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ATHLETIC PUBALGIA – A DIAGNOSTIC AND THERAPEUTIC CHALLENGE IN CLINICAL PRACTICE

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ABSTRACT

Introduction: Athletic pubalgia is a complex medical issue that affects athletes like footballers or hockey players. Chronic groin pain is caused by overuse injuries of the musculotendinous structures around the pubic symphysis. This review article aims to present the current knowledge on athletic pubalgia, including pathophysiology, epidemiology, diagnostic approaches and treatment strategies.

Methods: This article is based on 30 scientific publications from PubMed, Journal of Education, Health and Sport and Google Scholar. In this review we pay attention to the latest information about risk factors, diagnostic methods, significant symptoms and management strategies.

Results: Athletic pubalgia usually affects male professional athletes like football and hockey players. Groin pain coexisting with specific exercises and movements is the most common symptom. To make a correct diagnosis, the clinical picture, imaging studies, and clinical tests must be considered. First-line treatment is conservative therapy, which is sufficient in most cases. Further treatment includes special rehabilitation programs combined with surgical treatment, most often using endoscopic methods.

Conclusions: Athletic pubalgia is a condition that has long been known to clinicians in the professional and recreational sport population. However, it requires detailed diagnostics, including specially selected tests performed during a physical examination and imaging techniques—particularly MRI—performed by experienced specialists. Available treatment methods, tailored to the severity of the condition, allow the vast majority of patients to fully return to sport.

KEYWORDS

Athletic Pubalgia, Sports Hernia, Groin Pain, Diagnosis, Conservative Treatment, Surgical Approach

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1. Introduction

Athletic pubalgia is a broad and nonspecific term for a complex clinical syndrome where the common symptom is a groin pain. Usually the pain has its origins in a tear of the rectus abdominis or the adductor longus muscle group from the pubis. So it applies to a broad spectrum of anatomical structures within the pelvic region and often requires some kind of limitation of physical activity. [30][22]

This medical condition is known under many different names, such as sports hernia, Gilmore's groin, footballers groin injury complex or athletic hernia. [8][22]. There are some conditions which lead to athletic hernia including rapid directional changes, kicking and high core and lower limb load. But the main condition is lack of muscular balance and weakening of the musculo-tendinous structures of the pelvic. So it lead to overloads in the area of the pubic symphysis. [30]

Athletic pubalgia is not very rare medical case in clinical practice yet the exact injury patterns, specific surgical indications and techniques or significant surgical anatomy for anatomic footprint of structures involved in sports hernia.[22]

According to Mitrousias et al., taking into account the Doha Agreement, in clinical practice, more specific nomenclature should be used. It should be related to the specific anatomical structure affected by the injury for example, an athlete may be diagnosed with adductor-related groin pain along with the anatomical diagnosis of avulsion of the adductor longus proximal insertion or another may be diagnosed with hip-related groin pain along with the anatomical diagnosis of a labrum tear. Adopting these principles eventually will improve communication between healthcare professionals. When making a diagnosis and naming, we should always refer to the anatomical structures affected by the injury; we should not use terms rejected by consensus meetings. [20]

2. Epidemiology

According to studies from 60% to more than 70% cases of pubalgia among professional athletes were associated with high-intensity team sports such as football, soccer and hockey. What is interesting is that groin pain occurs recreational athletes surprisingly often and that is a significant change over the years. It is shown that athletic pubalgia is a condition that mainly affects young men between 26 and 45 years old. Different anatomical structures of the pelvis between male and female patients may be responsible for this predominance. Time between first symptoms to definitive diagnosis vary from 1 to 53 months, the median time is 6 months.[10][4]

3. Risk factors

Activities such as sprinting, high running loads, sudden change of direction and kicking can lead to groin injury. [4] Soccer players, runners, american football, ice hockey players are in the most vulnerable group of athletes.[10][17]

