

IS CHRONIC GROIN PAIN A BERMUDA TRIANGLE OF SPORTS MEDICINE?

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SUMMARY – Chronic groin pain is one of the most complex conditions encountered in the field of sports medicine. Conservative treatment is long lasting and the result of treatment is often uncertain and symptom recurrences are common, which can be very frustrating for both the patient and the physician. The complex etiology and uncertainties during treatment of chronic groin pain is the reason why some authors call it the Bermuda Triangle of sports medicine. In our prospective, 7-year study, 114 athletes with chronic groin pain resistant to conservative therapy were treated surgically. In 109 athletes with sports hernia, we performed nerve neurolysis along with resection of the genital branch of the genitofemoral nerve and we also reinforced the posterior wall of inguinal canal using a modified Shouldice technique. In 26 athletes that had concomitant adductor tendinosis and in 5 athletes with isolated tendinosis we performed tenotomy. Eighty-one of 83 patients with isolated sports hernia returned to sports within a mean of 4.4 (range, 3-16) weeks. Thirty-one athletes with adductor tenotomy returned to sports activity within a mean of 11.8 (range, 10-15) weeks. If carefully diagnosed using detailed history taking, physical examination and correct imaging techniques, chronic groin pain can be treated very successfully and quickly, so it need not be a Bermuda Triangle of sports medicine.

Key words: *Groin – injuries; Athletic injuries; Hernia, inguinal; Musculoskeletal pain*

Introduction

Chronic groin pain is characterized by pain centered on the lower abdominal wall (laterally to the sheath of the rectus abdominis muscle, medially to the inguinal ligament), in the symphysis and adductor region. The pain is often intensified during sports activities that increase the intra-abdominal pressure, during sneezing and coughing. Groin pain has an estimated incidence of 0.5% to 10% among athletes and is particularly common in soccer and hockey players, karate fighters and fencing¹⁻³. One study reported a

23% groin injury rate in a population of 100 professional rugby league players^{4,5}. First description of this condition in an athlete was given in the early 1932 by Spinelli⁶. Among soccer players, it was described by Bandini in 1949⁷.

Chronic groin pain is one of the most complex conditions encountered in sports medicine. Conservative treatment is quite often long lasting, its outcome very uncertain, and recurrence common. Therefore, this condition can be frustrating for both the athlete and the physician. The groin, an anatomical region where diagnosis and symptoms are often confusing, may also represent a Bermuda Triangle (a sea triangle where ships, planes and people have mysteriously disappeared) for clinicians to disappear in vortices of suppositions and assumptions⁸. Chronic groin pain is

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responsible for a large proportion of time lost from sports and work. The main difficulty in treating these patients is determining the origin of pain.

The complex anatomy of the groin region (at the junction of three biomechanical complex body areas: abdomen, lower limbs and pelvis) and frequent coexistence of two or more disorders^{9,10} produce overlapping symptoms and make correct diagnosis very difficult even for experienced physicians. The ability to visualize the anatomy of the groin area is important for both physical examination and differential diagnosis. Experience and thorough knowledge of the anatomy of the region remain vital in any complete understanding of groin pain. By providing a means of focusing the differential diagnosis in a structured manner, practitioners who lack expertise may approach this problem with more confidence¹¹.

Many different theories about the cause of groin pain have been proposed based on physical examination and intraoperative finding. One cause of groin pain can be disruption of the musculotendinous elements of the groin, which has been described by Gilmore¹². Disruption to the groin is characterized by three typical surgical findings: a torn external oblique aponeurosis causing dilatation of the superficial ring, torn conjoint tendon, and dehiscence between the torn conjoint tendon and the inguinal ligament, constituting the major injury.

Enthesopathy at the site of insertion of the abdominal and the adductor muscles to the pubic bone has been described as another important cause of groin pain¹³⁻¹⁵. The adductor longus and gracilis are generally affected and so are, although not as frequently, the rectus abdominis, the pyramidalis and the lateral aponeurosis of the obliquus externus abdominis. The athlete reports intensive pain at the insertions of one or both adductors and gracilis or at the pubic symphysis. If the adductor longus muscle is injured, pain to the injured area will be intensified by resisting leg adduction and in passive stretching at full abduction of the hip^{16,17}. Tenderness on palpation is localized at the origin of the adductor longus tendon or at the musculotendinous junction.

