

# THE GROIN REGION ANATOMY AND CLINICAL ANATOMICAL APPROACH TO ATHLETIC GROIN PAIN REVIEW OF LITERATURE

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## INGUINAL BÖLGE ANATOMİSİ VE ATLETİK PUBALJİYE KLİNİK ANATOMİK YAKLAŞIM İLE LİTERATÜR İNCELEMESİ

### ABSTRACT

The anatomy of the groin region is complex and involves a confluence of structures. Groin pain is a chronic symptom located in the inguinal region. In this review, it is aimed to give an overview of inguinal pain in the literature, to examine surgical and rehabilitation interventions and to compare the time to return to sports. In addition, different diagnostic approaches are indicated. To create a map for further studies by compiling in detail the studies in the literature on the anatomy of the groin region and the definition, treatment and return to sports after the treatment of athletic groin pain. The results of this review showed a comparable return to play rate and return to play time between surgical and rehabilitative interventions. We believe that dealing with the reasons of groin pain in detail in the treatment process will affect the duration of treatment and return to play.

**Keywords:** Athletic groin pain, groin region, inguinal region, groin pain treatment, surgical interventions, rehabilitative interventions, femoral triangle, groin injuries

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## ÖZET

Inguinal Bölge anatomisi karmaşıktır ve çeşitli yapıların organizasyonunu içerir. Pubalji kasık bölgesinde lokalize olan kronik bir semptomdur. Bu derlemede pubalji konusunda literatürde yer alan genel bilgilerin verilmesi, cerrahi ve rehabilitasyon müdahalelerinin incelenmesi ile spora dönüş sürelerinin karşılaştırılması amaçlanmaktadır. Ayrıca farklı tanı yaklaşımları belirtilmektedir. Inguinal bölgenin anatomisi ve atletik pubaljinin tanımı, tedavisi ve tedavi sonrası spora dönüş konularında literatürde yer alan çalışmaları detaylı bir şekilde derleyerek ileriki çalışmalar için bir harita oluşturmaktır. Bu derlemenin sonuçları, cerrahi ve rehabilitasyon müdahaleleri arasında spora dönüş oranı ve süresinin karşılaştırılabilir olduğunu göstermiştir. Tedavi sürecinde pubalji nedenlerinin detaylı olarak ele alınmasının tedavi süresini ve spora dönüş süresini etkileyeceği belirtilmiştir.

**Anahtar Sözcükler:** Atletik Pubalji, Inguinal Bölge, Pubalji tedavisi, cerrahi müdahaleler, rehabilite edici müdahaleler, femoral üçgen, Inguinal Bölge yaralanmaları

## INTRODUCTION

The inguinal region, which is defined as the groin, is located at the intersection of the abdomen and thigh (1). The pain in the groin area can be of gynecological, urogenital, gastrointestinal, or neurological origin. It may confuse research examining groin pain (GP) (2). Groin injuries in connection with physical activity, in particular sports, are very common and in football they are among the most common and most time-consuming injuries. The difficulties in understanding the etiology and pathology of groin injuries are partly a result of the groin being an anatomical region connected to several other regions and also an area where pain from pathology elsewhere often radiates. The complexity of the anatomy and biomechanics is a well-known problem with a continued need for further research (3). Athletic groin pain (AGP) is a chronic injury to the inguinal region (which is located at the intersection of the torso and lower limb) in a population that physically active (4). GP in athletes is important for clinicians because of its high incidence, time to return to sports, superior prevalence and high recurrence rates. It is an important topic for sports physiotherapy and sports medicine research (5). There have been many studies in the literature about GP. Some of these are studies on a specific nationality(1), some in certain age groups (6, 2); some by applying a certain treatment (2, 4, 7, 8, 9), and some of them are carried out for a specific sport (1). For GP, the source of the pain is important. Pain can be caused by many reasons (1, 5). Various methods are used during clinical examination to make a clear diagnosis of GP(5).

