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Athletic Pubalgia (Sports Hernia): Narrative Review of Pathophysiology, Diagnosis, and Management

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Abstract

Background. Athletic pubalgia is a frequent yet poorly defined cause of chronic groin pain in athletes. It is not associated with a true inguinal hernia but results from overload-related injury to the musculotendinous and fascial structures responsible for pelvic and core stability. Heterogeneous terminology and diagnostic uncertainty lead to delayed diagnosis and inconsistent treatment strategies.

Aim. To synthesize current evidence regarding the pathophysiology, diagnostic approach, and management strategies for athletic pubalgia.

Materials and methods. A narrative review of the literature was conducted using PubMed, Google Scholar, and Scopus databases. English-language studies published after 2000 and involving adult populations were included, with a focus on etiology, clinical presentation, imaging, conservative treatment, surgical techniques, and rehabilitation protocols.

Results. Available evidence indicates that athletic pubalgia is primarily caused by an imbalance between the abdominal wall and hip adductor musculature, leading to chronic overload of the pubic symphysis complex. Clinical diagnosis remains challenging due to overlapping symptoms with other causes of groin pain. Magnetic resonance imaging plays a key role in

confirming characteristic musculotendinous injuries and excluding alternative diagnoses. Conservative treatment is recommended as first-line therapy. Surgical intervention provides higher success rates and a more reliable return to sport in patients with persistent symptoms.

Conclusions. Athletic pubalgia is a complex, multifactorial condition requiring a comprehensive diagnostic and therapeutic approach. While rehabilitation is fundamental in initial management, surgery offers superior outcomes in refractory cases, highlighting the need for high-quality prospective studies to standardize diagnostic criteria and treatment algorithms.

Keywords

"sports hernia", "athletic pubalgia", "rehabilitation", "biomechanics", "groin pain".

1. Introduction

Athlete's hernia also referred to as sports hernia, athletic pubalgia, core muscle injury or groin pain syndrome is a pain syndrome localized in the groin region that typically occurs in the absence of a true inguinal hernia, defined as a protrusion of the peritoneum through congenital or acquired defects of the abdominal wall [1,2]. The condition primarily affects athletes - most commonly men - participating in sports that involve repetitive rotational movements, sudden changes of direction, and sprinting, such as football, hockey, and tennis. The prevalence of groin pain in this population is estimated at 2–20%, with women comprising only approximately 10–15% of affected individuals [3].

The high frequency of groin pain reported in these disciplines is most often attributed to chronic mechanical loading of the pelvic muscle attachments, which is insufficiently counterbalanced by weakness of the abdominal wall or thigh musculature. Patients typically describe symptoms of a chronic and insidious nature, developing gradually without a clearly identifiable traumatic event, although some patients can indicate a distinct moment of onset [4]. Commonly reported complaints include a sensation of "tightness" or "strain" in the groin, a burning or dull pain radiating to the scrotum or the medial aspect of the thigh, and poorly localized pain situated above the inguinal ligament. These symptoms are exacerbated by physical activity - particularly sprinting, abrupt changes in direction or forward flexion - and usually diminish or resolve at rest [5,6].

Patients presenting to primary care physicians and physiotherapists often undergo a prolonged diagnostic process, which may contribute to symptom chronicity and frequently results in partial or complete withdrawal from sporting activity [7]. Diagnostic delay largely reflects the broad differential diagnosis associated with groin pain, including inguinal hernias, hip joint pathology and osseous disorders of the pelvis. Exclusion of these conditions is often time-consuming, and completion of differential diagnostics may exhaust available diagnostic pathways, partly owing to limited awareness of this syndrome among clinicians [8].

An additional challenge is the paucity of high-quality studies addressing the prevalence and management strategies of athlete's hernia in the general population, beyond elite or professional athletes. This limitation hampers the development of uniform, evidence-based standards of care for this patient group. The aim of the present study is to synthesize current knowledge and to outline contemporary diagnostic and therapeutic approaches to groin pain syndrome.

2. Material and Methods

The literature review was conducted using the PubMed, Google Scholar, and Scopus databases. The following search terms were applied: "sports hernia," "rehabilitation and sports hernia and athletes," "athlete's hernia," "athletic pubalgia," "sportsman's groin," "Gilmore's groin," and "groin pain syndrome".

Only articles published after 2000 and written in English were considered. Studies published before 2000 or in languages other than English were excluded. The review was limited to adult patients; therefore, articles involving pediatric populations were not included. Identical search strategies were applied across all databases, with no differences in search criteria between sources. The search and analysis of available scientific literature was performed independently by all the authors. The search strategy involved initial screening of titles and abstracts, followed by full-text evaluation based on predefined inclusion criteria.