Osteitis pubis is characterized by pubic symphysis pain and joint disruption¹⁸. Pubic symphysis, abdominal and adductor muscles represent a kinematic chain where contractions of abdominal and adductor muscles

produce movements in symphysis sliding ranging by 2 mm and rotational movements in the extent of up to 3 degrees^{19,20}. Correct balance between the abdominal muscles and adductors is absolutely necessary in order to reduce the pathology to minimum. Disbalance in the strength of the adductor and abdominal wall muscles is a frequent cause of pathologic changes in the groin area. Advanced stage of osteitis pubis is characterized by degenerative arthropathy of the pubic symphysis, abnormal vertical motion of the pubic symphysis, greater than 2 mm on single-leg standing plain radiographs (flamingo views)¹. Osteitis pubis may be difficult to distinguish from chronic adductor tendinosis, and these two conditions may occur concomitantly in the same patient. The pain over the pubis when compression is applied to the iliac wing with the patient in the lateral decubitus position (positive lateral compression test) helps distinguish osteitis pubis from other conditions such as chronic adductor tendinosis²¹.

In the literature, the term sports hernia is used for the syndrome of weakness of the posterior inguinal wall without clinically recognizable hernia²²⁻²⁴. Sports hernia has become a common injury in athletes who participate in sports that require repetitive twisting and turning at speed, such as soccer, hockey, tennis and field hockey. A study of the National Hockey League (NHL) players showed a significantly increased incidence of groin injuries from 1991 to 1997⁴. Some researchers believe that sports hernia is the most common cause of chronic groin pain in athletes^{9,18}. Other investigators found it to be just a rare cause of chronic groin pain¹⁴. Clinically, sports hernia is characterized by insidious onset, gradually worsening, diffuse, deep groin pain. It may radiate along the inguinal ligament, perineum and rectus muscles. Akita *et al.*²⁵ report that the symptom site was predominantly the proximal medial thigh region (76%), followed by the inguinal canal region (74%), the periscrotal region 42%, the proximal ventral thigh region (21%), and the lower abdominal region (9%). Maneuvers that cause increases in the intra-abdominal pressure will usually increase pain. Clinically, it is difficult to distinguish between sports hernia, distal rectus strain/avulsion and groin disruption. However, the pain of sports hernia is usually located more laterally and proximally than in groin disruption. Several theories exist in the literature regarding the causes of sports hernia and most theories

implicate an overuse syndrome. Hip abduction, adduction and flexion-extension with the resultant pelvic motion produce a shearing force across the pubic symphysis, leading to stress on the inguinal wall musculature perpendicular to the fibers of the fascia and muscle. Pull from the adductor musculature against a fixed lower extremity can cause significant shear forces across the hemipelvis. Subsequent weakening or tearing of the transverse fascia or conjoined tendon has been suggested as the source of pain²³. Other studies have reported abnormalities at the insertion of the rectus abdominis muscle^{14,15} or avulsions of part of the internal oblique muscle fibers at the pubic tubercle. Some researchers claim that the origin of pain in sports hernia is abnormality in the external oblique muscle and aponeurosis or that entrapment of the genital branches of the ilioinguinal or genitofemoral nerves may be the source of pain^{3,25-27}.

We believe that in sports hernia cases, the posterior wall of the inguinal canal (transverse fascia) is dilated, which means the ileo-inguinal nerve and the genital branch of the genitofemoral nerve may be compressed when the muscles of the abdominal wall are tensioned. This causes pain in the inguinal region, and this pain frequently radiates into the adductors, sometimes also into the scrotum. Dilatation of the inguinal canal can give rise to the retraction of the rectus muscle and increased tension at the point where the rectus muscle is attached to the pubic bone. As a result, the patient often feels pain in the pubic bone area²⁸.

