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## REVISIÓN

### GROIN PAIN: DIFFERENTIAL DIAGNOSIS

### PUBALGIA: DIAGNÓSTICO DIFERENCIAL

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## ABSTRACT

Pubalgia is part of the clinical manifestation of the injury of musculoskeletal structures, diseases of nervous peripheral system, genitourinary and digestive systems, and rheumatic diseases. The most frequent responsible injuries of the onset of inguinal pain in athletes are common aponeurosis of Rectus Abdominis and Adductor Longus muscles injuries (in relation with processes of inguinal hernia (15%) and pubic osteoarthropathy), and hip injuries (especially femoroacetabular impingement and tears of acetabular labrum (22%)). Most patients with groin and pubic pain two or more diseases coexisting at the same time can be diagnosed. In conclusion, a correct differential diagnosis is necessary to choose the best treatment.

**KEY WORDS:** Pubalgia, groin pain, osteitis pubis, differential diagnosis.

## RESUMEN

La pubalgia forma parte de la manifestación clínica de las lesiones de estructuras músculo-esqueléticas, patologías del sistema nervioso periférico, genitourinario y digestivo, y de enfermedades reumáticas. Las lesiones más destacadas responsables de la aparición de dolor inguinal en deportistas son las de aponeurosis conjunta (en relación con procesos de herniación inguinal (15%) y de osteoartropatía púbica), y las de la cadera (especialmente el choque femoroacetabular y las lesiones del rodete acetabular (22% pacientes)). Una gran proporción de pacientes con dolor inguinal y púbico presentan dos o más patologías coexistiendo a la vez, por lo que es necesario un buen diagnóstico diferencial para elegir el tratamiento adecuado.

**PALABRAS CLAVE:** Pubalgia, dolor inguinal, osteopatía de pubis, diagnóstico diferencial.

## INTRODUCTION

*Pubalgia* literally means pain in the groin and pubis area (around the abdominal inguinal ring and pubis ligaments) which might be extended to the adductors and the lower abdominal area.<sup>1</sup> According to literature, *pubalgia* is more frequently suffered by men, in a rate 5:1. This is not due to morphologic differences between masculine and feminine genders, but to the practice of sports traditionally associated to masculine population. Many injuries are consequence of sport practice which are described as the main sources for groin pain and pubis pain.<sup>2</sup> So, *pubalgia* is considered to be the manifestation of an excessive muscular requirement of the various musculoskeletal structures in the pelvic girdle, surpassing their regeneration ability and so predisposing them for injury (that is, pain due to overuse). A classification list of the various sports more frequently causing *pubalgia* had already been established by Renström. Here, soccer is the first rated and long distance running is the second one,

followed by rugby, weightlifting and cycling.<sup>2</sup> Anyway, most researches prove so great an impact of groin pain in sportsmen brought under daily and labor-intensive training for those sports which require exploding movements of lower limbs, fast speed-up, rotation of the spine and hip, sudden changes of direction, the repetitive gestures of shooting and lateral movements.<sup>3, 4</sup> The most remarkable issue is that in sport scopes, *pubalgia* happens mostly during months of increasing competitions, strength, hard, long-time trainings and shorter times for resting and recovery.<sup>5</sup> *Pubalgia*, meaning groin/pubis pain, is amongst a great variety of clinical injuries. About 27-90 % groin aching patients do really have more than one injury which could hurt the musculoskeletal system, nervous system, genitourinary system and digestive system.<sup>3, 6, 7</sup>

This text will review the recent literature about the various musculoskeletal injuries which deal with groin pain. So then, it has been established the relation between them in an infography of differential diagnosis, where there are also figured more pathologies, like visceral or autoimmune diseases, which must be considered. This infography wants to be a summarized help to diferencial diagnosis of *pubalgia*.

