"SPORTSMAN’S HERNIA”. PART TWO: MULTISPECIALIST DIFFERENTIAL DIAGNOSIS OF MOST COMMON DISORDERS

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First part of the paper concerning sportsman’s hernia (Pol Przegl Chirurg 2012; 84(1) 90-100) presents pathophysiology, nomenclature and treatment of so called “sportsman’s hernia”. These disorders are traditionally treated by orthopedists, gynecologists, neurologists, urologists or surgeons and are infrequently manifesting as pain in the groin region. Therefore diagnosis of these disorders is complex, difficult and requires general knowledge of disorders of this region.

This paper discusses multispecialist differential diagnosis of most common pain disorders in this region. Table 1 presents disorders causing complaints in the groin region that are difficult to differentiate from pain caused by inguinal hernia.

Disorders of muscles, fascia and joints

The most common orthopedic disorder to cause pain in the groin region is adductor enthesopathy (painful disease changes of tendon attachments to bones, Adductor Strains, Adductoren tendopathie).

An estimated 10-18% football players complain of pain in the inguinal and femoral region; in 62% of these cases adductor enthesopathy is diagnosed (1, 2). Pain is caused by disease changes in one of the three adductor

Table 1. Causes of groin pain

| 1 | Abdominal disorders (aneurysms, appendicitis, large intestine diverticulosis and diverticulitis, colitis) |
| 2 | Genitourinary disorders (inflammation, prostatitis, inflammation in the region of the scrotum and testes, gynecological disorders, nephrolithiasis, testis tumors, testis torsion) |
| 3 | Disorders of the spine (discopathy) |
| 4 | Orthopedic disorders |
| a) | adductor enthesopathy |
| b) | osteitis pubis – pubalgia |
| c) | bursitis / iliopsoas tendopathy / bursitis |
| d) | fatigue fractures |
| e) | avulsion fractures |
| f) | snapping hip syndrome (coxa saltans) |
| g) | aseptic necrosis of femoral head |
| h) | myositis ossificans |
| i) | Legg-Calvé-Perthes disease |
| j) | epiphysiodesis |
| k) | instability of the pubic symphysis |
| 5 | Neurological disorders |
| a) | obturator nerve neuralgia |
| b) | neuralgia of the lateral cutaneous nerve |
| c) | neuralgia of ilioinguinal nerve |
muscles: long adductor muscle (musculus adductor longus), short adductor muscle (musculus adductor brevis), and great adductor muscle (musculus adductor magnus) (fig. 1). Furthermore, complaints may be caused by disorders of the pectinate muscle (musculus pectineus) and gracilis muscle (musculus gracilis). All these muscles attach to the pubic bone and femur or tibia. All these muscles are innervated by the obturator nerve.

Enthesopathy can be diagnosed using clinical examination. Adduction of a lower limb in a hip joint against resistance causes pain during palpation of muscle attachment to the bone. The complaints increase gradually. The pain is located at the site of muscle attachment to the pubic bone and radiates to medial side of the femur and in the direction of the straight abdominal muscle. The pain causes muscle rigidity that often completely resolves after an exercise (physiotherapy). In untreated cases, the pain reappears upon the limb loading with increased intensity. When these complaints are neglected or treated inconsistently, there is a risk of so called “pain cycle” leading to continuous pain (fig. 2) (1). In unclear and difficult diagnostic cases, ultrasound imaging and magnetic resonance imaging (MRI) are helpful. Ultrasound imaging is helpful in particular in diagnosis of muscle ruptures (3). Results of ultrasound imaging in muscle sprains are unclear (the author’s own experience). In muscle ruptures the following aspects need to be considered that affect further management:

a) are there biomechanical anomalies that result in injury,

b) are there abnormalities in foot and lower limb position that result in abnormalities of muscle balance,

c) are there any differences in the length of lower limbs resulting in excessive load on adductor muscles during the exercise.

So far, causal relation between biomechanical anomalies and damage of adductor muscles has not been proven. Despite that many sport physicians are convinced that such relation exists. Site of muscle injury plays an important role in enthesopathy. In traumatic injuries of muscle attachment to the pubic bone, conservative approach (calm, unloading) for 6-8 weeks precedes physiotherapy that can be started only in the period free from pain complaints.