3. Research results

3.1 Etiology and pathophysiology

At present, there is no clear consensus regarding the etiology or pathophysiology of athletic pubalgia. Despite the misleading terminology, it should be emphasized that this condition is not

synonymous with a true hernia and is not associated with the classic pathological mechanism of visceral protrusion through weakened structures of the abdominal wall.

Groin pain syndrome is primarily related to chronic overload and repetitive strain of the structures surrounding the groin, whose principal function is to stabilize the pelvis during movement. Some authors describe, in this context, a functional entity referred to as the “pubic joint.” This concept denotes a complex biomechanical system comprising both pubic symphyses and the surrounding pelvic musculature. The pubic joint integrates the posterior pelvic ring, the hip joints, and the lower limbs, and its stability depends less on the condition of the articular cartilage than on the balance of forces generated by the muscles responsible for its stabilization.

Within this system, three main muscular compartments are distinguished. The anterior compartment is responsible for trunk stabilization and pelvic alignment and includes the rectus abdominis as well as the oblique and transversus abdominis muscles. The medial compartment plays a key role in hip adduction and external rotation and consists of the hip adductors (adductor longus, brevis, and magnus), along with the gracilis and pectineus muscles. The posterior compartment includes the hamstring muscles, part of the adductor magnus, and the accompanying neurovascular structures. Some studies also identify additional structures as potentially involved in the pathogenesis of the syndrome, including the iliopsoas muscle, the hip rotators (obturator internus and externus), and the acetabular labrum.

The structures forming the pubic joint are primarily engaged in hip adduction and rotation, which results in substantial mechanical loading during dynamic activities such as sudden changes of direction, sprinting, trunk rotation with a fixed lower limb, or kicking movements. This biomechanical demand explains the higher prevalence of athletic pubalgia in sports such as athletics (both long-distance running and sprinting), football, hockey, as well as skiing and rugby.

Risk factors frequently preceding symptom onset include an imbalance in strength between powerful hip adductors and weakened abdominal wall muscles, overload-related microtrauma resulting from prolonged and intensive training based on repetitive movement patterns, the presence of so-called pre-hernia conditions, femoroacetabular impingement limiting hip internal rotation and consequently increasing mobility and stress at the pubic symphysis, as well as congenital weakness of the inguinal wall.

In the pathophysiology of groin pain syndrome, particular emphasis is placed on injury to the rectus abdominis–adductor longus complex. These structures share a common aponeurotic attachment to the pubic bone and function as antagonists. A predominance of adductor strength predisposes to microtears and secondary damage at the musculotendinous attachments of adjacent structures. This process may also lead to weakening of the posterior wall of the inguinal canal, composed in part of the transversalis fascia, thereby producing a pathophysiological pattern that may resemble a hernia-like mechanism.

It should be emphasized, however, that athletic pubalgia does not constitute a distinct disease entity but rather a constellation of symptoms resulting from overlapping injuries to the previously described structures. The clinical picture may be further complicated by irritation, compression or entrapment of neural structures, particularly the ilioinguinal nerve and the genital branch of the genitofemoral nerve, which contributes to the heterogeneity of clinical presentations [9-14].

3.2 Diagnostic Considerations

Athletic pubalgia should be suspected primarily in physically active men who present with chronic groin pain that worsens during athletic activity. The most reported symptoms include tenderness along the inguinal canal and the pubic tubercle, pain radiating to the testicle or the medial aspect of the thigh, and exacerbation of symptoms during physical exertion, coughing, sneezing, the Valsalva maneuver, sit-ups or resisted hip adduction [15,16].

Despite the apparent association of symptoms with activity or injury, the diagnostic work-up should encompass a broad spectrum of conditions that may cause pain in this region. Key differential diagnoses include true inguinal hernias; orthopedic conditions of developmental origin (particularly in younger patients); acetabular labral tears and femoroacetabular impingement; stress fractures of the femoral neck or pubic ramus; lumbar spine pathology; sacroiliac joint inflammation; visceral diseases, including inflammatory bowel disease; rheumatologic disorders affecting adjacent joints; as well as urologic conditions such as epididymitis and prostatitis, and gynecologic disorders, including endometriosis [17,18].