## MATERIAL AND METHOD

The theoretical frame of this work is based upon the newest and most recent bibliographical references (amongst medicine, sport and physical therapy literature) about *pubalgia* and other related terms. Collecting information is mostly searched through PubMed, a free database of references and abstracts on life sciences and biomedical topics of U.S. National Library of Medicine. The proper information is obtained by using key words, such as '*dolor inguinal*' ('groin pain'), '*pubalgia*', '*osteopatía del pubis*' ('osteitis pubis') and 'differential diagnosis'. Most articles are included in on-line clinically-relevant journals such as *British Journal of Sports Medicine*, *The American Journal of Sports Medicine*, *American Journal of Roentgenology*, *British Journal of Radiology* and *The Journal of Bone and Joint Surgery*. All these data have been supplied with book references from the Library of the University College Gimbernat (U.A.B.<sup>1</sup>).

According to the entire theoretical framework an infography of differential diagnosis of *pubalgia* has been drawn, based upon the reference of Tom Turmezei's infography named *The Surgical Sieve Differential Diagnosis of Acute Abdomen*, published in the *British Medical Journal*. Our infography means the abstract, figure and comprehension of our entire theoretical framework.

## RESULTS

### CONJOINT TENDON INJURY<sup>2</sup> AND *PUBALGIA*

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<sup>1</sup> U. A. B. (Universidad Autónoma de Barcelona): University of barcelona (T. N.)

<sup>2</sup> previously known as the **inguinal aponeurotic falx** ( T.N.)

Injuries affecting inguinal structures are about 2 and 5 % of all injuries suffered by elite sportsmen and athletes.<sup>8</sup> In sport scope muscle-tendon injuries of rectus abdominis and thigh adductors muscles, weakness of inguinal falx, inguinal hernia and symphysis osteoarthropathy are the main local causes for *pubalgia* or groin pain.<sup>9</sup> Articular structures and ligament reinforcement seem not to be strong enough to stabilize symphysis, the hip adductors muscles (mainly the adductor longus) and rectus abdominis play a fundamental role in the dynamic stability of pubic symphysis. Anatomically, these muscle groups insert themselves near the pubis and are closely related, with an anatomical continuity through tendon fibres and aponeuroses.

The development of injury in conjoint tendon can be probably due to repetitive microtrauma (pain due to overuse) associated to practicing sports which constantly or mechanically require effort of inguinal structures (soccer, artistic gymnastics, hurdling, etc.).<sup>9</sup> Then, generally, the first injured structure is the proximal tendon of adductor longus, because of its low vascularization (44-60 %), injury of abdominalis rectus itself (27 %) and a whole injury of conjoint tendon (15-30 %).<sup>11</sup> Just an injury in one of these structures themselves can disturb the balance in the dynamic stability system of symphysis, weighting down the other structures and predisposing then to injury.<sup>7, 10</sup> A second way of injury can be direct trauma, involving both excessive extension of body/spine and excessive abduction of thigh. Complete lesion of abdominalis rectus and adductors insertions are frequent, and symphysis pubis diastases, as described in jockeys and bull-riders.<sup>7</sup>

Injuries of the structures mentioned above, predispose to instability and subsequent symphysis retrogress. Pubis osteoarthropathy occurs with some unspecific signs and inflammatory and degenerative symptoms. Some authors consider this is more an empirical signal or a bundle of radiologic visualizations than a clinical entity.<sup>7</sup> On the other hand, it has been demonstrated that just osteoarthropathy is not frequent itself, and is mostly associated to adductor and/or abdominalis rectus injuries (conjoint tendon injury).<sup>8, 9, 10</sup> There is another important concept: the lumbar-pelvis- femur articular complex, and some authors seem to have proved that restricted hip mobility increases demanding the whole pelvic girdle, bringing up pubis osteoarthropathy due to mechanical stress.<sup>11</sup>