Neuville et al. show in their prospective cohort studies that strength training can increase risk of developing athletic pubalgia. In their study they proved that college American football athletes who participated in OWL (Olympic weightlifting) which is popular to increase overall power, have a 2.86-fold higher risk of developing athletic pubalgia compared to those who did not participate in this kind of strength training. Additionally for athletes playing in skill position 9.32 times greater odds of athletic pubalgia compared with others playing a nonskill position were reported. [21]

Moreover some studies suggest that the difference in strength between stronger adductor muscles and weak lower abdominal muscles, which is also mentioned as one of the risk factors, can increase due to off season training programs. It's been reported that during hockey training camps adductor strains occurred 20 times more often than during the regular season. [21]

According to the study by Goes et al., most of the diagnosed patients (88,1%) were male. Female, gynecoid pelvis which supply more space for abdominal musculature attachment and lead to better force distribution and prevents overloads in pubic symphysis. Male, most common, android pelvis is narrower and less stable. What makes a patient's gender an important risk factor. [10]

4. Pathophysiology – the three theories

There are three main theories behind the pathophysiological aspects of athletic pubalgia. In the first theory ilioinguinal or iliohypogastric nerve entrapment by external oblique muscle is pointed as a main cause of condition. It is related to a little more proximal pain.

The second theory focuses on a weakness in the posterior abdominal wall and the fact that a pseudoherniated bulb can compress the genitofemoral nerve.

The last theory suggests a muscle imbalance due to increasing pressure in the adductor compartment caused by precursor lesion in the adductor musculature. Ultimately it leads to macro or microscopic damages in the pubic attachments close to the pubic cartilage plate.[10]

As long as the athlete will continue his sport activity without special treatment the natural progression of sport hernia will proceed. From chronic microtrauma to the injury of tendons and muscles and then to the pubic bone and symphysis. [7]

Dudai et al. grade the severity of the injury between 1 to 5:

- 1) Minor groin ligament or muscle injury
- 2) Involvement of the adductor and rectus abdominis muscles
- 3) Inflammation of prepubic aponeurosis. Posterior wall bulging
- 4) Symphysis joint damage with disc herniation
- 5) Pubic bone injury with bone marrow edema and stress fractures [7]

5. Clinical symptoms, physical exam

The most common symptom among patients is pain, most predominant in the pubic area and inguinal region. A tearing sensation is sometimes described and it can radiate toward the testis, suprapubic locale or beginning of the adductor longus. The intensity of the pain decreases after rest and increases with specific movements for example rapid change of direction, sprint, jumping, kicking. Additionally pain worsens with sneezing, coughing and sexual intercourse. [13][21] Aside from torment in pubic symphysis area athletes report firmness. Typically the pain is located unilateral but can become bilateral and central lower abdomen as the injury progresses.

Cohen et al. pointed signs that assumed athletic pubalgia and in addition to the previously mentioned deep lower abdominal pain during sport-specific activities they mentioned: palpable tenderness in space where rectus abdominis with its tendon inserted to the bone over pubic ramus, pain with resisted hip adduction in particular present at 0st, 45st and 90st of hip flexion and pain with resisted abdominal curl-up. [5]

No findings such as bulge at the external inguinal ring or palpable true hernia should occur. It's mentioned that Valsalva maneuvers can provoke symptoms in the absence of a clinically evident hernia. During examination one should remember about sensory exam because entrapment of the iliohypogastric, ilioinguinal and genitofemoral nerves can cause paresthesia or dysesthesia involving the lower abdomen, inguinal region, inner thigh or genitals. Moreover in exam both hips range of motion must be checked, internal rotation and abduction in particular because some intra- and extra-articular pathology can overlap on athletic pubalgia. [5]

6. Diagnostic methods, tests

Clinicals based their diagnosis on specific patient's symptoms, findings in physical examination, imaging methods such as radiography, ultrasound and magnetic resonance imaging. [10]

Neuville et al. in their cohort study suggest clinical criteria to help recognize athletic pubalgia such as:

- tenderness to palpation of the proximal adductor or rectus abdominis muscle
- long lever test on adduction with pain: in this test we place the patient in a supine position with the hip in 30st of flexion. Then we ask the patient to resist adduction when the knee is in full extension. Can be done with an isolated leg or simultaneously with a contralateral leg. Pain during this procedure calls for a positive test. [5]

- positive sit-up test: in supine position with stabilized feet, arms straight ahead patient hold for 5 seconds in this position. A test is positive when the pain at rectus insertion is reproduced. [21][5]

Goes et al. in their epidemiological analysis show what tests in physical examination were most often positive in patients with athletic pubalgia:

- test of adductor contraction against resistance with extended knee (77.6% positive)
- simultaneous hip and abdominal flexion against resistance (76.7% positive)
- palpation of the pubic body (68.6% positive)
- test of adductor contraction against resistance with a flexed knee (67.8% positive)
- palpation of the inguinal ring (62.4% positive) [10]

Like it was mentioned before many disorders around the hip and pelvis can coexist with athletic pubalgia making the diagnostic process more difficult. Most common adductor tendinopathy, osteitis pubis and FAI can complicate the clinical presentation. [5]

Recent literature has implied a strong relationship between athletic pubalgia and femoroacetabular impingement (FAI). FAI is described as an abnormal contact between the femoral neck and the acetabular rim during terminal motion of the hip due to excessive bone on the acetabular rim, the femoral neck or both. These changes limit the range of motion that cause compensatory patterns of movement around the pelvis and trunk. Under this condition joints and muscles are exposed to excessive strain which weakens structures in the pelvic region and predispose patients to athletic pubalgia. Some studies have shown that 89% of patients return to the previous level of sport when simultaneously FAI and pubalgia surgeries had place.[5]

There are many hip tests which can help with correct diagnosis. One of them is FADIR (Flexion, Adduction, Internal Rotation). In the procedure the patient lies supine, hip and knee are flexed to 90 degrees, adducted and internally rotated at the hip joint. The test is positive when pain occurs and may suggest femoral acetabular impingement or labral tear. [30][5]

Another hip test called FABER (Flexion, Abduction, external rotation, also known as Patrick test) can be helpful in diagnostic procedure. In this test patient supine, flex knee to 90 degrees, foot is placed on the opposite iliac crest to stabilize pelvis against table, other hand placed on knee and externally rotates hip. We call test positive when pain occurs. If it is groin pain it suggest FAI, labral tear or iliopsoas tendinitis. [5]

Imaging Techniques

Ultrasonography

A widely used, first-line imaging technique but requires from radiologist specific skills and experience in this specific kind of hernias. This method is effective for detecting posterior wall bulging and distinguishing athletic pubalgia from inguinal hernia. During ultrasonography we can use the Valsalva maneuver to increase intra-abdominal pressure and improve visualisation of soft tissue disruptions. This particular modification is called dynamic ultrasonography examination and is considered as the gold standard for sports hernia investigation. [13] Valuable method particularly in grade 1-3 injuries, but due to operator dependency should be interpreted with caution. [7][29]

MRI

According to the study by Zoga et al., this imaging technique is 68% sensitive and 100% specific compared with findings at surgery. Also MRI is 86% sensitive and 89% specific for adductor pathology and 100% sensitive for osteitis pubis.[5]

MRI examination is dedicated to visualize the bone, muscle and ligament structures of the symphysis for lesions of the ilio-inguinal ligament and the conjoint tendon. Moreover with this technique we can detect any kind of anatomical individual abnormalities in this area. [2]

Dedicated for detecting bone marrow edema, stress fractures, pubic symphysis inflammation, disc herniation, adductor tendon and rectus insertion pathology. Helps establish the diagnosis with advanced case grade 4-5 athletic pubalgia when should be the primary imaging tool, when nerve involvement is suspected or with isolated adductor tendinopathy. [7]

Tears of the rectus abdominus are pathognomonic for athletic pubalgia on MRI but they are uncommon. [5]