Other, rare causes of groin pain are stress fractures, avulsion fractures, bursitis (iliopsoas, trochanteric, piriformis, ischial), snapping hip syndrome, traumatic myositis ossificans, hip joint pathology (arthritis, aseptic vascular necrosis of the femoral head, labral tear, impingement), referred lumbosacral pain, nerve entrapments/irritations (obturator nerve, lateral cutaneous femoral nerve, femoral nerve, perineal nerves), inguinal hernia, intra-abdominal disorders (diverticulosis, inflammatory bowel disease, aneurysm) and genitourinary abnormalities^{9,23,29,30}.

Patients and Methods

Between January 1, 2004 and December 2010, 114 patients (one female) with chronic groin pain resistant to conservative treatment underwent surgical proce-

dures. They all suffered from chronic pain of various intensity in the region of lower abdominal wall and adductor insertion. Nonoperative treatment (rest, cryomassage, antiinflammatory drugs (NSAIDs), local steroid injections, strengthening and stretching, electrotherapy, ultrasound therapy) had already been undertaken during the period of 3-6 months but proved unsuccessful. The mean age of the athletes involved was 24.1 (range, 17-42) years. Seventy-one patients were competitive athletes or professionals and 43 patients were recreational athletes. The majority of them (n=91) were soccer players.

Preoperatively, all athletes underwent thorough physical examination. Palpation of the pubic bone and its muscle insertions was performed (each muscle group was tested individually with iliopsoas test, adduction test and rectus abdominis test). Inguinal canal was evaluated for external ring dilatation, tenderness over the conjoined tendon and pubic bone, and posterior wall weakness. Furthermore, we evaluated each patient hip by testing the range of motion (impingement test was performed). Following physical examination we performed x-ray of the pelvis and ultrasonography of the muscles and inguinal canal. Dynamic ultrasound examination of the inguinal canal was of great benefit when clinical examination failed to detect posterior wall deficiency. In patients with the symptoms of adductor tendinosis, osteitis pubis and femoroacetabular impingement magnetic resonance imaging (MRI) was performed.

Operative technique

All patients underwent surgery in general or regional anesthesia. In 109 athletes with sports hernia, we performed reinforcement of the posterior wall of the inguinal canal using transverse fascia duplication (modified Shouldice technique), ilioinguinal nerve neurolysis and resection of the genital branch of the genitofemoral nerve. In four patients, a small indirect hernia was found. The surgical technique used involves a standard groin incision of approximately 4 cm. The external oblique aponeurosis is visualized. After opening external oblique muscle aponeurosis, meticulous ilioinguinal neurolysis is performed, spermatic funiculus is identified and genital branch of the genitofemoral nerve identified (Fig. 1) and resected. The next step is preparation



Fig. 1. Dissected genital branch of the genitofemoral nerve.

of the posterior wall of the inguinal canal where we identify transverse fascia. After division of transverse fascia, a preperitoneal lipoma located beneath the fascia protrudes (bulges) into the operative field confirming our diagnosis (Fig. 2). Careful dissection of both parts of divided transverse fascia is obligatory. Using nonabsorbable running suture, duplication of the transverse fascia is performed in two layers. The next step is additional reinforcement of the posterior inguinal wall by suturing the lower part of the transverse and internal oblique muscle to the inguinal ligament, also performed in two layers using running suture.

In 26 athletes with sports hernia and adductor tendinosis and in five athletes with isolated adductor tendinosis, bilateral adductor longus tenotomy was

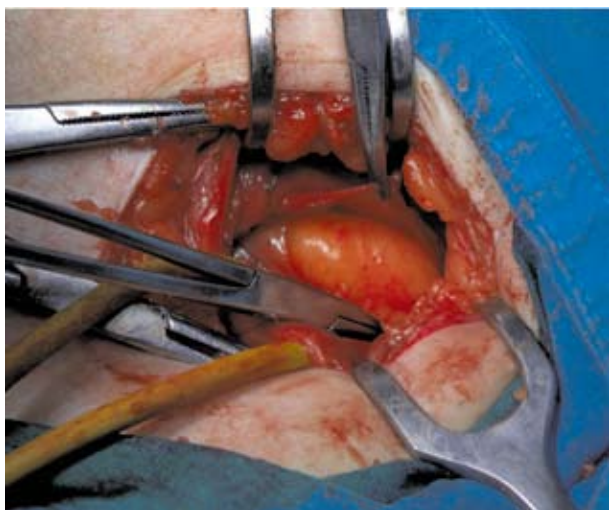


Fig. 2. Bulging preperitoneal lipoma located beneath the transverse fascia.