In a systematic review of 72 studies by Serner et al, 72 studies are divided as follows; in 18 studies include conservative interventions and 54 studies include surgical interventions. Conservative treatment studies contained passive physical therapy modalities and/or exercise therapy which are 10 studies of total 18 studies or injection therapy (corticosteroids or dextrose) which are 8 studies of total 18 studies.

This shows that a wide variety of conservative

treatment protocols are applied. Surgical studies included open hernia repair which are 12 studies of total 54 studies, laparoscopic hernia repair which are 10 studies of total 54 studies, and adductor tenotomy which are 9 studies of total 54 studies. Many surgical treatments were combined (16 studies), and additional neurotomy of the ilioinguinal, genitofemoral, and/or iliohypogastric nerve was constantly performed(12 studies). From this situation, it is understood that the surgical procedures applied for treatment also vary(2).

This review article aims to examine GP in detail, compile the research, determine the clinical projections, and create a map for further studies.

## MAIN BODY

### *Pathogenesis*

To better understand the pathogenesis of chronic groin pain in athletes, a precise anatomical knowledge of the pubic symphysis and surrounding soft tissues is required (10). Despite consensus that athletic pubalgia results from injury to muscular and/or fascial attachments to the anterior pubis, there is considerable debate in the literature about the pathogenesis and the exact anatomical areas of disruption (11). Since no gold standard exists regarding diagnosis for most of the soft tissue related groin pain, this approach offers a possibility to identify the anatomical structures that are painful in athletes with groin pain and thereby differentiate between the different pathologies. This is no attempt to label the groin pain with a diagnosis at this stage, but merely to create a basis for which the further research into "real diagnoses" can begin and to be able to compare cohorts of patients in relation to epidemiology, investigations, treatment, and prevention(3).

### *The Groin Region and Triangle*

If we want to define the groin region briefly, we can say the point where the thigh and abdomen meet and in addition, we can use landmarks such as anterior superior iliac spine and pubic tubercle. It is the area that contains the pubic tubercle medially, the anterior superior iliac spine superolaterally, the inguinal ligament superiorly, and the adductor group muscles inferiorly.

The neuroanatomy of the groin is complicated and also so many variations can be seen from the terminal branches of retroperitoneal lumbar plexus which is exiting through the inguinal canal. In-depth knowledge of the neuroanatomy of the region is essential to avoid nerve injury (7,12,13).

According to the study by Falvey et al. study, the corners of the groin triangle are determined as follows; the anterior superior iliac spine ; the pubic tubercle, and the point of 3G. If we briefly explain the 3G point, the 3G point is actually a point defined for the top of the triangle. This point corresponds to the following alignments; midpoint between anterior superior iliac spine and upper end of patella on anterior coronal plane - in the line of posterior coronal plane the femur double the distance extends from the spinous process of the 5th lumbar vertebra to the ischial tuberosity (14). And at the same study borders were determined as follows; the superior border of the triangle forms by the line between the pubic tubercle and the anterior superior iliac spine, the medial border of the triangle forms by the line from the pubic tubercle to the 3G point, the lateral border of the triangle forms by the line from the anterior superior iliac spine to the 3G point. The representation of the borders of the groin triangle and the anatomical landmarks on it is shown in figure 1.

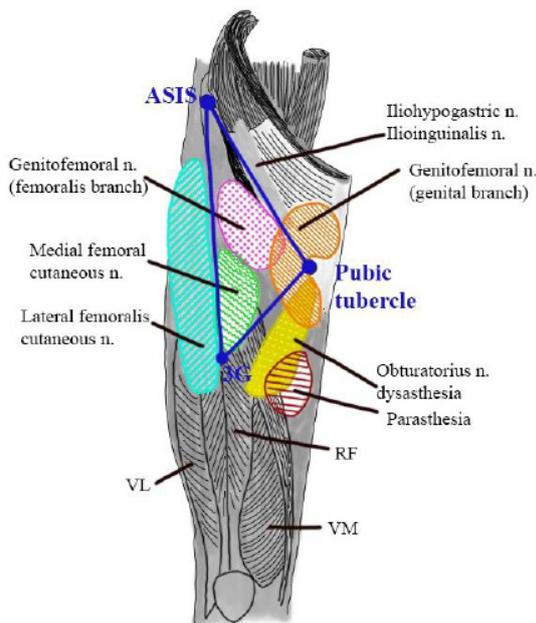


Figure 1. The groin triangle with its borders

## Pubic Symphysis

Pubic symphysis is the structure where the left pubic and right pubic bones meet in the midline. The medial surfaces of the pubic bones are the articulating surfaces. Pubic symphysis is shown at the Figures 2 and 3.