Factors with the strongest influence: increased MR signal intensity observed from the structures of the inguinal canal and increased MR signal intensity observed from bone marrow of superior ramus of the pubic bone. In ultrasound the main finding was increased size of the inguinal canal and the presence of a protrusion in the posterior wall of the inguinal canal.[7] [12][1][15]

Despite the many useful information we can obtain during this examination, performing the Valsalva maneuver during an MRI may be problematic. But some other signs of inguinal posterior wall weakness may be revealed, such as adductor longus tendinopathy, symphyseal central disc protrusion, bone marrow oedema of the pubic branches.[2]

CT

By using CT scan we received more information about bony structures and soft tissues similar to MRI. Thanks to this imaging method, it is possible to detect factors predisposing to the occurrence of athletic pubalgia earlier, for example the widening of the symphysis pubis caused by pubic instability or stress injuries. Supportive findings like reactive sclerosis, marginal erosion and capsular thickening can also be found with this method and confirm the diagnosis. Precise image and analysis of joint spaces, cartilage and bony morphology can be useful in differential diagnosis of groin pain when we take into account other diseases like osteoarthritis or FAI. [14]

The main disadvantage of this method is high radiation exposure therefore CT is not the preferred choice for routine sports evaluation. [7]

Intra- and extra-articular injections are another but rarely used diagnostic method. In diagnostically uncertain cases injections of local anesthetic or corticosteroid may be helpful. Drugs can be injected to the hip joint, pubic symphysis or muscle attachment sites. Locations where pain decreases after injection are probably the primary source of pain. [5]

7. Conservative Treatment

Conservative treatment is known as the first-line therapy for patients with athletic pubalgia, the most common method is rehabilitation with physical therapy and pharmacotherapy. According to Dudai et al. particularly for mild to moderate cases (grades I- III) when no severe muscle or tendon damage is known, where pain occurs only during activity and does not persist at rest. The main goals of this nonsurgical management is to reduce pain, restore function and a successful return to sports. This strategy may be considered for acute or subacute cases when symptoms persist less than 6-12 weeks. It's recommended that before surgery a conservative treatment should be provided. [7][1][29][27][9]

According to studies around 80% of the patients experienced good outcomes with conservative therapy [18][25].

Pharmacotherapy

Nonsteroidal anti-inflammatory drugs (NSAIDs) are used in pain and inflammatory management [7][1]. Corticosteroid injections or platelet-rich plasma are used for very short-term severe inflammation control [7][1][15][29]

Physical therapy

Studies say that active physical training is more effective than just limiting or avoiding activities that induce groin pain. In physiotherapy the active therapy program (ATP) should consist of exercises that focus on core stability and balance, adductor muscle strengthening. On the other hand we have some conventional treatment programs (CT) based on heat, transverse friction massage, transcutaneous electrical nerve stimulation (TENS), mobilization techniques and stretching exercises.[7][29][28][3]

Studies and reviews suggest that active exercise programs had a significant impact in reducing groin pain and should be recognized as a basic element of conservative treatment. [16][3]

Additionally, to reduce pain and swelling, cryotherapy and ultrasound therapy can be introduced. However it has a limited effect. [7]

Another non-surgical intervention, which targets the pathomechanism of nerve entrapment that often coexists with chronic straining of inguinal ligament, is radiofrequency denervation (RFD). In this method high-frequency radio waves are used to mute signal transmission where chronic inflammation occurs, focusing on the area around the inguinal ligament. However not recommended for advanced AP cases (grades 4-5), where structural and complex neural problems are involved. [7]

Shockwave therapy is another conservative approach. Proposed by Schoberl et. al. this method uses metabolic changes to reduce pain, promoting cell repair and can also remove calcified deposits. This therapy proved to be very effective in reducing post-traumatic pain and allowed for a return to sports within 3 months of the injury. [6][26]