Physical examination remains the cornerstone of clinical assessment; however, the literature emphasizes the pivotal role of magnetic resonance imaging (MRI) in detecting microstructural injuries associated with athletic pubalgia. Particular attention should be paid to abnormalities of the rectus abdominis and adductor longus aponeurosis, including partial tears or avulsions of

the lateral portion of the rectus abdominis tendon, asymmetry compared with the contralateral side, and bone marrow edema in the region of the pubic tubercle. Common MRI findings also include injury to the pubic plate, osteitis pubis, tears of the rectus abdominis and adductor muscle pathology. An additional advantage of MRI lies in its ability to exclude other causes of groin pain and to identify conditions that frequently coexist with groin pain syndrome [19-21]

Ultrasonography is another commonly employed imaging modality, particularly for assessing insufficiency of the posterior wall of the inguinal canal. Its diagnostic accuracy, however, is highly operator-dependent, and there is a lack of standardized protocols and clear interpretative guidelines for sports hernia [16, 22, 23]. Complementary diagnostic tools may include computed tomography, herniography, and plain radiographs of the abdomen and pelvis. These modalities have limited specificity, are partially invasive, and are used primarily to rule out alternative pathologies rather than to confirm the diagnosis [14].

3.3 Different approaches to treatment

Management of athletic pubalgia may be either conservative or surgical. In appropriately selected cases, surgical treatment can be performed using open (conventional) techniques or minimally invasive laparoscopic approaches.

3.4.1 Operative treatment

Surgical treatment of athletic pubalgia is usually considered after failure of appropriately conducted rehabilitation. It represents the most effective therapeutic option and is associated with the highest rates of return to sport [24,25]. Two principal surgical approaches are commonly described.

The first, regarded as the classical approach (Bassini-type technique), involves tensioning of the transversalis fascia, often combined with tenotomy of the hip adductor muscles. This strategy is aimed at addressing the mechanism considered to be causal in the pathogenesis of sports hernia [26,27]. The second approach, classified as minimally invasive (Muschaweck and Berger technique), is based on limited surgical intervention, typically performed unilaterally and confined to the symptomatic side. Depending on the clinical presentation, the procedure may involve the abdominal wall, the adductor musculature, or both. Authors emphasize that less invasive techniques are associated with a faster return to sporting activity and a more favorable course of postoperative rehabilitation [28,29]

Some reports describe modifications of both surgical strategies involving reinforcement with synthetic (polypropylene) or biological mesh materials, analogous to techniques used in inguinal hernia repair. The aim of this approach is to strengthen weakened structures of the abdominal wall and to reduce the risk of symptom recurrence [30-33].

Another important factor differentiating surgical management is the choice of surgical access - open versus laparoscopic. Both classical and minimally invasive techniques may be performed using either approach, with comparable clinical effectiveness. The primary difference concerns the time required to return to full athletic activity, which is shorter in patients treated laparoscopically [34].

Following open procedures, this period typically ranges from 1 to 6 months, whereas after laparoscopic surgery it is usually between 2 and 6 weeks [35]. Regardless of the technique employed, comprehensive postoperative rehabilitation remains an integral component of treatment.

Overall, the outcomes of surgical management for athletic pubalgia are very favourable. Reported rates of return to play range from 80% to 100%, depending on the study [35,36]. It should be noted, however, that treatment outcomes may vary according to the type of sport and the level of athletic participation. Some authors suggest that more favourable outcomes are observed in non-professional or recreational athletes [37]. Conversely, professional athletes, despite successful surgical treatment, may demonstrate inferior long-term outcomes compared with athletes who have never developed athletic pubalgia [38].

3.4.2 Non operative treatment - Rehabilitation

Rehabilitation following surgical treatment and during non-operative management is based on similar principles. The literature emphasizes that rehabilitation is typically considered the first-line treatment for athletic pubalgia and in fact is the main non-operative option for patients with sports hernia; however, its effectiveness in achieving full return to pre-injury sporting performance is significantly lower when not combined with surgical intervention [35]. Conservative management focuses primarily on restoring range of motion and improving core muscle stabilization through dynamic and functional training aimed at reducing pain and enabling a safe return to physical activity. Most authors highlight the importance of activating the transversus abdominis, improving lumbopelvic stability, and strengthening the muscles of

the hip girdle, particularly the adductors, gluteal muscles, and hip flexors. The total duration of conservative rehabilitation is generally estimated at 6–8 weeks; failure to achieve meaningful clinical improvement within this timeframe is considered an indication to consider surgical treatment [39].