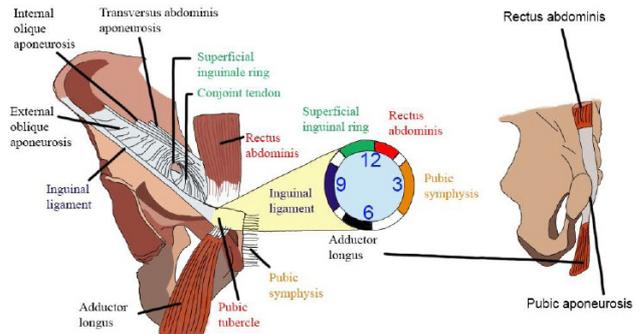


Figure 2. Inguinal region organization

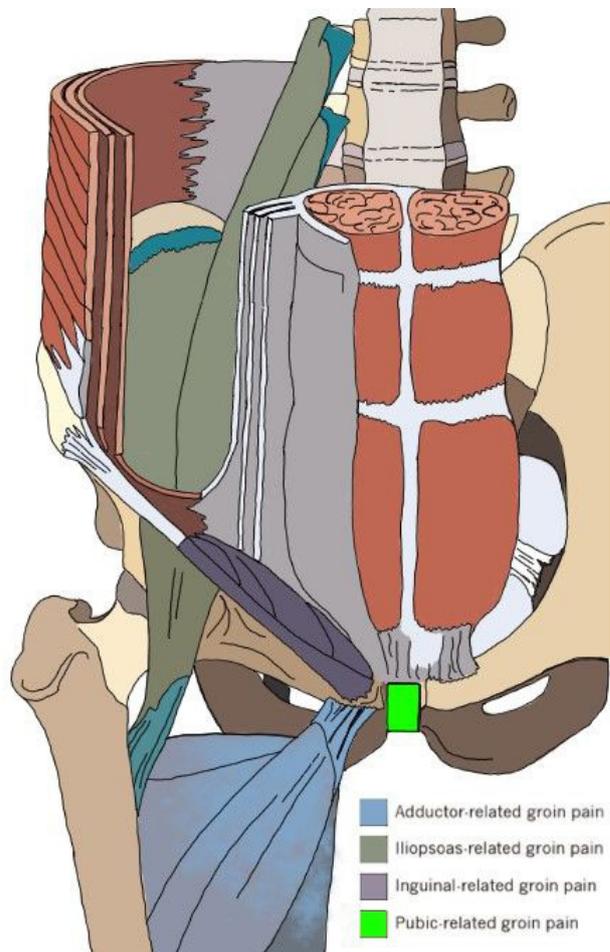


Figure 3. Junction of the abdomen and thigh

## Pelvic Girdle, Gluteal Region and Thigh

The arterial supply for psoas minor muscle is from the lumbar arteries, although there are minor helps from other vessels that supply psoas major. A branch of L1 (first lumbar nerve) innervates psoas minor muscle. Iliacus muscle is a triangular muscle that originates from the superior of the the iliac fossa concavity, the iliac crest, iliolumbar ligaments and the sacrum superior surface. Its fibers converge into the psoas major, and the muscles then attach to the lesser trochanter of femur, but some of the fibers' insertions are directly to the below of the femur and in front of the lesser trochanter. The anterior surface of the iliacus muscle is related to the lateral femoral cutaneous nerve, the caecum. The iliac fossa is at the posterior surface of the iliacus muscle, and medial border of iliacus muscle is psoas major. Anterior surface of the iliacus muscle is related to a lot of structures like; fascia lata, sartorius and rectus femoris muscles and deep femoral artery. Posterior surface of the iliacus muscle is related to the hip joint capsule. Its arterial supply is similar with psoas major muscle. The main supply comes from the iliac branches of the iliolumbar artery. Iliacus is innervated by femoral nerve's branches, L2 and L3. Psoas major muscle has a flexion role on the thigh on the pelvis. Psoas major muscle is effective in balance of the trunk in a several positions like sitting or squat. Tests for iliopsoas have been made in a clinic by flexing the hip against resistance while body is in the supine position. Also at this test hip and knee flexed position (15,8).