concomitantly performed. A 3-cm long incision was made distally and parallel to the groin crease, above the adductor tendon. The fascia was split longitudinally, the adductor longus identified and complete tenotomy was performed.

Results

Patients were discharged on day 1-4 after the operation. No immediate postoperative complications were observed. Results are presented in Table 1. Eighty-one (97%) of 83 athletes with only sports hernia returned to sports within a mean of 4.4 (range, 3-16) weeks. Two (3%) athletes did not return after 4 months. One athlete had osteitis pubis and another one had acetabular impingement syndrome.

Thirty-one patients that had adductor tenotomy (26 with sports hernia and adductor tendinosis and five patients with isolated adductor tendinosis) performed returned to sports within a mean of 11.8 (range, 10-15) weeks.

All athletes except for two (one with pubic bone osteitis and one with acetabular impingement syndrome) were satisfied with the results of treatment. When asked to evaluate the results of treatment, 91 (80%) athletes evaluated (graded) it as excellent, 19 (17%) as good, two (1.5%) as fair and only two (1.5%) evaluated (graded) it as poor (Table 2).

Discussion

Chronic groin pain can be the most difficult sports injury to accurately diagnose and treat. The entire

Table 1. Results

Cause of groin pain	Number of patients	Return to sports (%)	Return to sports (wks)
Sports hernia	83	81 (97%)	4.4 (3-16)
Sports hernia and adductor tendinosis	26	26 (100%)	
Adductor tendinosis	5	5 (100%)	11.8 (10-15)
Total number of patients	114		

Table 2. Satisfaction with treatment

Grade	Number of patients
Excellent	91 (80%)
Good	19 (17%)
Fair	2 (1.5%)
Poor	2 (1.5%)

process of diagnostics and treatment can be quite time consuming and cause frustrations for both the patient and the physician. Frequent coexistence of two or more disorders in this anatomically complex area makes it very difficult to establish the correct cause of pain^{10,15}. The groin, an anatomical region where diagnosis and symptoms are often confusing, may also represent a Bermuda Triangle.

Thorough history and careful physical examination are of great importance in making the diagnosis. Physical examination should determine the maximum tenderness point, evaluate the increase in pain during stretching or contraction of the muscles, coughing and sneezing (Valsalva maneuver). Detailed examination of the inguinal canal should be performed, with evaluation of the external and internal inguinal ring for dilatation, pain during internal ring palpation, and posterior wall weakness. In posterior wall weakness, the tip of the examiner's finger enters the abdomen without feeling resistance; bulging of the posterior inguinal wall can be felt when the patient is asked to cough or perform Valsalva maneuver. In order to confirm an uncertain diagnosis of sports hernia, dynamic ultrasound should be performed because it can be quite helpful¹⁰. X-ray of the pelvis is mandatory in order to screen our patients for pubic osteitis.

It is our belief that sports hernia is the most common cause of chronic groin pain in athletes³¹ and we concur with numerous authors on it^{15,32,33}. Ekberg *et al.*³² have described sports hernia in 52% of athletes, and Lovell⁹ in 50% of athletes with chronic groin pain.

Although initial therapy of sports hernia is conservative, because of high success of operative treatment and fast return to sports activity (3-5 weeks), we advocate surgery in early stage of the disease (after maximum 4-6 weeks of unsuccessful conservative treatment). Operation that reinforces the posterior wall of inguinal canal by duplicating it and resects the

genital branch of the genitofemoral nerve enables pain elimination and fast return to sports activities.

