with chronic groin pain from osteitis pubis and/or adductor tendinopathy. Monthly injection of 12.5% dextrose and 0.5% lidocaine is performed into the thigh adductor origins, suprapubic abdominal insertions, and symphysis pubis, depending on palpation tenderness. Injections were given until complete resolution of pain or lack of improvement for 2 consecutive treatments.

Other groups [10] have proposed a hip arthroscopy for patients with chronic groin pain. Different entities have been found in these cases: lesions of the acetabular labrum, a partial resection being performed, and a cartilage degeneration grade II in the Outerbridge classification.

For some authors [48], when conservative treatment fails, tenotomy of the adductor longus tendon gives good long-term functional results in the treatment of chronic groin pain that is localized at the origin of the adductor longus muscle. Decreased muscle strength is observed in some studies and does not seem to influence participation in sports.

Management of sportsman's hernia

The management of sportsman's hernias is different, and that is the reason for the importance of a proper diagnosis. Conservative treatment of SH does not often result in resolution of symptoms [3]. In some series the athletes have received different conservative treatments without success [8] and the surgical procedures performed in these cases have offered a definitive resolution to this problem [8]. Several surgical approaches are available for the repair of inguinal hernias, but without knowing the true natural history of this disorder, and the problem is that it is difficult to know when it is appropriate to have a hernia repaired [49]. It is recommended to operate only if conservative therapy, with prolonged rest, fails [2].

But a precise diagnosis is always preferable before performing a hernia repair in a patient with chronic groin pain. Steele *et al*. [36] found no significant difference in outcome between subjects who had an abnormal ultrasound scan on the symptomatic side and those who had a normal scan. There was a significant difference in outcome between patients who had a bone scan with increased uptake at the symptomatic pubic tubercle and those who did not ($p < 0.04$). This study supports other studies that show that good results can be obtained with surgery when posterior inguinal wall deficiency is the sole diagnosis. Ultrasound scan does not appear to aid in predicting surgical outcome, while the role of isotope bone scanning still requires further study. In fact, Kesek *et al*. [15] published advanced changes in the relief clinical symptoms in 21 (65.6%) patients out of 32 who showed bone changes at the pubic symphysis.

Surgical intervention in chronic groin pain by performing a hernia repair results in pain-free return of full activities in a majority of cases [3]. There is no consensus view supporting any particular surgical procedure for sportsman's hernia [6]. Various types of operations, based on the various theories regarding the pathophysiological process, have been developed for the treatment of this syndrome (Table I). Some surgeons focus on the external elements of the inguinal canal, and repair the external oblique fascia or enforce the groin with the rectus abdominis. Other surgeons perform an inguinal hernia repair procedure, either with sutures or synthetic mesh, performed by an open approach or laparoscopically. Some researchers believe that the problem is in the lower abdominal muscles, or is caused by nerve entrapment, and treat it accordingly. Other authors recommend a Bassini hernia repair in combination with a percutaneous adductor longus tenotomy [16]. There are no controlled comparative data on the results of the various surgical approaches, and there is no evidence that surgical treatment is more beneficial than conservative treatment.

But, basically a number of reports have been published describing different repairs of the posterior inguinal wall deficiency as the main approach for sportsman's hernias (Table I). Appropriate repair of the posterior wall results in a therapeutic benefit in selected cases. Among the different surgical procedures that have been proposed to solve this pathology, open and laparoscopic mesh reinforcement of the inguinal area with a polypropylene mesh is one of the most common options, the endoscopic preperitoneal approach being the technique more used in the last year [7, 14, 50, 51], although other authors consider an open hernia repair using mesh, performed as an outpatient procedure with local anaesthesia and sedation, as the optimal treatment [5]. Ingoldby [26]

Table I. Surgical technique and results of returning to normal activity

Authors [references]	Number	Return to normal activity [%]	Surgical technique
Susmallian [14]	35	97.1	TEP with mesh
Paajanen [7]	41	95	TEP with mesh
Hackney [8]	15	87	Open repair to the posterior inguinal wall
Malycha [49]	50	93	Open surgical repair of the hernia
van Veen [50]	55	100	TEP with mesh
Simonet [9]	10	100	Open inguinal repair (7 with mesh)
Kluin [52]	14	93	TAPP and TEP
Steele [36]	47	77	Open inguinal repair
Srinivasan [51]	15	87	TEP
Taylor [55]	9	89	Open inguinal repair
Polglase [24]	64	93.8	Bassini repair and Tanner slide or by plication of the transversalis fascia followed by a nylon darn
Lacroix [22]	11	100	Repair of the external oblique tear, ablation of the ilioinguinal nerve
Azurin [56]	8	100	TEP inguinal repair
Genitsaris [54]	131	97	TAPP
Van Der Donckt [60]	41	91.3	Bassini hernia repair and percutaneous adductor longus tenotomy
Ahumada [18]	12	100	Open inguinal repair (9 reinforced with mesh)
Kumar [43]	35	96	Open repair of external oblique tear (when present) and prolene darn or Lichtenstein mesh repair of the posterior inguinal canal
Akermark [48]	16	62.5	Tenotomies of the adductor longus tendon
Edelman [10]	10	90	TEP with surgisis
Bohnsack [61]	30	94	Hip arthroscopy
Topol [20]	24	92	Simple dextrose prolotherapy
Ziprin [47]	25	92	One open hernia repair In the rest, defects were found in the external oblique aponeurosis through which neurovascular bundles containing terminal branches of the iliohypogastric nerve passed. Tears were repaired after division of the bundles
Ingoldby [26]	28	96	50% open mesh repair 50% lap mesh repair
Simonet [23]	10	100	Open repair either directly or with a synthetic mesh reinforcement (7 cases)

performed a comparative non-randomized study comparing the open and the laparoscopic approach, showing that the endoscopic repair permits an early return to activity.

