According to classic definition, hernia is a “displacement of parietal peritoneum and abdominal organs though a defect in the abdominal wall (natural or resulting from congenital defects) or a defect resulting from a disease condition or injury of abdominal wall (postoperative scars)” (1) This definition assumes existence of hernial orifice, hernial sac and its contents. Has this definition stood the test of time? Can it define complaints that result in surgical procedure that is performed in the presence of “classic” inguinal hernias?

More and more often we must face patients presenting not with a hernia, but with pain that appeared suddenly or after an unspecific injury of the groin region.

Half percent to 6.2% of professional athletes suffer from groin pain. This condition most often affects professional hockey and football players (2, 3, 4). Annually 10 to 18% complain of pain in the groin region, also referred to as “sportsman’s hernia” (5, 6). “Sportsman’s hernias” are among the least studied, least understood and worst defined human complaints. The term sportsman’s hernia includes a variety of diagnoses and wide range of pathological factors that must be either ruled out or confirmed before the final diagnosis is made (7). Various muscle, tendon and skeletal diseases of the groin region have a direct or indirect effect on walls of inguinal canal and on inguinal rings.

Etiology of chronic pain in the groin region can be classified into four categories:
1) adductor enthesopathy
2) pubalgia – osteitis pubis
3) degenerative changes of the hip joint
4) sportsman’s hernias, threatening hernias, Gilmore’s groin

There are multiple terms in the literature to name complaints in the groin region (tab. 1).

The term “sportsman’s hernia” was used for the first time by Greg Lovell to describe a syndrome of chronic pain in athletes who were diagnosed with small medial hernias (simple hernias).

Gilmore’s hernia – groin injury. As early as in 1980’s Gilmore paid attention to pain complaints experienced by athletes. According to Gilmore, groin disruption is not a classic displacement of visceral organs outside natural borders of abdominal cavity. It is defined as a serious musculoskeletal injury of the groin that can be treated with surgical reconstruction of damaged structures and restoration of normal anatomical conditions (9). According to Gilmore, these damages result from abnor-

Table 1. Determination of pain complaints in the groin region

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>athlete’s hernia</td>
</tr>
<tr>
<td>2</td>
<td>groin disruption (Gilmore’s groin)</td>
</tr>
<tr>
<td>3</td>
<td>threatening hernia</td>
</tr>
<tr>
<td>4</td>
<td>soft hernia</td>
</tr>
<tr>
<td>5</td>
<td>athletic pubalgia</td>
</tr>
<tr>
<td>6</td>
<td>osteitis pubis</td>
</tr>
<tr>
<td>7</td>
<td>hockey groin syndrome</td>
</tr>
<tr>
<td>8</td>
<td>Ashby’s inguinal ligament enthesopathy</td>
</tr>
<tr>
<td>9</td>
<td>pubic inguinal pain syndrome (PIPS)</td>
</tr>
</tbody>
</table>
malities of muscular balance and their excessive use (fig. 1 and 2).

Strong hip flexors, potently developed in football players and used to kick the ball, according to Gilmore lead to anteflexion of the pelvis. This anteflexion of pelvis results in extension of abdominal muscles that become weaker and are not sufficient to stabilize the pelvis. Excessive physical activity results in groin disruption leading to its injury.

Gilmore defines a disease entity “Gilmore’s groins” as a set of mechanical factors that partially or completely damage all structures of the groin region. Muscular imbalance is presumed to affect static conditions of the pelvis and groin region, resulting in exposure of the groin to injury. Gilmore did not consider neuropathy or preperitoneal lipomas as the causes of pain complaints.

The most common pathological changes in the groin according to Gilmore are presented in tab. 2.

Hackney (10) believes that groin injury in athletes is related to limitation of rotational motions in the hip joint which may lead of stresses in the groin region, manifesting ad groin pain. Furthermore, it causes stress in the region of pubic symphysis, leading to avulsion of the transverse fascia from the inguinal ligament (11). In view of the course of muscles and stresses in the groin (compare fig. 1), it is clear that these forces must eventually result in avulsion of inguinal ligament and damage of the conjoined tendon (12). Hackney’s theory (10) explains two principal disease symptoms occurring in this region – adductor enthesopathy and pubalgia (fig. 3).

Threatening hernia or so called soft groin are the terms used to indicate condition of the groin without definite hernia. Both these terms should be treated with great caution since physical examination is unable to reach the deep inguinal ring and only incompletely

<table>
<thead>
<tr>
<th>Table 2. Pathological changes found during surgical treatment of Gilmore’s groin</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 tear of the external oblique abdominal muscle fascia</td>
</tr>
<tr>
<td>2 tear of iliopubic tract</td>
</tr>
<tr>
<td>3 avulsion of iliopubic tract from the pubic tubercle</td>
</tr>
<tr>
<td>4 avulsion of iliopubic tract from the inguinal ligament</td>
</tr>
<tr>
<td>5 lack of inguinal ligament</td>
</tr>
</tbody>
</table>

Fig. 1. Muscle bands in the hypogastric region. The external oblique muscle (in red) with the internal oblique muscle (in blue) tenses the abdominal wall in oblique direction, while the transverse muscle (violet) in transverse direction. The recti muscles (grey) tense the abdominal wall between the costal arch and the pubic bone [according to 43]
verify posterior wall of the inguinal canal (1, 13, 14). (fig. 4a and 4b – US imaging of the groin with an examining digit + scheme).