### Femoral Triangle

The femoral triangle, an important triangular shaped landmark to examine the region and understand relationships in the groin. In vivo, it shows up as a triangular shaped depression while thigh's moving flexion, abduction, and lateral rotation. The femoral triangle's boundaries:

- At the superior; inguinal ligament. Inguinal ligament schematized at the Figure 3.
- At the medial; adductor longus muscle's lateral border.
- At the lateral; sartorius.

Lateral side of the femoral triangle floor is formed by the iliopsoas muscle and medial side of it is formed by the pectineus muscle.

The femoral triangle roof is formed by several fascias like fascia lata and cribriform fascia and also subcutaneous tissue, and skin.

The contents of this triangular landmark, in order of from lateral side to medial side, are the:

- Femoral nerve and femoral nerve's branches.
- Femoral sheath and femoral sheath's contents:
- Femoral artery and several of femoral artery's branches.
  - Femoral vein and vein's tributaries (profunda femoris veins etc.).
  - Lymph nodes (deep inguinal) and several lymphatic vessels (8).

### What is exactly groin pain?

GP is usually seen in athletes. A few studies reported that for soccer players which are male the incidence of GP is 10-18%. (16, 17, 18). There is no concurrence on criteria of diagnosis or definitions. The pain which seen in adductor muscle group is a mostly cause of it. And the pain causes lots of related problems which takes a longer time (19, 20).

GP is frequently hip related pathology. Symptomatic hip arthritis is so common by the age of 85. It develops in about one in four people in the population till this age. Groin injuries count for almost 1 in 20 athletic injuries. And 1 in 10 patient visits clinic with this cause. Most athletes with this pathology have multiple different pathologies spanning a few disciplines. In treating process for these patients, the orthopedic surgeon must be aware of both this region's musculoskeletal disorders and non-orthopedic cases that can exist as GP. A large history should be taken from the patient and a physical examination should be performed (21).

### What can cause Groin Pain?

In athletic population GP is so common. It occurs mostly in those sports which require kicking (soccer etc.). Lots of the causes of pathology in these areas are related to the musculoskeletal system. Nevertheless, almost all of the problems are non-orthopedic. It should be kept in mind that clinical conditions such as pelvic tumor may also cause pain in the relevant region and therefore a detailed examination is required.

In this kind of case, diagnosis which is correct for this situation is frequently delayed for a long time like months. This situation has destructive outcomes for the athlete. GP causes can be medical causes, stress fractures, avulsion fractures, osteitis pubis, and nerve compression (22).

**Medical causes** of pain can include intestinal and intra-abdominal problems (Crohn's disease and/or diverticulitis, appendicitis, and intestinal obstruction etc.). Intestinal problems ought to be doubted in athletic population with complaints like lower abdominal and/or pelvic pain, with nausea and vomiting.

**Stress fractures** are mostly felt to happen from a overload by submaximal forces, but the precise etiology is unknown. Many situation like this presumably go unknown because the most of the patients treat themselves by resting until the pain improves.

**For stress fractures**, the most affected bone is the tibia. Stress fractures are so common in bones which are weight-bearing in lower extremity. These fractures of the pubic rami are widespread among athletes that long-distance runners.