During the operation the inguinal canal should be thoroughly explored in order to find the different entities that could be detected during the surgery (Table II), such us a true inguinal hernia, a wide

Table II. Pathology found during surgery

Authors [referenes]	*n*	Pathology found during surgery	No clear pathology
Susmallian [14]	35	• True inguinal hernia in 4 (11.4%) • Wide internal ring and peritoneal dimple in 28 (80%)	3 (8.6%)
Paajanen [7]	41	• Obvious musculotendinous tear in 10 (24%) • Muscle asymmetry in 7 (17%)	24 (58%)
Malycha [49]	50	• Significant bulge in the posterior in 40 (80%)	10 (20%)
van Veen [50]	55	• Inguinal hernia in 100%	0%
Simonet [9]	10	• Tears in the floor of the inguinal ring in 100%	0%
Kluin [52]	18	• Inguinal hernia in 9 (50%) • Hernia femoralis in 4 (22.2%) • Preperitoneal lipoma in 3 (16.6%) • Hernia obturatoria in 1 (5.5%)	1 (5.5%)
Kesek [15]	51	• Inguinal hernia in 12 (23.5%) • Obturator hernia in 1 (1.9%)	32 (62.7%)
Taylor [55]	9	• Inguinal hernias in 8 (88.8%) • Partial avulsion of the internal oblique fibres from their insertion at the public tubercle in 1 (11.2%)	0%
Polglase [24]	72	• Substantially deranged posterior wall of the inguinal canal in 85% • Apparent splitting of the conjoint tendon in 26% • Indirect inguinal hernias in 8%	0%
Lacroix [22]	11	• Varying degrees of tearing of the external oblique aponeurosis and external oblique muscle associated with ilioinguinal nerve entrapment in 100%	0%
Azurin [56]	9	• Small inguinal hernias in 100% (7 patients had bilateral hernias when they were explored intraoperatively)	0%
Genitsaris [54]	262	• A deficiency of the posterior inguinal wall in 100%	0%
Ahumada [18]	12	• Most common intraoperative findings were non-specific attenuation of the inguinal floor and cord lipomas	–
Kumar [58]	35	• Tear in the external oblique aponeurosis with or without a significant posterior bulge in 20 (57.1%) • Significant posterior bulge in 10 (28.6%) • Tear in the conjoint tendon with dilated superficial ring in 3 (8.6%) • Small direct hernial sac in 1 (2.9%) • Lipoma of the spermatic cord in 1 (2.9%)	0%
Bohnsack [59]	30	• Lesion of the acetabular labrum in 17 (57%) – cartilage degeneration grade II in 11 (37%)	2 (6%)
Ziprin [47]	31	• Occult inguinal hernia in 1 (3.2%) • Patent processus vaginalis in 1 (3.2%) • Defects found in the external oblique aponeurosis through which neurovascular bundles containing terminal branches of the iliohypogastric nerve passed in 29 (93.6%)	0%

internal ring and peritoneal dimple [14], a hernia femoralis [52], a preperitoneal lipoma [52], hernia obturatoria [52], a pre-vascular hernia [53], an obvious musculotendinous tear [7], a muscle asymmetry [7], or a significant bulge in the posterior wall [49], but even if no clear pathology is identified, reinforcement of the wall using a mesh offers good clinical results for athletes with idiopathic groin pain [50], although other authors recommend not to use the mesh in these cases [2]. Basically, the most common finding in athletes with chronic groin pain was a deficiency of the posterior wall of the inguinal canal [24].

However, there are some aspects that should be analyzed when we decide to operate on these patients, since some series show that further clinical investigation of the non-cured, operated athletes gave an alternative and treatable diagnosis in more than 80% of cases [42].

Conclusions

In conclusion, athletes with chronic groin pain who are unable to compete in active sport should be considered for routine inguinal hernia repair if no other pathology is evident after clinical examination and investigation [49]. Groin pain in athletes is a difficult problem requiring a multidisciplinary approach to diagnosis and treatment planning. Endoscopic preperitoneal herniorrhaphy is an effective treatment for obscure groin pain when the pain is associated with an inguinal hernia and allows for a short recovery time back to full athletic activity. The laparoscopic approach also allows the examination and repair of both inguinal posterior walls in the same approach, which will offer a shorter convalescent period and better results as compared with open myorrhaphy [54].

These techniques, an open or laparoscopic hernia repair, offer good results with no complications [7] and in most of the series an operative treatment can return the patient to his sport within 3 months [52, 55].

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