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Also check if the departments “Surgery and Anesthesiology” in the Diskapi Yildirim Beyazit Teaching and Research Hospital can be changed to “General Surgery and Anesthesia and Reanimation,” respectively. And if department of “Surgery” can be changed to “General Surgery” in the last affiliation.

AU2) Please check if the section head “Case Series” can be Changed to “Case Study.”

AU3) Please check if the edits to the sentence “The most frequent radiological ...” retain the intended meaning.

AU4) Please define “PP” in the footnote of Table 1. Also specify what does “*” in the table indicate.

AU5) Please provide in-text citation for Table 2.

The Value of Anterior Inguinal Exploration With Local Anesthesia for Better Diagnosis of Chronic Groin Pain in Soccer Players

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CASE SERIES

Key Words: groin pain, athletic pubalgia, sports hernia, pubic inguinal pain syndrome, hernia repair

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Groin pain is a common complaint among recreational and professional athletes, especially soccer, hockey, and American football players.^{1–3} “Athletic pubalgia” is the term used to denote chronic pubic or groin pain in athletes. The underlying cause may vary: osteitis pubis, rectus abdominis injury, adductor tendon injury, sports hernia, or pelvic stress fracture.^{2,4} The pubic region is the intersection of the powerful forces that move the abdomen and the leg. When there is an imbalance between the abdominal and adductor muscles, a posterior wall weakness may develop in the inguinal region and cause groin pain.¹

In fact, “sports hernia” is a misnomer and should not be used for all individuals with chronic groin pain.¹ This term should rather be reserved for proven posterior inguinal floor weakness. It is not an entity such as a manifested direct and indirect hernia, which involves a visible bulging in the groin. Inguinal wall weakness can be diagnosed by imaging in some cases, whereas the only means for diagnosis in others is surgical exploration.

We present a case series of athletes with groin pain who were referred to the surgical service by a sports medicine physician with significant experience in treating soccer injuries. The significance of sports hernias and the value of surgical exploration are discussed using perioperative evidence.

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The authors report no conflict of interest.

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Between September 2006 and September 2010, 24 male soccer players with groin pain were referred for surgical consultation. Age, side and duration of pain, previous treatments, physical examination findings, and operative findings were prospectively recorded. The times to return training and full match performance were also recorded.

Of the 24 athletes, 7 did not proceed to surgical exploration. One athlete had findings consistent with a hydrocele and underwent hydrocelectomy. Remaining 6 athletes had normal physical examinations and were not determined to be surgical candidates. According to the records provided by the sports medicine physician, 2 of these cases were able to return to full sports activity within 3 months after further physical therapy. The other 4 patients have experienced some pain and are not able to play at the maximum capacity at the moment, although none of them has yet come back for surgical reevaluation.

The remaining 17 athletes underwent open anterior inguinal exploration while under local anesthesia and intravenous sedation. The information for these patients is presented in Table 1. The mean age was 26.5 years (range, 18–40 years). The mean duration of pain before surgery was 6.6 months (range, 1–18 months). Most patients had previously been diagnosed with osteitis pubis by a sports medicine physician who had treated these patients with nonsteroidal anti-inflammatory drugs, physical therapy, special exercise programs, and local steroid injections before seeking consultation with a general surgeon.

All athletes who underwent surgical exploration had tenderness to palpation in the inguinal region on the affected side. Preoperative ultrasound and magnetic resonance imaging (MRI) was obtained in all cases. The most frequent radiological diagnosis on MRI was osteitis pubis, where no hernia was detected. A small indirect hernia was reported in ultrasound in 1 case; nevertheless, a sports hernia was seen upon surgical exploration.

Surgical exploration was performed with local anesthesia. Patients were conscious and were able to give a cough during surgery, which allowed the physician to observe the hernia sac and the strength of the posterior wall. Thirteen patients had a typical sports hernia, which was not detected in preoperative examination but became manifest with intraoperative Valsalva maneuver (by coughing). One patient did not have any type of hernia. His ilioinguinal nerve was found to be bent via an aperture in the external aponeurosis. This patient was treated only with an ilioinguinal nerve release. However, his pain persisted after the operation, and a pelvic bone stress fracture was seen on repeat MRI. Nineteen inguinal hernia repairs were performed in 16 patients, including 17 mesh repairs and 2 minimal suture repairs.