**Avulsion fractures** on the pelvis happen nearly only in the adolescent population. There are 3 locations which are typical for avulsion fractures of the pelvis (Anterior superior iliac spine, anterior inferior iliac spine and ischial tuberosity). These typical avulsion fractures can happen from a hard and strong contraction of the muscles during several activities like jumping and running in sports such as basketball or kicking sports such as soccer etc. Osteitis pubis is a disorder whose cause is not yet fully known. It is mostly seen with pain at the pubic symphysis. Nerve entrapment at the groin region is not so common. Pain occurs because the nerve is compressed while it is passing through fibrous tunnels and between muscles. There are many extrinsic factors for this clinical situation (Local edema, excess scar formation etc.)

Studies about soccer have reported of this region injury rate is around 10-18% (17, 18). Adductor muscles, iliopsoas muscle, abdominal muscles and symphysis joint are some of the anatomical structures that aches most frequently in athletes with GP. Techniques that evaluate the strength and flexibility of the mentioned muscles, as well as pain due to these anatomical structures, are therefore important tools in the clinical examination of athletes with GP (23). In

1980, Renström and Peterson (24) reported the idea of separating groin injuries into diagnoses corresponding with the anatomy. Injuries can come from many sources, but 62% of injuries were from the muscle-tendon unit of adductor longus. In a study of 189 cases, the cause of chronic pain in this region was attributed to adductor injury with a rate of 30% and osteitis pubis in 20% of the total number of cases (25). In 2007, studies were further developed and presented as a clinical entity concept. This concept, relating the groin pain to the anatomical structures, is still a fairly rough way of separating the injuries of the groin, however, it allows for further diagnostic methods to be more precisely aimed as well as it can direct the treatment strategy (26). The same researchers demonstrated this approach in a randomized controlled trial with a specific exercise therapy for adductor muscles and their function (27). Inguinal disruption, explain to the patient that the injury is related to overuse of muscles and tendons in the groin. If a inguinal disruption is causing severe discomfort, consider non-steroidal anti-inflammatory drugs and simple analgesics to relieve pain (28).

At the Junction of the abdomen and thigh figure is schematized of the causes of the GP (Figure 3).

## CONCLUSIONS

In an article examining the anatomical and biomechanical causes of GP, pathological conditions of the hip and groin are two parts; acute and chronic injuries). It was observed that the speed of returning to sports of the athletes who applied MMT was faster than the athletes who applied ET.

There was no significant difference between the MMT and ET groups in the number of athletes who could return to sports activities (9). When the literature is searched, various interventions for GP catch our attention.

In a study in terms of examining the results of conservative treatment, NSAIDs, stretching and strengthening, mobilizing reduced activity and acupuncture the complete recovery process took 7 months for women and 9.5 months for men (30). Hölmich et al. (27) emphasized the importance of active physical therapy program. The active physical therapy program applied on the pelvic stabilizer muscles was more successful than the passive local applications.

Rodriguez et al reported a program that included rehabilitation. This program includes many methods. They combined regional passive application methods (Electrotherapy modalities, ultrasound, cryo massage etc.) and a program that includes progressive increased physical loading for athletes with osteitis pubis (31). Symptoms disappeared in all athletes after 10 weeks of treatment. A study by Extrand and Ringborg has mentioned that patients treated with strengthening exercises experienced some short-term positive effects (32). The long-term effects were not significantly more different than a control group that did not receive therapy. Holt et al., in their study, all athletes returned to sports within 16 weeks. The reason for this success is the steroid injection they apply when they cannot get results from rest and progressive exercise. This injection was performed directly into the pubic symphysis(33).

In a study by O'Connell et al., in which persistent complaints were observed 6 months after steroid injection, 31% of the group complained of this condition (34). In one study, prolotherapy was applied when the athletes could not get a successful result from rest or different physical therapy modalities. And all the athletes returned to sports within about 3 months (35). After open approach surgery for single adductor tenotomy, a high rate of return to sports was achieved in approximately 14 weeks and full athletic activation of the athletes was observed (36, 25, 8). More than half of the group showed a return to the same or lower level of sport (25) and a large majority of athletes have generally returned to the same level as before (8). Extrand and Ringborg obtained various results with the surgical method they applied to the ilioinguinal nerve. More successful results were obtained in those who underwent surgery than those who received conservative treatment within 3 to 6 months (32). A surgical intervention such as laparoscopic (hernia) repair provides a faster recovery process than open surgery. In a study in which both approaches were used, the group that underwent laparoscopic surgery had a very high rate of return to sports within approximately 4 weeks (37). Similar results were acquired by Genitsaris et al. (38) (100 % of patients returned to the sport in 3 weeks), Paajanen et al. (24) (90% returned at 1 month), and Van veen et al. (39) (returned in 6–8 weeks). Considering that the basic mechanism underlying this whole situation is a strong instability of the pelvic ring, arthrodesis may be an alternative, and indeed this has shown good short-term