Finally, we find a set of clinical entities such as 'sportsmen hernia', 'sports hernia', 'Gilmore's groin', groin disruption, etc. All of them reach to mean insufficiency for one or various structures of the inguinal canal, associated to different grades of inguinal hernia. About 98 % patients affected are men, most frequently athletes. Most patients with a chronic groin pain are diagnosed of incipient hernias (symptomatic non-tangible hernias). Weakness of the inguinal canal walls, existing in about 15 % athletes affected by groin pain, use to be acquired and produced by mechanical misuse in all movements that require increasing intra-abdominal pressure (Valsalva). Together with some peculiarities of the inguinal canal posterior wall (deficiency of striated muscle

tissue, a structural weakness called 'orificio miopectineo'<sup>3</sup> and the spermatic cord access) would develop an incipient inguinal hernia. Other structures injuries, such as conjoint tendon (Zimmerman) or the aponeurosis of the Obliquus externus abdominis (Gilmore), brings up a direct inguinal hernia, which happens to 24 to 51 % sportsmen affected by chronic groin pain.<sup>12, 13</sup> Gullmo, Magee and Isrhad believe in the relationship between abdomen wall injury (surgical or traumatic) and the hernia-development processes, and compression and extension of ilioinguinal, iliohypogastric and genitofemoral nerves and their piercing branches (Hockey groin syndrom). Finally, it is important to point than conjoint tendon injury can cause lesions in aponeurosis of the Obliquus externus abdominis because of its proximity and anatomic relation, which compromises the integrity of the external inguinal ring and weakens the inguinal canal posterior wall, considering that the inguinal ring inserts in the anterior abdominalis rectus aponeurosis.

### **PUBIS OSTEOMYELITIS**

This is a clinical entity rarely described in medical literature. It is a bone infection caused by bacteria or fungi, mostly affecting children. It may also happen by direct inoculation after urological or gynecological surgery, vaginal birth and abuse of parenteral drugs. Pubis osteomyelitis has been as well described in healthy athletes, as an spontaneous and non-direct-traumatic occurrence, with no recognizable origin; the most probable hypothesis could be some side effects of repetitive micro-trauma.<sup>17, 18</sup> Radiologic studies seems to give a similar pattern with pubis osteoarthropathy, but it is rather different because of a clinical non-traumatic and febrile occurrence, and from the laboratory testing results and cell culture obtained from pubis symphysis, which confirm infectious etiology.

### **TENDINOPATHY IN ILIACUS-PSOAS MUSCLES, ILIOPECTINEAL BURSITIS AND HIP IMPINGEMENT**

Tendinopathies in iliacus-psoas muscles and iliopectineal bursitis are associated to repetitive micro-trauma related to sport practicing. Continuous demand of psoas in contraction (flexion and hip external rotation) and lengthen (hip extension), which is characteristic in many sports, inflicts big stress to the muscle-tendon transition area, where degenerative kind tendinopathies are generally established. Severe injuries usually happen because either an eccentric contraction of the muscle or because a direct trauma in femoral triangle superior apex. It is important to note that there is a tendency to withdrawal of the hip flexors during growing periods in teenagers, which can increase the stress in the muscle-tendon transition area, and could be the reason for the numerous medical histories of groin pain in young sportsmen. On the other hand, the excessive demand on iliacus-psoas area can increase friction between the tendon and iliopectineal bursa, which can cause inflammation by mechanical irritation.<sup>19</sup> Allen et al. (1984) established a

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<sup>3</sup> Probably, groove for iliopsoas (T. N.)

difference between external hip impingement and internal hip impingement. The second one is actually described in medical literature as an extra-articular tendon dynamic disturbance, produced by sub-dislocation or lateral-medial displacement of the iliopsoas tendon over the anterior side of the femoral head, the articular capsule or the iliopectineal eminence when passing from flexion, abduction and eccentric hip rotation to extension and internal rotation. Symptoms are similar and not very easy to distinguish from intra-articular pathologies (acute groin pain): when it is due to intra-articular pathology, flexion and forced internal rotation use to cause great pain on physical exam (sign of impingement or 'positive strike'). Several authors find that the tendon stand out is asymptomatic for 5-10 % sportsmen in pre-competition exams; others say that less than 1/3 patients affected by hip impingement fell pain while standing out. The etiology of the stand out and symptoms of pain are the same in these patients, being the excessive demand the main trigger of pain.<sup>20</sup>