Treatment of adductor enthesopathy in an acute phase involves use of massages, compressive dressings, limb elevation and immobilization. Furthermore non-steroidal anti-inflammatory drugs may be used, although their use is controversial. If the treatment is used consistently, if an athlete actually adheres to his constraints and stops his training for approximately 6 weeks (stops, not only limits its intensity), pain and inflammatory changes resolve quickly. In chronic complaints, training should be stopped and a heating compress should be applied for as long as long local tension of adductor muscles is felt and as long the pain persists during thigh adduction. Several days, after resolution of tension and pain, heating compresses should be used, and injections of non-steroidal anti-inflammatory drugs should be given. In persistent cases, injections of non-steroidal anti-inflammatory drugs in the most tense muscle groups provide relief.

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**Fig. 1.** Attachment of adductor muscles to the pelvic bone

**Fig. 2.** Pain cycle according to Renström and Peterson
When complaints resolve, before return to normal athletic activity exercises of adductor muscles are done, initially isometric, subsequently dynamic training without loading, then with increasing load, muscle tension and specialist training. In neglected cases surgical treatment is indicated – adductor tenotomy.

The causes of failure are related to inconsistent primary treatment. Pressure exerted on the physician by coaches and athletes for whom the treatment seems too long and too harsh, contributes to treatment failure. As a consequence, chronic periostitis occurs or in extreme cases – traumatic rupture of the affected muscle – most often the long adductor muscle.

Treatment of chronic conditions, when conservative treatment options are exhausted, involves adductor tenotomy and (or) the gracilis muscle with subsequent consistent postoperative rehabilitation and gradual return to athletic activity. The author performed tenotomy of the long adductor muscle and the gracilis muscle (both muscles with small graft areas). After the operation, the period of rehabilitation ensued that lasted for approximately 6-8 weeks. Success of surgical treatment depended on proper diagnosis, atraumatic surgery and consistent postoperative rehabilitation. In some cases, tenotomy was accompanied by surgical procedure of the groin region – laparoscopic hernioplasty TEP.

Osteitis pubis – also referred to as pubalgia is a painful, non-bacterial pubic symphysitis, pubic osteitis and inflammation of fascias, muscles and aponeuroses that attach in this region (4) (fig. 3).

It was for the first time described by Beer in 1924 (5). It is caused by recurrent microinjuries caused by the action of twisting and cutting forces on the pubic symphysis that occur during sudden changes of motion direction. Handball, football, basketball, tennis players and runners are at risk of these injuries. Like adductor enthesopathy, different length of limbs, their excessive pronation, valgus or varus position may lead to pubalgia (6). Pubalgia manifests as hypogastric pain that exacerbates after an exercise and twisting movements. Pain increases gradually unless that chain of events resulting in pubalgia is stopped.

Pain in the region of pubic symphysis during clinical examination supports the diagnosis, while lack of pain precludes its diagnosis (7). Clinical diagnosis may be confirmed by an X-ray image that demonstrates widened pubic symphysis, blurring and irregularity of contours of articular surface or periarticular sclerotization. An X-ray image may be normal at early stages of development of this disorder (8). In such cases, flamingo or stork stress views are indicated, involving taking images in a standing position on alternating legs. The test is positive if mobility of the pubic symphysis during this test exceeds two millimeters (9). MRI and bone scans are further diagnostic possibilities (8, 10). The treatment is to explain to the affected person that the cure is spontaneous following resolution of destructive factors and that the process of repair and treatment may take over one year (8, 11). Exercises that cause pain should be excluded from the rehabilitation program. When intensity of complaints decreases, gradually range of mobility and loading increase. Furthermore, if there are biomechanical abnormalities, they should be corrected (correction of uneven limb length, excessive pronation, etc.)

Orchard et al. (12) performed surgical treatment of inguinal hernia (using a conventional method, without a graft) in case of pubalgia and obtained resolution of pain complaints and complete return to athletic activity as soon as
within 6 weeks after the surgery. These observations are consistent with reports by Hennigway et al. (13), who found a significant increase of inguinal muscle strength (of posterior wall of the inguinal canal) and alleviation of pain after anterior hernioplasty with subsequent rehabilitation.

The pelvis is stabilized by both muscles of abdominal wall and hip adductors and abductors (13). Therefore it is understandable that any abnormality of this balance (injury, congenital factors, abnormal limb position) result in compensatory movements and abnormal pelvic static conditions.

Fatigue fractures occur as a consequence of repeated injuries. They often manifest as inguinal pain. They can be suspected in athletes who suddenly changed the way of training. The pain exacerbates during an exercise and decreases at rest. It gradually increases during loading exercises, as during running. Both fractures in the region of femoral neck and pubic bone fractures may manifest as inguinal pain.