8. Surgical Treatment

After 2-3 months of conservative treatment without any progress or when imaging techniques reveals grade 4-5 groin injury, such as increasing groin pain that occurs during regular daily activity and prevent athletic performance, painful (pain scores >7, range 0-10) posterior wall deficiency, pathology of symphysis, disc herniation, edema in bone marrow or the pyramidalis-anterior pubic ligament-adductor longus complex (PLAC) then surgical intervention is needed. Also, significant tendons or muscle tears in the area of the adductor longus or rectus abdominis and nerve involvement for example genitofemoral nerve or other inguinal nerve entrapment should be referred to surgical treatment. [7][27][9]

Surgical approaches can be divided into conventional open techniques or minimally invasive techniques. For grades 1-3 open techniques are suitable, it involves suture-based reinforcement of the posterior wall without mesh implantation because it may cause irritation in active athletes. Dudai et al. in their study mentioned a minimal repair open technique by Muschaweck where excision of the fibrotic nerve segment is preceded and led to pain relief for the patient. But this method is not dedicated for advanced cases. For patients with grades 4-5 a laparoscopic alternative is more suitable.

The TAPP (transabdominal preperitoneal) approach, known as the Lloyd release:

- dedicated for grades 4-5
- minimally invasive, laparoscopic tenotomy of the inguinal ligament nearby the pubic tubercle, followed by mesh placement
- according to studies over 90% of athletes returned to activity after 4-6 weeks after surgery after their level of pain decreased[7][29]

The TEP (Totally Extraperitoneal) approach

- dedicated for grades 4-5
- studies shows that over 90% of patients return to full activity with no pain
- reinforcing the posterior wall and restoring the structural integrity of the pubic symphysis with the polypropylene mesh
- staples and sutures have been replaced by the biological glue what helps decreased the risk of postoperative neuralgia
- the risk of intra-abdominal complications is lower than in open access [7][29][23]

The TEP-RRT (TEP with Release and Reinforce Technique)

- improved TEP method that takes into account the dual pathophysiology of AP
- first stage focuses on releasing entrapped nerves by an adhesio-neurolisis and the mid-ligament division of the inguinal ligament
- in second stage posterior wall and pubic bone are strengthened by mesh placement using biological glue, without sutures and staples to avoid irritation and provide better stability
- according to studies by Dudai et al. almost every patient after TEP-RRT for AP return to sport and remain active, 75% of patients return to sport in less than 8 weeks and 25% in less than 12 weeks after surgery
- moreover data shows that this method has a low risk of complications, about 1% of patients experienced mesh infection, deep vein thrombosis, rectus hematomas and thermal injury [7]

Like it was mentioned before in cases when serious injuries of tendons and muscles are associated with athletic pubalgia it required surgical repair. One of the most common causes of groin pain related to tendon and muscle damage is a rectus abdominis-adductor longus (RA-AL) aponeurotic plate injury [19]. Benton et al. (2018) in their review for over 100 athletes demonstrated outcomes of specific surgical technique for RA-AL. aponeurotic plate injury. In this approach the adductor longus is fractional lengthening and this reduces the tension exerted on the tendon and muscular compartment. In the next stage of the operation limited tenotomy is performed and thanks to this a structural layer is turned up to reinforce the terminal insertion of the rectus and the entire area of the injured region of the aponeurotic plate is strengthened. This study showed positive outcomes of patients who had undergone this treatment. Low complication rate, return to prior levels of sport at high rate, low percentage of any functional deficits experienced by patients who underwent a single surgical procedure were reported. However some patients who had surgery before, especially female patients, experienced significantly poorer results and it took them longer to return to sport. In general conclusion their technique for RA-AL. Aponeurotic plate repair is recognized as safe and can be performed with positive outcomes [9].

A systematic review by McKeeman et al. (2025) reported essentially equivalent results in success rate for rectus abdominis repair and posterior wall reinforcement as the surgical methods. For both procedures success rates were between 70% and 90% but there is still no clear answer as to which method is better [18]

Postoperative Rehabilitation

Research shows that the most promising therapeutic results are achieved with the rapid initiation of post-operative rehabilitation that is considered a meaningful criteria of long-term outcomes. Recommendations say that patients should begin walking immediately after surgery. Then start from jogging to running within 3-4 weeks. They should return to full activity within 2-4 months after operation. [24]

Dudai et al. in their study propose the use of a specific postoperative rehabilitation protocol- athletic muscle rehabilitation program (AMRP) and prove its effectiveness. In their research that included 461 athletes after TEP-RRT surgery the percentage of those who returned to full athletic activity was 98.5%. No cases of recurrence were reported.