outcomes (40). Although many studies in the literature mention surgical methods, this method has some risk factors. In addition to the normal risks commonly observed in surgeries, many different risks can be observed such as numbness (permanent or in the labia which in females that can interfere with sexual sensation), deafferentation hypersensitivity and also testicular atrophy and loss of a cremasteric reflex which seen in male patients etc. Risks associated with reoperation in a same area may include a lots of parameters (bleeding, disruption of the prior hernia repair, vascular injury, and testicular loss)(7).

There are also studies comparing physiotherapy and rehabilitation and surgical interventions, but this makes it difficult because there is still not enough research in this area and it becomes difficult to make an objective comment on the subject. There was little argument directly comparing two methods which are surgical and physical therapy for AGP. A study by Paajanen et al. indicated a much a lot higher return to play rate for surgical intervention (90%) than conservative management (around half of all) for pathology which is abdominal-related (41). A study on this topic showed that rehabilitation had a significantly quicker return to play time for pain which is pubic-related than surgery (4). Although the majority of the literature about the superior return to play rate and time about GP is in favor of surgical interventions, King et al.'s study argues the opposite of the literature (4).

Rehabilitation has specified a better return to play time than surgery for pain which is pubic-related. A slight difference was observed between the two groups (abdominal and adductor) in terms of return to play rate and return to playtime.

In this review article, in which the definition and causes of GP are examined in detail, many articles in the literature are compared in terms of GP treatment protocols, return to play time, and rates. The causes of GP have a wide variety. The main objective should be to work for the elimination of the cause and, if the cause is not in a position to eliminate it, modify it and reduce the effects.

Treatment protocols can be classified as conservative treatment and surgical intervention. Studies in the literature have generally mentioned the importance of physiotherapy and rehabilitation (including ET) in this regard. There is a wide variety of approaches to surgical procedures applied in this situation.

According to our review, there is no clear consensus on the treatment of GP in the literature. However, some studies have emphasized the superiority of physical therapy. It has been seen in some studies in the literature that surgery and physiotherapy have been compared for abdominal-related GP return-to-play times gave similar results for the two groups, but in some of the studies, the return-to-play times of physiotherapy were ahead.

In clinic there are lots of parameters can affect the decision to surgery. These parameters can be the level of sports, the athlete's active period, season's time, previous conservative management's type and duration, athlete's choices, age, gender and a lot more. Conservative treatment is the first option but if it fails surgical approach is first-line treatment. There are so many varied surgical approaches.

In the light of all these studies that we scanned in literature, we need more detailed researches for the standardization of the treatment procedure.

This study was carried out based on the definition of AGP and the examination of the anatomy of the region. In the literature, many methods have been used for the treatment method of AGP. This study is important in terms of compiling and comparing the methods used with each other. This study, which has such a wide scope, contributed to the literature on this subject. A map has been created for future studies.

## DECLARATIONS

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## REFERENCES

1. Falvey ÉC, King E, Kinsella S, et al. Athletic groin pain (part 1): a prospective anatomical diagnosis of 382 patients—clinical findings, MRI findings and patient-reported outcome measures at baseline *British Journal of Sports Medicine* 2016;50: 423-430.
2. Serner A, van Eijck CH, Beumer BR, Hölmich P, Weir A, de Vos RJ. Study quality on groin injury management remains low: a systematic

review on treatment of groin pain in athletes. *Br J Sports Med.* 2015 Jun;49(12):813.