### **FEMUR-ACETABULUM IMPINGEMENT AND ACETABULAR LABRUM TEAR**

Femur-Acetabulum impingement means some morphological disturbance in the femoral head, in the acetabulum or in both structures, which is verified by a thorough exam of radiological tests.<sup>21</sup> The coherence of coccyx-femur articulation is compromised and the disturbance is related to articular cartilage and acetabular labrum worn out, and to premature degenerative joint disease or osteoarthritis. This process usually affects to 18-35-year young, active people, which suffer symptoms like articular blockade, instability, crackle and painful stand out in hip and groin while rotating hip, especially internal hip rotation and flexion (sign of impingement or 'positive strike')<sup>22, 23</sup> Acetabular labrum tear was formerly associated to epiphysis displacement of the femoral head, to dislocation and sub-dislocation of coccyx-femoral joints and to Legg-Calvé-Perthes disease, among others. It seems to be true that diagnosis of acetabulum-rim injuries has increased recently thanks to MRI,<sup>4</sup> and nowadays other aetiologies are suggested, such as capsular and ligament laxity, articular hypermobility, femur-acetabulum impingement, hip dysplasia and worn out ageing. In sport-people, injury maybe caused by direct trauma with dislocation, sub-dislocation, acetabulum fracture; or because of side effect of repetitive micro-trauma in sports pivoting on hip, or adduction, extension and forced eccentric hip rotation. Injury is mainly found in the ante-superior face of the rim and occurs with some mechanical and ache symptoms, which are similar to femur-acetabulum impingement. Some works demonstrate that 22 % of patients with *pubalgia* and 55 % of patients with hip pain by unknown causes, suffered of acetabular labrum tear.<sup>21</sup> Some hip dysplasia are unnoticed in a medical exam, and are non-symptomatic during some time. The groin pain process begins with a mechanical overload and injury of peri-articular tissues (rim and cartilage), because of a great absence of coherence.<sup>24, 25</sup> Many hip dysplasia arise after an initial diagnosis of femur-acetabulum impingement or a non traumatic injury of the Acetabular labrum.

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<sup>4</sup> Magnetic resonance imaging (MRI), nuclear magnetic resonance imaging (NMRI), or magnetic resonance tomography (MRT). (T. N.)

## **APOPHYSITIS AND AVULSION FRACTURE**

This kind of injuries are common in athletes and young sportsmen who are bone immature, and growth plate of the apophysis where muscles insert, are the weakest point in the bone-tendon-muscle chain. About 14 to 40 % young people who practice strong physical exercise, are more likely to suffer these injuries, and, among them, 90 % are about 14 and to 19 years old.<sup>19</sup> Injuries more frequently described in papers, are tuberosity of the ischium (53 %) by pull of ischium-tibialis and Adductor Magnus muscles (typical of sprinters and hurdlers) (53%), EIAI due to pull of the Rectus Femoris muscle (typical of football players) (22 %), EIAI by the Sartorius muscle action (jumping sports) (11 %), lesser trochanter by Psoas action (11 %), and other less frequent areas such as the iliac crest by the abdomen muscles action and pubis symphysis by pull of rectus abdominis muscles or the adductor muscles.<sup>15, 19</sup> All these injuries occur with local pain in the inguinal area, corresponding to the strained bone region and its surroundings.<sup>26</sup> When epiphyseal plate stops growing (about 20-25 years old), muscle-tendon injuries are more frequent.<sup>19</sup>