Femoral neck fractures are classified as medial and lateral fractures. Their treatment and prognosis depend on location of the fracture and type of fracture line. Abduction fractures with angle of femoral neck flexion exceeding 126° and Pauwels 1 angle below 30° belong to stable fractures that can be treated conservative. Adduction fractures with angle of femoral neck flexion below 126° and Pauwels angle above 30° belong to unstable fractures that require surgical treatment. An abduction fracture can be treated by unloading of the affected limb (crutches, wheelchair) until the resolution of complaints, usually for 6 to 8 weeks. Adduction fractures, due to the risk of displacement, require surgical treatment (14). In any case of inguinal pain which etiology cannot be clearly determined, X-ray imaging is required (1).

Pain can also be caused by benign or malignant bone tumors. Often X-ray imaging is unable to detect pathological lesions at an early stage of the disorder (fatigue fractures and neoplasms). In such cases bone scintigraphy can be helpful. In unclear cases, combination of scintigraphy and MRI may help to make a diagnosis. The time to confirm the diagnosis may be variable but should not exceed 6 to 8 weeks until the onset of pain.

Another fracture with projection of pain to the groin is a fatigue pubic bone fracture. It is not as dangerous as previously reported femoral neck fracture (15). It is most commonly found in runners and recruits after long walks. It is relatively easy to diagnose. Medical treatment, involving avoidance of exertion for 4 – 6 weeks with subsequent rehabilitation, allows majority of affected subjects to return to complete activity within 4 – 5 months. Treatment of these fractures would be incomplete without emphasizing additional risk factors such as: abnormalities of hormonal balance, abnormal nutrition, wrong training.

Avulsion fractures. Three types of avulsion fractures that cause inguinal pain, are found in the inguinal region (fig. 4). Sudden tension of the sartorius muscle (musculus sartorius) during for example jumping, may result in avulsion of attachment of this muscle from the anterior superior iliac spine (spina iliaca anterior superior). During a potent contraction of the rectus femoris muscle (musculus rectus femoris), it can detach from the anterior inferior iliac spine (spina iliaca anterior inferior). Avulsion of ischial tuberosity (tuberositas ischiae) is the third injury. Shortening of femoral flexor muscles (musculus semitendi-

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1 Pauwels angle is an angle between a horizontal line connecting both iliac spines and a line going through the surface of the fracture of the femoral neck.

Fig. 4. Tendinous avulsion in the pelvic bones.
nosus, musculus semimembranosus et caput longum musculi biceps femoris) is regarded as a cause of this fracture. Avulsion of iliac spines and ischial tuberosity can be successfully treated conservative in majority of cases. Translocation of bone fragments for more than 1 – 2 cm requires surgical treatment (1).

Changes in the region of the hip joint such as: fibrosis of the articular capsule, tendon, muscle and periosteum abnormalities are also responsible for pain projecting to the groin. Pain can be the first symptom of degenerative changes in the knee joint (arthritis, osteochondrosis dissecans). Patients, in particular young athletes, present with pain appearing after exercise, and visit an orthopedist, pediatric orthopedist, radiologist or rheumatologist. Often preliminary diagnoses include coxitis fugax, streptococcal arthritis, Perthes disease, rheumatic disorders. They are treated for many months with antibiotics or high doses of anti-inflammatory agents, without any improvement. Often examination of the groin region is omitted, but in this case it would reveal pain without coexisting hernia. Correct medical history can support positive family hernia history (16). Revision of the groin region often clears any doubts (17, 18). Changes in the region of the hip joint with limitation of its mobility can cause pubalgia that can imitate complaints found with inguinal hernia (19) (fig. 5).

Iliopsoas tendinopathy (tendopathia musculi iliopsoas) and bursitis (fig. 6). There are 13 bursae tendineae in the region of the hip joint, between tendons, muscles and above bony eminences. Their injuries and inflammation result in formation of pathologies of the bursae. Traumatic bursitis is treated with puncture and hematoma removal.

Bursa iliopectinea (bursa iliopectinea), located in front of the hip joint, is the largest bursa tendinea in the human body. Complaints caused by its pathologies (hematoma, inflammation) most often occur with hip stresses (football players, dancers, athletes running uphill). Difficulties with determination of nature of the pain and its location delay diagnosis (20). Pain can be induced by elevation of a limb extender in the hip joint by approximately 15° above the table level. Puncture of the bursa and MRI facilitate correct diagnosis (1). Treatment (conservative) involves avoidance of excessive movements in the hip joint with gradual return to activity after resolution of acute symptoms. Surgical intervention is rarely required (20). Bursitis is inseparably associated with snapping hip syndrome (coxa

Fig. 5. MRI coronal view of lateral vastus with hematoma and rupture of lateral vastus