Alternative operative treatment includes positioning a synthetic mesh, which can be done laparoscopically as well^{21,34-36}. However, insertion of a synthetic mesh into the athlete's groin can harden and eliminate elasticity of the strata of the abdominal wall completely. As a foreign body, it results in stiffening and hardening of the entire inguinal canal³⁵. This can lead to possible restriction or even permanent termination of the athlete's physical and functional capacity.

Adductor tendinopathy is, according to our experience, the second most frequent cause of chronic groin pain. Sometimes it is very difficult to distinguish it from pubic osteitis because of similar symptomatology and frequent coexistence of these two conditions. In order to distinguish one from another, careful clinical examination is mandatory where one should perform a lateral compression test³⁷ and pubic spring test³⁸, which can, according to our experience, be quite helpful. In addition, one should always perform pelvic x-rays, ultrasound³⁹ and MRI, and in unclear cases technetium bone scan. The treatment of musculotendinous groin injuries is predominantly conservative: resting, ice, NSAID, local steroid injections, strengthening and stretching, electrotherapy, ultrasound therapy. In case of persistent symptoms after 3-6 months of conservative therapy, operative treatment is recommended⁴⁰. Fasciotomy, excision of the scar/granulation tissue, partial or complete tenotomy, drilling of insertion area, and circular denervation of the insertion area are performed⁴¹⁻⁴³.

Pubic osteitis is a rarer cause of chronic groin pain. It is the third most common cause of groin pain in athletes⁴⁴, preceded by sports hernia and adductor pathology. We think that one should differentiate two entities, one being pubic osteitis and the other symphyseal osteitis. In symphyseal osteitis, the predominant localization of pathology is in the joint itself and is characterized by visible changes on plain x-rays: widening of the joint, sclerosis and irregularity of the pubic symphysis, erosion, osteolysis (cystic change) and osteophyte formation^{38,45}.

Hence, in pubic osteitis, x-rays are without evident pathology but MRI shows diffuse marrow edema of the pubic area. In symphyseal osteitis, single leg standing plain radiographs (flamingo views) are mandatory

and vertical motion of the pubic symphysis greater than 2 mm implicates the presence of abnormal range of motion. In order to differentiate these two conditions, symphyseal cleft injection can be very useful and can also provide a short term symptom relief in patients with symphyseal osteitis¹.

Symphyseal osteitis therapy is primarily conservative including corticosteroid injections into the fibrocartilaginous disc^{37,38,46}. In case of persistent pain, operative treatment is recommended, which should be different in relation to the stage of the disease. When there are no signs of vertical motion in the symphysis, curettage or proximal adductor release with adjunctive drilling can be performed⁴⁷.

If the patient has vertical instability, pubic symphysis plate arthrodesis, augmented with bone graft can be performed. Williams *et al.*⁴⁵ have reported good results after arthrodesis of the pubic symphysis in seven rugby players with vertical instability at the pubic symphysis. Wedge resection of the pubic symphysis can cause pelvic instability with SI arthrosis and therefore we would not recommend it. Moore *et al.*⁴⁸ have reported two cases of late posterior instability of the pelvis after resection of the symphysis pubis.

Chronic stress injury to the pubic bone¹⁹ caused by repetitive jumping, twisting or turning, as seen in soccer and rugby, can lead to pubic osteitis. This condition is characterized by similar MRI findings as in stress fractures in the form of abnormal signal intensity as a sign of bone marrow edema.

Pubic and symphyseal osteitis could be two different entities with the same clinical presentation or perhaps they could be two stages of the same condition, meaning that pubic osteitis could represent an early stage of the injury that is characterized by bone marrow edema and symphyseal osteitis could be its later and more chronic form.

Treatment of osteitis pubis is primarily conservative; generally it begins with physical therapy⁴⁹. Rest, NSAIDs, calcium, D-vitamin, cryomassage, physical therapy, electrotherapy, ultrasound therapy, radiation therapy, oral glucocorticoids, anticoagulation, alendronate sodium and intravenous pamidronate can be applied in the treatment^{5,37,38,46}. Osteitis pubis is a serious injury that requires a prolonged rehabilitation period and time away from sports. Full recovery has been reported to take from several months to up to several

years^{18,50}. Paajanen *et al.* report successful treatment of osteitis pubis by mesh placement using completely extraperitoneal endoscopic technique in five athletes⁵¹. Other causes of groin pain are very rare.