3. Hölmich P. Groin injuries in athletes—development of clinical entities, treatment, and prevention. *Dan Med J.* 2015;62(12):B5184.
4. King E, Ward J, Small L, Falvey E, Franklyn-Miller A. Athletic groin pain: a systematic review and meta-analysis of surgical versus physical therapy rehabilitation outcomes. *Br J Sports Med.* 2015 Nov;49(22):1447-51.
5. Delahunt E, Thorborg K, Khan KM, et al. Minimum reporting standards for clinical research on groin pain in athletes *British Journal of Sports Medicine* 2015;49:775-781.
6. Pålsson A, Kostogiannis I, & Ageberg E. Physical impairments in longstanding hip and groin pain: Cross-sectional comparison of patients with hip-related pain or non-hip-related groin pain and healthy controls. *Physical Therapy in Sport*, 2021; 52, 224-233.
7. Hu QL, Chen DC. Approach to the Patient with Chronic Groin Pain. *Surgical Clinics of North America*, 2018; 98(3), 651-665.
8. Kalebo P, Karlsson J, Sward L, Peterson L. Ultrasonography of chronic tendon injuries in the groin. *Am J Sports Med* 1992; 20: 634-639.
9. Weir A, Jansen JA, van de Port IG, Van de Sande HB, Tol JL, Backx FJ. Manual or exercise therapy for long-standing adductor-related groin pain: a randomised controlled clinical trial. *Man Ther.* 2011 Apr;16(2):148-54.
10. Robertson BA, Barker PJ, Fahrer M, Schache AG. The anatomy of the pubic region revisited: implications for the pathogenesis and clinical management of chronic groin pain in athletes. *Sports Med.* 2009;39(3):225-234.
11. Elattar O, Choi HR, Dills VD, Busconi B. Groin Injuries (Athletic Pubalgia) and Return to Play. *Sports Health.* 2016;8(4):313-323.
12. Rab M, Ebmer And J, Dellon AL. Anatomic variability of the ilioinguinal and genitofemoral nerve: implications for the treatment of groin pain. *Plast Reconstr Surg* 2001;108(6):1618-23.
13. Amid PK, Hiatt JR. New understanding of the causes and surgical treatment of postherniorrhaphy inguinodynia and orchalgia. *J Am Coll Surg* 2007;205(2): 381-5.
14. Falvey EC, Franklyn-Miller A, McCrory PR. The groin triangle: a patho-anatomical approach to the diagnosis of chronic groin pain in athletes *British Journal of Sports Medicine* 2009;43:213-220.