The patient satisfaction rate was 94%. The mean follow-up period was 21.8 months (range, 3–44 months). The healing period was observed by physical examination and communications with the team doctors. The return to full training and match performance rate

TABLE 1. Case Characteristics, Complaints, and Preoperative and Operative Information

Case	Age	Soccer Player Level	Complaint	Side	Duration of Pain (Mo)	Osteitis Pubis	Previous Operation	Preoperative Examination	Operative Findings	Surgical Procedure	Mesh Type
1	23	Professional	Pain	Right	3	Yes	Left inguinal hernia repairs (2)	Enlarged external ring, tenderness	Sport hernia, whole wall weakness, ilioinguinal nerve entrapment by external aponeurosis	Partial external aponeurosis release at pubic corner, iliohypogastric nerve excision, mesh repair	Standard PP
2	30	Professional	Pain	Left	5	Yes	No	Tenderness	Sport hernia, whole wall weakness	Mesh repair	Standard PP
3	23	Professional	Pain	Right	6	Yes	Right varicocelectomy	Tenderness	Sport hernia, 2-cm fascia defect, ilioinguinal nerve bended via an apertura in external aponeurosis	Partial external aponeurosis release at pubic corner, ilioinguinal nerve release, mesh repair	Standard PP
4	28	Professional	Pain	Bilateral	4	Yes	No	Tenderness	Sport hernia, whole wall weakness	Simultaneous bilateral mesh repair	Standard PP
5	34	Amateur	Pain	Right	18	No	No	Tenderness	Ilioinguinal nerve bended via an apertura in external aponeurosis	Ilioinguinal nerve release	Light PP
6	31	Hobby	Pain	Left	12	No	No	Bulge with Valsalva maneuver	Sport hernia, whole wall weakness	Mesh repair	Standard PP
7	40	Hobby	Pain	Right	6	No	No	Bulge with Valsalva maneuver	Sport hernia, whole wall weakness	Mesh repair	Light PP
8	27	Hobby	Pain	Right	1	No	No	Bulge with Valsalva maneuver	Sport hernia, whole wall weakness	Mesh repair	Light PP
9	22	Professional	Pain bulge*	Left	—	Yes	Right inguinal hernia repair	Bulge with Valsalva maneuver	Internal ring normal, small indirect sac, preperitoneal fat herniation	High dissection, mesh repair	Composite lightweight (PP + polyglactin)
10	33	Professional	Pain	Bilateral	2	No	No	Bulge with Valsalva maneuver	Left indirect hernia, right point hernia	High dissection, partial external aponeurosis release at pubic corner, simultaneous mesh repair	Composite lightweight (PP + polyglactin)
11	27	Professional	Pain	Right		Yes	Left varicocelectomy	Bulge with Valsalva maneuver	Small indirect sac	High dissection, mesh repair	Composite lightweight (PP + poliglecaprone)
12	22	Professional	Pain	Bilateral	18	Yes	Left varicocelectomy	Enlarged external rings	Sport hernia, whole wall weakness, ilioinguinal and genitofemoral (genital branch) nerve entrapment by external aponeurosis	Partial external aponeurosis release, right ilioinguinal and left genitofemoral (genital branch) nerve excisions, simultaneous mesh repairs	Composite lightweight (PP + polyglactin)
13	29	Professional	Pain	Right	5	Yes	No	Tenderness	Sport hernia, whole wall weakness	Mesh repair	Composite lightweight (PP + polyglactin)

TABLE 1. (continued) Case Characteristics, Complaints, and Preoperative and Operative Information

Case	Age	Soccer Player Level	Complaint	Side	Duration of Pain (Mo)	Osteitis Pubis	Previous Operation	Preoperative Examination	Operative Findings	Surgical Procedure	Mesh Type
14	18	Professional	Pain	Bilateral	6	Yes	No	Tenderness	Sport hernia, whole wall weakness	Left mesh repair; right minimal suture repair after 1 month interval	Standard PP
15	20	Professional	Pain	Left	6	Yes	No	Tenderness	Sport hernia, whole wall weakness	Mesh repair	Standard PP
16	21	Professional	Pain	Left	4	Yes	No	Tenderness	Sport hernia, whole wall weakness	Mesh repair	Standard PP
17	22	Professional	Pain	Right	3	Yes	No	Tenderness	Sport hernia, whole wall weakness	Minimal suture repair	None

was 88%. These 15 patients were able to rejoin team training after a mean period of 4 weeks.