Conclusion

Chronic groin pain is one of the most complex conditions encountered in sports medicine. Conservative treatment is quite often long lasting, its outcome very uncertain, and recurrence common. Therefore, this condition can be frustrating for both the athlete and the physician. Chronic groin pain, if carefully diagnosed using detailed history taking, physical examination and correct imaging techniques, can be treated very successfully and quickly, so it need not be a Bermuda Triangle of sports medicine.

Since chronic groin pain in athletes is predominantly caused by sports hernia, a simple procedure that reinforces the posterior wall using transverse fascia duplicature (Shouldice technique) and resects the genital branch of the genitofemoral nerve enables, through pain elimination, early start of rehabilitation and fast return to sports, which is very important for every athlete.

References

1. ANDERSON K, STRICKLAND SM, WARREN R. Hip and groin injuries in athletes. *Am J Sports Med* 2001;29(4):521-33.
2. FON LJ, SPENCE RA. Sportsman's hernia. *Br J Surg* 2000;87(5):545-52.
3. MINNICH JM, HANKS JB, MUSCHAWECK U, *et al.* Sports hernia. *Am J Sports Med* 2011;39(6):1341-9.
4. EMERY CA, MEEUWISSE WH, POWELL JW. Groin and abdominal strain injuries in the National Hockey League. *Clin J Sport Med* 1999;9(3):151-6.
5. O'CONNOR D. Groin injuries in professional rugby league players: a prospective study. *J Sports Sci* 2004;22(7):629-36.
6. SPINELLI A. Una nuova malattia sportiva: la pubialgia degli schermitori. *Orthop Traumatol Apparato Motore* 1932;4:111-27.
7. BANDINI T. Su una sindrome dei retto-adduttori nei giocatori di calcio. *Rassegna Med infor Tunistica Patol Lavoro* 1949;5:804.
8. BIZZINI M. The groin area: the Bermuda triangle of sports medicine?. *Br J Sports Med* 2011;45:1-2.
9. LOVELL G. The diagnosis of chronic groin pain in athletes: a review of 189 cases. *Aust J Sci Med Sport* 1995;27(3):76-9.