## **PUBIS AND FEMORAL NECK STRESS FRACTURE**

Stress fractures or fatigue fractures are a consequence of the extraordinary stress applied to the healthy bone, exceeding its resilience and overwhelming the capacity of the bone to remodel. They use to happen to sport and army people (long distance runners). Wachsmith first described the stress fracture of the inferior pubic ramus in 1937.<sup>27</sup> The inferior pubic ramus happens to suffer more stress fracture than the superior pubic ramus; and its research proved that stress fracture of the superior pubis ramus was the main entity causing chronic groin pain on Australian elite soccer players.<sup>28</sup> Clinically speaking, local pain comes out in pubis, groin and adductor muscle area, and it is insidious while practicing exercise and calms down when resting, although fracture will be complete and the pain will be incessant if physical exercise is not given up. Femoral neck Stress fracture are about 11 % amongst all the fractures suffered by sportsmen, and about 5 % of the whole population. Groin pain is located in the deepest level, and with the same pattern than pubis fracture; but if they are not attended to on time, they are more likely to become a complete fracture, and its displacement may become a non-vascular necrosis process of the femoral head.<sup>15, 29, 30</sup>

## **HIP OSTEOARTHRITIS**

Hip osteoarthritis is a degenerative joint disease. Primary hip osteoarthritis is quite a frequent disorder from about 50 years of age, happening to 20-30 % of these people. Hip osteoarthritis is secondary when is caused by other previous factors, like Legg-Calve-Perthes disease, hip dysplasia, or septic osteo-necrosis of the femoral head. Pain progressively grows, and is mainly located in groin and around, and is also less frequently in the Trochanter area, interior side of

the thigh and knees. Flexion and hip rotation are the more restricted movements.<sup>31</sup>

## **HOCKEY GOALIE – BASEBALL PITCHER SYNDROM**

It is an infrequent syndrome described on this kind of sportsmen, so it has been named [like that]. Groin pain is a by-product of myofascia hernia and / or of the epimysium of the adductor longus muscle, which are noticeable in MRI, few centimeters near the pubis. The aetiology of this symptom is not further known; some authors suggest that the repetitive stress on that area, passageway of vessels and nerves through the muscle fascia, maybe one of the factors causing this syndrome.

## **FEMORAL NERVE AND OBTURATOR NERVE NEUROPATHY**

Nerve compression syndrome or compression neuropathy of the Obturator nerve is being more and more studied as a cause for chronic groin pain in athletes.<sup>32</sup> Injury in this area use to be a by-product of surgery, tumoral compression or haemorrhage, although there are other causes in the sport scope, such as nerve entrapment in its exit of the obturator canal, or in its entrance to the adductor muscles compartment through the thick fascia that surrounds the Adductor brevis muscle.<sup>32</sup> Pain during exercise uses to begin in the origin point of adductor muscles, and it can irradiate even to the most distal point of the thigh. There are other symptoms, like paraesthesia and numbness of groin and internal side of the thigh. Weakness of adductor muscles appears in later phases.<sup>19, 32</sup> Femoral Nerve injury can possibly be a complication after urogenital, pelvis or, generally, abdomen surgeries. A very known clinical of Femoral nerve compression is that of haemophiliac patients treated with anticoagulant (blood thinner) when there is a retroperitoneal hematoma or a psoas-iliacus hematoma. In sports scope there are just few cases, but they mostly appear in dance and gymnastics athletes, because extreme hip extension and knee flexion can cause elongation of the nerve and compression in its starting point the pelvis, under the inguinal ligament. Clinically, patients have a total lack of strength of quadriceps muscle, with or without muscle atrophy, knees weakness, awkwardness to running or jumping, and paraesthesia of the anterior-medial side of thigh. Pain, cramp and fibrillation appear along the inguinal area, hip, thigh and medial leg. The patellar reflex or knee-jerk is weak or null. The best way for evaluating any neuropathy is Electromyography, although any other complementary testing is very useful to reject abdomen, pelvis or lumbar region, which might be involved.<sup>19, 33</sup>

## **CONCLUSIONS**

1.- *Pubalgia* is a term which describes an existing pain in the inguinal and pubis areas, which may spread along lower abdomen and the hip adductor muscles.