Postoperative rehabilitation is most described using a three-phase model, with return to sporting activity expected at approximately 8 weeks following surgery. A key principle of this model is the progression of loading based on pain response and movement quality, rather than solely on the time elapsed since the operation. Phase I spans from the immediate postoperative period to approximately the second postoperative week and is aimed at supporting tissue healing. It involves relative rest with gradual restoration of passive hip range of motion. During this phase, lifting and activities that increase intra-abdominal pressure are discouraged. Early patient mobilization is encouraged, limited to level walking and activities of daily living. Gait re-education is initiated concurrently, and efforts are made to achieve a neutral pelvic position, which may be facilitated by low-resistance stationary cycling. Phase II focuses on restoring neuromuscular control and normalizing the biomechanics of the structures forming the so-called pubic joint. This phase includes further increases in hip range of motion and soft tissue flexibility, progression of core stabilization exercises (particularly targeting the transversus abdominis, multifidus, and gluteal muscles), balance and proprioceptive training, aerobic conditioning (e.g., cycling, elliptical training, walking), and correction of faulty movement patterns. Particular attention is paid to the function of the deep stabilizing muscles of the trunk and hip. Phase III, typically encompassing weeks 5 to 8 after surgery, is directed toward a gradual return to full sporting activity. In some patients, depending on symptom severity and individual response to rehabilitation, this phase may be extended up to 12 weeks. The program includes running drills and progressively higher-intensity exercises tailored to the specific demands of the athlete's sport [35,39-41].

It should again be emphasized that non-operative treatment, although frequently employed due to its lower invasiveness and greater accessibility, is associated with substantially lower success rates, estimated at approximately 20–30%, compared with surgical management, where reported success exceeds 80% [42]. Within conservative management, some authors also describe the use of corticosteroid injections or platelet-rich plasma (PRP). These modalities, however, are not widely adopted and are generally considered adjuncts to standard therapeutic strategies rather than standalone treatments [43-45].

3.5 Discussion

Athletic pubalgia represents a complex syndrome of groin pain whose etiology, pathophysiology, and optimal management remain subjects of ongoing debate. Current evidence suggests that a central factor in the development of this condition is a disruption of the biomechanical balance among the structures responsible for pelvic stabilization, leading to overload injuries within the pubic joint. Diagnosis requires a multidirectional approach, based on thorough clinical examination, comprehensive differential diagnosis, and appropriately selected imaging modalities, with magnetic resonance imaging currently playing the most significant role.

Therapeutic management should be individualized and incorporate both conservative and surgical strategies. Rehabilitation remains the cornerstone of first-line treatment. However, in cases where clinical improvement is not achieved, surgical intervention demonstrates markedly higher effectiveness and a greater likelihood of return to full sporting activity. Regardless of the surgical technique employed, comprehensive postoperative rehabilitation is an indispensable component of treatment and substantially influences long-term outcomes.

It is important to acknowledge the significant limitations of the available literature. A large proportion of studies are based on small patient cohorts, often including heterogeneous populations of athletes from various sports, which complicates the interpretation and generalization of results. Moreover, many widely cited studies are retrospective, date back several decades, and have not been followed by prospective or randomized investigations. There is also a lack of standardized definitions, uniform diagnostic protocols and comparable rehabilitation and surgical treatment regimens.

Consequently, there is a clear need for further high-quality research conducted in homogeneous populations, with adequate sample sizes and long-term clinical follow-up. Such an approach is essential for improving understanding of the mechanisms underlying athletic pubalgia, optimizing diagnostic pathways, and developing coherent, evidence-based standards of care for both elite athletes and recreationally active individuals.

3.6 Conclusion

Athletic pubalgia is a complex clinical syndrome of multifactorial origin, arising from biomechanical disturbances and overload-related injuries of the musculotendinous and fascial structures responsible for pelvic and trunk stability. The absence of a uniform disease definition and the substantial overlap of symptoms with other pathologies affecting the groin region significantly complicate and delay the diagnostic process. A comprehensive clinical assessment, supported by imaging studies - most notably magnetic resonance imaging - is essential for identifying characteristic lesions and for excluding alternative causes of groin pain.

Therapeutic management should be individualized and based on a stepwise approach. Targeted rehabilitation focused on improving neuromuscular control, lumbopelvic stabilization, and restoration of muscular balance constitutes the foundation of conservative treatment. In patients who fail to respond to non-operative management, surgical intervention, using either open or minimally invasive techniques, is associated with high rates of return to sport, provided that a structured postoperative rehabilitation program is implemented. The limitations of the existing literature, including heterogeneity of study populations and a lack of prospective investigations, highlight the need for further high-quality research aimed at standardizing diagnostic criteria and developing evidence-based treatment algorithms.

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