10. ORCHARD JW, READ JW, NEOPHYTON J, *et al.* Groin pain associated with ultrasound finding of inguinal canal posterior wall deficiency in Australian Rules footballers. *Br J Sports Med* 1998;32(2):134-9.
11. FALVEY EC, FRANKLYN-MILLER A, McCRORY PR. The groin triangle: a patho-anatomical approach to the diagnosis of chronic groin pain in athletes. *Br J Sports Med* 2009;43:213-20.
12. GILMORE J. Groin pain in the soccer athlete: fact, fiction, and treatment. *Clin Sports Med* 1998;17(4):787-93.
13. ASHBY EC. Chronic obscure groin pain is commonly caused by enthesopathy: 'tennis elbow' of the groin. *Br J Surg* 1994;81(11):1632-4.
14. MEYERS WC, FOLEY DP, GARRETT WE, *et al.* Management of severe lower abdominal or inguinal pain in high-performance athletes. PAIN (Performing Athletes with Abdominal or Inguinal Neuromuscular Pain Study Group). *Am J Sports Med* 2000;28(1):2-8.
15. TAYLOR DC, MEYERS WC, MOYLAN JA, *et al.* Abdominal musculature abnormalities as a cause of groin pain in athletes. Inguinal hernias and pubalgia. *Am J Sports Med* 1991;19(3):239-42.
16. SCHILDERS E, BISMIL Q, ROBINSON P, *et al.* Adductor-related groin pain in competitive athletes. Role of adductor entheses, magnetic resonance imaging, and enthesal pubic cleft injections. *J Bone Joint Surg Am* 2007;89(10):2173-8.
17. STRAUSS EJ, CAMPBELL K, BOSCO JA. Analysis of the cross-sectional area of the adductor longus tendon: a descriptive anatomic study. *Am J Sports Med* 2007;35(6):996-9. Epub 2007 Feb 2016.
18. LYNCH SA, RENSTROM PA. Groin injuries in sport: treatment strategies. *Sports Med* 1999;28(2):137-44.
19. MEISSNER A, FELL M, WILK R, *et al.* Biomechanics of the pubic symphysis. Which forces lead to mobility of the symphysis in physiological conditions? *Unfallchirurg* 1996;99(6):415-21.
20. WALHEIM G, OLERUD S, RIBBE T. Mobility of the pubic symphysis. Measurements by an electromechanical method. *Acta Orthop Scand* 1984;55(2):203-8.
21. KLUIN J, den HOED PT, van LINSCHOTEN R, *et al.* Endoscopic evaluation and treatment of groin pain in the athlete. *Am J Sports Med* 2004;32(4):944-9.
22. FREDBERG U, KISSMEYER-NIELSEN P. The sportsman's hernia - fact or fiction? *Scand J Med Sci Sports* 1996;6(4):201-4.
23. HACKNEY RG. The sports hernia: a cause of chronic groin pain. *Br J Sports Med* 1993;27(1):58-62.
24. MALYCHA P, LOVELL G. Inguinal surgery in athletes with chronic groin pain: the 'sportsman's' hernia. *Aust N Z J Surg* 1992;62(2):123-5.
25. AKITA K, NIGA S, YAMATO Y, *et al.* Anatomic basis of chronic groin pain with special reference to sports hernia. *Surg Radiol Anat* 1999;21(1):1-5.
26. RAB M, EBMER, 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.
27. STARLING JR, HARMS BA, SCHROEDER ME, *et al.* Diagnosis and treatment of genitofemoral and ilioinguinal entrapment neuralgia. *Surgery* 1987;102(4):581-6.
28. DIESEN DL, PAPPAS TN. Sports hernias. *Adv Surg* 2007;41:177-87.
29. MORELLI V, ESPINOZA L. Groin injuries and groin pain in athletes: Part 2. *Prim Care* 2005;32(1):185-200.
30. MORELLI V, WEAVER V. Groin injuries and groin pain in athletes: Part 1. *Prim Care* 2005;32(1):163-83.
31. DOJČINOVIĆ B, ŠEBEČIĆ B, STAREŠINIĆ M, *et al.* Surgical treatment of chronic groin pain in athletes. *Int Orthop* 2012;36:2361-5.
32. EKBERG O, PERSSON NH, ABRAHAMSSON PA, *et al.* Longstanding groin pain in athletes. A multidisciplinary approach. *Sports Med* 1988;6(1):56-61.
33. KESEK P, EKBERG O, WESTLIN N. Herniographic findings in athletes with unclear groin pain. *Acta Radiol* 2002;43(6):603-8.
34. SIDDIQUI MR, KOVZEL M, BRENNAN S, *et al.* A literature review on the role of totally extraperitoneal repairs for groin pain in athletes. *Int Surg* 2012;97(4):327-34.
35. LITWIN DEM, SNEIDER E, McENANEY PM, *et al.* Athletic pubalgia (sports hernia). *Clin Sports Med* 2011;30:417-34.
36. CUGURA JF, KITAC I, JANKOVIĆ J, *et al.* First case of single incision laparoscopic surgery for totally extraperitoneal inguinal hernia repair. *Acta Clin Croat* 2008;47:249-52.
37. MULHALL KJ, McKENNA J, WALSH A, *et al.* Osteitis pubis in professional soccer players: a report of outcome with symphyseal curettage in cases refractory to conservative management. *Clin J Sport Med* 2002;12(3):179-81.
38. JOHNSON R. Osteitis pubis. *Curr Sports Med Rep* 2003;2(2):98-102.
39. KROLO I, BABIĆ N, MAROTTI N, *et al.* Ultrasound in the evaluation of sports muscular injury. *Acta Clin Croat* 2008;39:15-9.
40. ROBERTSON IJ, CURRAN C, McCAFFREY N, *et al.* Adductor tenotomy in the management of groin pain in athletes. *Int J Sports Med* 2011;32:45-8.
41. BIEDERT RM, WARNKE K, MEYER S. Symphysis syndrome in athletes: surgical treatment for chronic lower abdominal, groin, and adductor pain in athletes. *Clin J Sport Med* 2003;13(5):278-84.