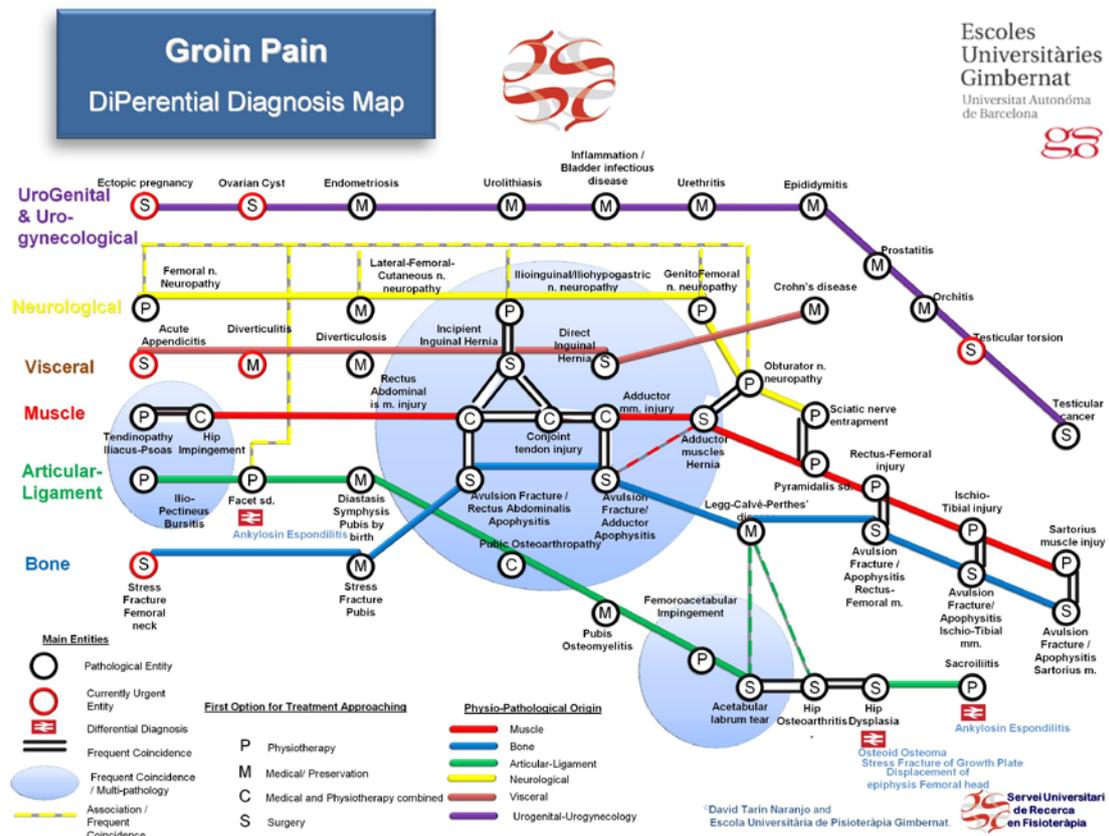
2.- This term itself doesn't have any pathological entity, because it is the clinical manifestation of a great variety of injuries of the locomotor system (focused in

pelvis, hip, thigh and spine), peripheral nervous system pathologies, genitourinary system pathologies, digestive system pathologies and rheumatic disorders.

3.- A variety of pathological entities and treatments are suggested and described in medical literature, each one focused in a very specific structure injury. Most patients suffer two or more injuries, which can produce unnecessary surgeries on patients diagnosed of *pubalgia*.

4.- Pubalgia must not be considered, diagnosed or treated by unifying all injuries in the same category; so a right, thorough differential diagnosis must be applied, and then, prescribe the appropriate treatment.

An infography describing differential diagnosis of pubalgia has been drawn, based upon the above conclusions, and it may be very useful for clinical evaluation and educational teaching as well. (Figure n. 1)



**FIGURE 1:** Infography - Differential Diagnosis of Pubalgia

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