DISCUSSION

The diagnosis and treatment of chronic groin pain in athletes requires a high index of suspicion and a multidisciplinary approach.^{3,5} When an athlete presents with groin pain that has failed to respond to conservative treatments within 6 to 8 weeks, the clinician should consider a sports hernia as a possible underlying cause.^{5,6} The mean duration of pain was 6 months in our series. A sports hernia or a small indirect hernia sac was found upon surgical exploration in all cases, and all but one could return to full activity after surgery.

Magnetic resonance imaging has been presented as a useful diagnostic tool by many centers.^{1,3,4} In our current practice, the sports medicine physician requests an MRI for the differential diagnosis of groin pain in all cases. However, no hernia was diagnosed on the MRI in any of the 24 athletes, whereas 19 patients had osteitis pubis at MRI. These patients with osteitis pubis were first treated by a sports medicine physician with a special exercise program following a resting interval, physical therapy, and local steroid injections. The groin pain disappeared for a while after these therapies but recurred afterward in all the 19 cases. The sports medicine physicians then suspected an underlying sports hernia in these patients and referred them for surgical evaluation. Surgery was not offered to 7 of them. A hernia was detected on surgical exploration in all the other 12 cases. This result demonstrates the pivotal role of a sports medicine physician in the management of chronic groin pain or the so-called pubic inguinal pain syndrome.

Nearly all types of hernia repairs have been used in the treatment of sports hernias. Prosthetic meshes are used in most series; however, minimal repair with sutures is also recommended.^{6,7} Laparoscopic repair has the advantage of the complete exploration of all possible apertures for herniation, which are not visible during an open anterior approach.⁸ Laparoscopy requires general anesthesia and is more expensive than open anterior repairs. Other reported advantages of laparoscopy are less early postoperative pain and quicker recovery; however, an open inguinal exploration and hernia

repair with local anesthesia are also associated with the same advantages.⁹ Moreover, this approach has another important advantage: because the patient is conscious during the operation, he can cough during exploration, allowing even small indirect sacs or weak areas on the posterior inguinal wall to be easily detected by the surgeon. The open anterior approach also provides an opportunity to omit prosthetic material and perform a minimal posterior wall repair with sutures.⁶

Athletic pubalgia may frequently be a multifactorial problem. There may be a nerve entrapment in addition to a sports hernia,^{3,5} which may be the only cause of the pain in some cases. Preservation of the nerves seems to be the best choice. When a regional nerve is found to be entrapped or bent sharply, it should be released gently. However, it may not be possible to protect the nerves in some cases. Nerve anatomy may hinder a proper mesh placement, and the division of the nerve or a branch of the nerve may be mandatory. Zieren et al⁹

TABLE 2. Postoperative Follow-up Results

Case	Operation Season (Mo)	Follow-up (Mo)	Return to Running (Wk)	Return to Training with Ball (Wk)	Match Performance (Wk)	Full Return to Soccer
1	April	44	1	3	4	Yes
2	June	42	2	4	5	Yes
3	October	38	3	8	?	No
4	October	38	2	3	5	Yes
5	February	34	Prolonged*	?	?	No
6	September	27	1	3	4	Yes
7	November	25	2	8	?	Yes
8	November	25	2	8	?	Yes
9	May	19	1	3	5	Yes
10	May	19	2	4	6	Yes
11	May	19	1	3	5	Yes
12	May	19	1	3	5	Yes
13	May	7	1	3	5	Yes
14	August	4	2	4	5	Yes
15	August	4	1	3	5	Yes
16	August	4	1	3	5	Yes
17	September	3	3	5	7	Yes

*Pubic bone stress fracture in computed tomography after the operation.

recommended primary excision of the ilioinguinal nerve on a routine basis in addition to tension-free mesh repair for soccer players. Brown et al¹⁰ also reported that 97 of 98 elite hockey players returned to play after division of the ilioinguinal nerve and repair with mesh. We performed nerve release in 3 repairs and resection in the other 3, in which the nerve or a branch of the nerve displayed sharp bending upon exploration.

In conclusion, when an athlete presents with chronic groin pain that cannot be relieved with conservative treatment in 6 to 8 weeks, the underlying pathology may be a sports hernia. In our series, the cure rate was high after anterior surgical exploration.

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