Fig. 6. The psoas muscle, iliacus muscle and iliopsoas bursa
saltans, schnappende Hüfte). It most often occurs when iliotibial tract (tractus iliotibialis), tensor fasciae latae muscle (musculus tensor fasciae latae) or tendon of the gluteus medius muscle (tendo musculi glutei medii) translocate over the trochanter major. This may lead to an inflammation of a local bursa tendinea. Approximately one third of patients respond to these changes with pain (21). Other cause of snapping hip syndrome include: tendon of the iliopsoas muscle (musculus iliopsoas) moving over the iliopectineal eminence (eminentia iliopectinea), avulsion of the acetabular labrum (labrum acetabulare), hip subluxation, intraarticular foreign bodies (22) (fig. 6). Treatment with non-steroidal anti-inflammatory and steroidal agents as intraarticular injections facilitate alleviation of bursitis. Surgical treatment is indicated in extreme cases.

Neuropathies

Nerves of the hypogastric region, groin, femoral region and sex organs create a delicate network of connections that results in non-characteristic pattern of pain (23, 24) (fig. 7 and 8).

Obturator nerve entrapment is increasingly commonly regarded as a cause of chronic pain in the groin region in athletes. After crossing the obturator canal, this nerve innervates adductor femoris muscles, gracilis and pubic muscles, and gives off sensory arms to the skin on the medial femoral region. Its area of innervations overlaps with the area affected by adductor enthesisopathy (fig. 9 and 10).

Nerve compression results in weakening of adductor function. First line therapy in this syndrome is surgical neurolysis that results in resolution of complaints within several weeks.

Neuralgia of the lateral cutaneous nerve occurs as a result of nerve compression at the level of the inguinal ligament (fig. 11). This complaints have the form of paresthetic neuralgia. Accidental injury of this nerve during a laparoscopic procedure results in neuralgia of this nerve. Treatment involves elimination of factors that results in compression of this nerve, while surgical treatment is rarely required (nerve decompression).

Neuralgia of ilioinguinal nerve is relatively rare. This nerve undergoes injury usually at sites of penetration of subsequent muscle layers of the abdominal wall. Knockaert et al. (25) believe that three symptoms are required for the diagnosis of neuralgia of ilioinguinal nerve (tab. 2). The site specified as (3) is located 2-3 cm medially and caudally in tab. 2 from the anterior superior iliac spine and corresponds to the site of cascade-like penetration of subsequent muscle layers of the abdominal wall by the nerve in the region of the inguinal canal (26).

Neuralgia of this nerve is most commonly the result of previous surgical treatment in the
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Fig. 9. Course of obturator nerve

Fig. 10. Retroperitoneal course of ilioinguinal nerve. 1. Ilioinguinal nerve, 2. Circumflex iliac artery and vein (intraoperativ view by TEP operation)

Fig. 11. Inguinal region nerves. 1. Iliohypogastric nerve, 2. Ilioinguinal nerve, 3. Lateral cutaneous femoris nerve. 4. Femoral ramus of the genitofemoral nerve, 5. Genital ramus of the genitofemoral nerve, 6. Obturator nerve, 7. Cutaneous ramus of the iliophygastric nerve, 8. Femoral nerve

hypogastric region. Another cause of these complaints lies in weak muscles of abdominal wall, resulting in prolonged course of the nerve through abdominal wall and inguinal canal. Except for weak abdominal muscles, angle of pelvis flexion also affects higher incidence of this neuralgia in women (27). Few reports concerning this subject (25, 28), treating it as a case report (17) as well as neglecting these complaints by the treating physicians results in them persisting for years, without diagnosis or treatment. Attempts of diagnosis using electromyography are prone to error due to difficult nerve location (25). Ultrasound imaging can help locate the nerve and thus targeted blockade can be sued (29).

SUMMARY

Inguinal pain is not necessarily caused by inguinal hernia and damage of inguinal canal structures. In the event of diagnostic problems, several other factors that could cause inguinal pain need to be considered and patient should be referred for a consultation to search for causes of pain elsewhere.

Table 2. Diagnosis of ilioinguinal nerve neuralgia

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<td>1.</td>
<td>Pain in the iliac fossa region with muscle pain radiating to the groin, central scrotum or major pudendal labia and upper thigh</td>
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<tr>
<td>2.</td>
<td>Hiper-, hipo-, or dysthesia involving an area innervated by ilioinguinal nerve</td>
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<tr>
<td>3.</td>
<td>Existence of a site in which injection results in resolution of complaints</td>
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