42. KUMAR A, DORAN J, BATT ME, *et al.* Results of inguinal canal repair in athletes with sports hernia. *J R Coll Surg Edinb* 2002;47(3):561-5.
43. MAFFULLI N, LOPPINI M, LONGO UG, *et al.* Bilateral mini-invasive adductor tenotomy for the management of chronic unilateral adductor longus tendinopathy in athletes. *Am J Sports Med* 2012;40:1881-6.
44. BEATTY T. Osteitis pubis in athletes. *Curr Sports Med Rep* 2012;11:96-8.
45. WILLIAMS PR, THOMAS DP, DOWNES EM. Osteitis pubis and instability of the pubic symphysis. When nonoperative measures fail. *Am J Sports Med* 2000;28(3):350-5.
46. HOLT MA, KEENE JS, GRAF BK, *et al.* Treatment of osteitis pubis in athletes. Results of corticosteroid injections. *Am J Sports Med* 1995;23(5):601-6.
47. RADIC R, ANNEAR P. Use of pubic symphysis curettage for treatment-resistant osteitis pubis in athletes. *Am J Sports Med* 2008;36(1):122-8.
48. MOORE RS Jr, STOVER MD, MATTA JM. Late posterior instability of the pelvis after resection of the symphysis pubis for the treatment of osteitis pubis. A report of two cases. *J Bone Joint Surg Am* 1998;80(7):1043-8.
49. HITI CJ, STEVENS KJ, JAMATI MK, *et al.* Athletic osteitis pubis. *Sports Med* 2011;41:361-76.
50. FRICKER PA. Management of groin pain in athletes. *Br J Sports Med* 1997;31(2):97-101.
51. PAAJANEN H, HEIKKINEN J, HERMUNEN H, *et al.* Successful treatment of osteitis pubis by using totally extraperitoneal endoscopic technique. *Int J Sports Med* 2005;26(4):303-6.

Sažetak

JE LI KRONIČNI SINDROM BOLNE PREPONE BERMUDSKI TROKUT SPORTSKE MEDICINE?

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Kronični sindrom bolne prepone je jedno od najsloženijih stanja u sportskoj medicini. Konzervativno liječenje je dugotrajno, ishod liječenja neizvjestan uz brojne recidive, a sve to djeluje frustrirajuće na sportaša i na liječnika koji ga liječi. Zbog brojnih nejasnoća oko etiologije i liječenja kronični sindrom bolne prepone neki nazivaju i bermudskim trokutom sportske medicine. U prospektivnoj studiji kroz 7 godina 114 sportaša s kroničnim sindromom bolne prepone otpornim na konzervativnu terapiju liječeno je operativno. Kod 109 sportaša sa sportskom hernijom učinjena je neuroлиза ilioingvinalnog živca, resekcija genitalne grane genitofemoralnog živca i pojačanje stražnje stijenke ingvinalnog kanala duplikaturom transverzalne fascije modificiranom tehnikom po Shouldiceu. Kod 26 sportaša koji su uz sportsku herniju imali i tendinozu aduktora te kod 5 sportaša s izoliranom tendinozom aduktora učinjena je tenotomija aduktora. Od 83 sportaša s izoliranom sportskom hernijom 81 se vratio sportu nakon 4,4 tjedna (raspon 3-16 tjedana). Sportaši s tenotomijom aduktora (n=31) vratili su se sportskim aktivnostima nakon 11,8 (raspon 10-15) tjedana. Ako se pažljivo razmotre smetnje sportaša, učini detaljan pregled i utvrdi pravi uzrok bolova, liječenje može biti kratkotrajno i uspješno, a sindrom bolne prepone ne mora predstavljati bermudski trokut sportske medicine.

Ključne riječi: *Prepona – ozljede; Sportske ozljede; Kila, preponska; Mišićnokoštana bol*