The program consists of 3 stages:

Stage 1 (1-3 weeks): early mobilization and strengthening,

- goals: activate core stability, prevent stiffness
- crucial exercises: isometric exercises, weight bearing movements
- patients should avoid high-impact activities to allow tissue healing

Stage 2 (4-6 weeks): progressive strength and functional training

- goals: improve core and pelvic stability, strengthen specific muscles coordination
- crucial exercises: exercises that focus on rectus abdominis, hip adductors and pelvic stabilizers
- include progressive resistance training for neuromuscular control

Stage 3 (7-12 weeks): preparing for return to full activity

- goals: restore full sports functionality
- crucial exercises: strength and endurance training, proprioceptive exercises and dynamic stabilization drills, sport-specific functional movements, aerobic training
- before returning to competition a functional assessments should be performed by the surgeon [7]

To confirm patient readiness to return to sport some clinical tests should be performed. It should be checked if pain occurs using tests such as Copenhagen five-second squeeze test, FADIR test, FABER test and with abdominal palpation. [27]

Serafim et al. in their systematic review found that athletes after surgical intervention for AP returned to sport earlier than those who received only conservative treatment. Additionally Guarneri et al. in their

studies confirm high return to play rate among high-level athletes. They reported that 96.5% of Major League Soccer players after surgical treatment exhibited comparable game quality to both before injury seasons. [11]

9. Conclusions

Athletic pubalgia seems to be a significant diagnostic and therapeutic challenge. Recently, the number of publications on this condition has been increasing, and some specific treatment plans have been proposed to ensure the fastest and most accurate diagnosis. Based on the structures affected by inflammation and the location of micro-injuries, a five-grade classification of the disease's severity has been developed, which we can use to plan further treatment.

The most common potential causes of the condition in the literature include microtrauma to the muscles and pelvic biomechanical imbalances leading to nerve compression. Congenital pathologies of the musculoskeletal system coexisting with athletic pubalgia are also frequently mentioned. The first line of differential diagnosis is clinical tests such as FADIR or FABER, which allow for the assessment of femoroacetabular impingement, as a very strong correlation has been observed with athletic pubalgia. MRI is considered the most useful imaging technique and remains the gold standard. Conservative treatment still remains the first-line approach and focuses on rehabilitation, with core strengthening exercises tailored to the severity of symptoms. Mobilization and strengthening exercises prior to surgical treatment are particularly important. Surgical treatment techniques that cover a wide spectrum of pathophysiological factors of athletic pubalgia have developed significantly over the years and have gained importance, with a choice of methods ranging from classical to open or minimally invasive endoscopic access depending on the severity of damaged structures in the groin area. According to recent reports, the best results in a quick return to sports are observed with the TEP or TEP-RRT method. This appears to be the best surgical approach due to low recurrence rates, rapid recovery, and superior pain resolution. Among postoperative rehabilitation protocols, the AMRP program is most frequently recommended by experts. Its effectiveness is based on clearly defined phases, ongoing process supervision, and adaptation to the patient's current needs. Research shows that implementing the AMRP program significantly contributes to patients' full return to sport and minimizes recurrence rates. The question of creating a standardized diagnostic procedure remains open. Further high-quality, prospective, and randomized studies are needed. The target group for follow-up should include athletes from various disciplines. Furthermore, to improve interdisciplinary communication between specialists, the nomenclature and classification system for athletic pubalgia should be standardized. Given the rapid development of treatment methods and new technologies in sports medicine, it is important to utilize them as much as possible for further scientific exploration. This has a significant impact on patients' well-being, quality of life, and professional careers.

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All authors contributed to the article.

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