15. Hopkins C. Standring S, editor. *Gray's Anatomy: The Anatomical Basis of Clinical Practice*. 41st ed. Philadelphia: Elsevier Limited; 2016.
16. Ekstrand J, Gillquist J. Soccer injuries and their mechanisms: a prospective study. *Med Sci Sports Exerc*. 1983;15(3):267-70.
17. Nielsen AB, Yde J. Epidemiology and traumatology of injuries in soccer. *Am J Sports Med*. 1989 Nov-Dec;17(6):803-7.
18. Engström B, Forssblad M, Johansson C, et al. Does a major knee injury definitely sideline an elite soccer player? *Am J Sports Med* 1990 Jan-Feb; 18: 101-5
19. Renström P, Peterson L. Groin injuries in athletes. *Br J Sports Med*. 1980 Mar;14(1):30-6.
20. Lovell G. The diagnosis of chronic groin pain in athletes: a review of 189 cases. *Aust J Sci Med Sport* 1995; 27: 76-9
21. Suarez, Juan C. MD; Ely, Erin E. MD; Mutnal, Amar B. MD; Figueroa, Nathania M. MD; Klika, Alison K. MS; Patel, Preetesh D. MD; Barsoum, Wael K. MD. Comprehensive Approach to the Evaluation of Groin Pain. *Journal of the American Academy of Orthopaedic Surgeons*: September 2013 - Volume 21 - Issue 9 - p 558-570.
22. Lynch SA, Renström PA. Groin injuries in sport: treatment strategies. *Sports medicine (Auckland, N.Z.)* 1999; 28(2), 137-144.
23. Holmich P. Adductor related groin pain in athletes. *Sports Medicine and Arthroscopy Review* 1997;5(4):285-91.
24. Paajanen H, Syvahuoko I, Airo I. Totally extraperitoneal endoscopic (TEP) treatment of sportsman's hernia. *Surg Laparosc Endosc Percutan Tech* 2004; 14: 215-218.
25. Martens MA, Hansen L, Mulier JC. Adductor tendinitis and musculus rectus abdominis tendopathy. *Am J Sports Med* 1987; 15: 353-356.
26. Holmich P. Long-standing groin pain in sportspeople falls into three primary patterns, a "clinical entity" approach: a prospective study of 207 patients. *Br. J. Sports Med*. 2007;41(4):247-52
27. Hölmich P, Uhrskou P, Ulnits L, Kanstrup IL, Bachmann Nielsen M, Bjerg AM, Krogsgaard K. Effectiveness of active physical training as treatment for long-standing adductor-related groin pain in athletes: Randomised trial. *Lancet*, 1999; 353(9151), 439-443.
28. Rolph R, Morgan C, Chapman G, Marsh S. Groin pain in athletes (published correction appears in *BMJ*. 2021 Nov 16;375: n2805). *BMJ*. 2020;368:m559.
29. McSweeney SE, Naraghi A, Salonen D, Theodoropoulos J, White LM. Hip and groin pain in the professional athlete. *Can Assoc Radiol J*. 2012 May;63(2):87-99.
30. Fricker P, Taunton J, Ammann W. Osteitis pubis in athlete: infection, inflammation or injury? *Sports Med* 1991; 12: 266-279.
31. Rodriguez C, Miguel A, Lima H, Heinrichs K. Osteitis pubis syndrome in the professional soccer athlete: a case report. *J Athl Train* 2001; 36: 437-440.
32. Ekstrand J, Ringborg S. Surgery versus conservative treatment in soccer players with chronic groin pain: a prospective randomised study in soccer players. *Eur J Sports Traumatol Rel Res* 2001; 23: 141-145.
33. Holt MA, Keene JS, Graf BK, Helwig DC. Treatment of osteitis pubis in athletes: results of corticosteroid injections. *Am J Sports Med* 1995; 23: 601-606.
34. O'Connell MJ, Powell T, McCaffrey NM, O'Connell D, Eustace SJ. Symphyseal cleft injection in the diagnosis and treatment of osteitis pubis in Athletes. *Am J Roentgen* 2002; 179: 955-959.
35. Topol GA, Reeves KD, Hassanein KM. Efficacy of dextrose prolotherapy in elite male kicking-sport athletes with chronic groin pain. *Arch Phys Med Rehabil* 2005; 86: 697-702.
36. Akermark C, Johansson C. Tenotomy of the adductor longus tendon in the treatment of chronic groin pain in athletes. *Am J Sports Med* 1992; 20: 640-643.
37. Ingoldby CJ. Laparoscopic and conventional repair of groin disruption in sportsmen. *Br J Surg* 1997; 84: 213-215.
38. Genitsaris M, Goulimaris I, Sikas N. Laparoscopic repair of groin pain in athletes. *Am J Sports Med* 2004; 32: 1238-1242.
39. Van Veen RN, de Baat P, Heijboer MP, Kazemier G, Punt BJ, Dwarkasing RS, Bonjer HJ, van Eijk CHJ. Successful endoscopic treatment of chronic groin pain in athletes. *Surg Endosc* 2007; 21: 189-193.
40. Williams PR, Thomas DP, Downes EM. Osteitis pubis and instability of the pubic symphysis: when nonoperative measures fail. *Am J Sports Med* 2000; 28: 350-355.
41. Paajanen H, Brinck T, Hermunen H, Airo I. Laparoscopic surgery for chronic groin pain in athletes is more effective than nonoperative treatment: a randomized clinical trial with magnetic resonance imaging of 60 patients with sportsman's hernia (athletic pubalgia). *Surgery*. 2011 Jul;150(1):99-107.