General surgeons must face the problem of pain in the groin region without clinical symptoms of any hernia. This pain usually occurs or exacerbate immediately after herniorrhapies or hernioplasties, being a diagnostic and therapeutic challenge for surgeons (15-18). Compression of sensory nerves in the groin region like: geniofemoral nerve, ilioinguinal nerve, less often obturator nerve and lateral cutaneous femoral nerve presumably cause pain. This compression can be caused by either excessively developed muscles which is common in athletes (in particularly in football players) or in subjects who perform activities that result in hypertrophy of muscles in the groin region. Daysine et al. (19) among 4000 patients subjected to surgical treatment found 30 cases of acute syndrome of pain complaints in the groin after surgical procedures involving hypogastric region or inguinal herniorrhaphy and hernioplasty procedures (also laparoscopic) and 103 patients without any hernia and without previous surgical procedures. Forty per cent of these patients reacted positive to the treatment with non-steroidal anti-inflammatory drugs. Other patients, in view of lack of improvement, were referred to further diagnostic procedures and orthopedic treatment.

Among 200 patients referred to treatment of inguinal hernias, the author treated 38 men under the age of 40 who actively participated in sports activities in whom intraoperatively 57 hernias were found (19 bilateral hernias). In four cases no inguinal hernia was found during the surgical procedure. In all these cases, a preperitoneal lipoma was found in the inguinal canal; its removal resulted in resolution of complaints (unpublished author’s results) (fig. 5 and 6). When a preperitoneal li-
“Sportsman’s hernia”. Part one: pathophysiology, nomenclature and treatment

Poma is at the level of the internal inguinal ring, in particularly when there is no hernia or when there are small hernias, both mechanisms that occlude the inguinal canal—sphincter and compression (12, 20, 21) result in increased compression of the lipoma embedded in the deep inguinal ring. This pressure is transferred to nerves that cross the inguinal canal: ilioinguinal nerve and genital ramus of the genitofemoral nerve, resulting in their compression and pain complaints, reported in Polish literature as neuropathy and in the English literature as entrapment syndrome.

US imaging demonstrated a dome-like elevation of Hesselbach triangle during Valsalva’s maneuver as is often observed and not always associated with pain in the groin region (22). Only the dome-like elevation of Hesselbach’s triangle above the level of abdominal wall, indicating weak transverse fascia, may indicate medial hernia (23, 24) (fig. 7 and 8). With well developed muscles of the abdominal wall (the external and internal oblique muscle), weakening of the transverse fascia results in increased pressure in the inguinal canal, change of its course and change of an angle of entrance of the spermatic cord, resulting in an excessive compression of the ilioinguinal nerve and genital ramus of the genitofemoral nerve (25) (fig. 9).

The above presented changes concern structures that are a part of the inguinal canal or cross this canal.

Weakening of the posterior wall of the inguinal canal, commonly although incorrectly referred to as “sportsman’s hernia”, is also
responsible for pain complaints in the groin region. This is presumably caused by the action of shear forces in this region. These forces result from disturbed physiological balance between the hip muscles and muscles of abdominal cavity.

Currently there is no consensus regarding preoperative diagnostic workup as well as a method of treatment of “sportman’s hernias”. It is difficult to establish a diagnosis using physical examination. Imaging studies (US imaging, CT, MRI), scintigraphic studies are unable to definitely rule out or confirm the diagnosis. An attempt of surgical treatment of “sportsman’s hernias” involves either reconstruction of damaged parts of the groin region (fascias of oblique muscles, transverse muscle) or a procedure as in the treatment of inguinal hernias. Sometimes combination of these surgical procedures with adductor tenotomy provides good results (author’s own observations). Surgical treatment seems more effective than medical treatment; among surgical techniques, laparoscopic techniques result in more rapid recovery than conventional ones. Table 3 presents results of treatment of “sportsman’s hernias” according to used treatment.

Table 3. Results of treatment of sportsman’s hernia according to the surgical technique used (adapted from 26)

<table>
<thead>
<tr>
<th>Author</th>
<th>Study type</th>
<th>Number of patients</th>
<th>Type of inguinal repair</th>
<th>Prosthesis</th>
<th>Positive results</th>
<th>Return to activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gilmore (27)</td>
<td>retrospective</td>
<td>1200</td>
<td>open reconstruction</td>
<td>no</td>
<td>97%</td>
<td>after 6 weeks</td>
</tr>
<tr>
<td>Meyers et al. (28)</td>
<td>prospective</td>
<td>157</td>
<td>open reconstruction of posteriori wall (in 23% combined with adductor tenotomy)</td>
<td>no</td>
<td>96%</td>
<td>after 6 months</td>
</tr>
<tr>
<td>Malycha et Lovell (29)</td>
<td>prospective</td>
<td>50</td>
<td>two layer reconstruction of posteriori wall of the inguinal canal with a prolene suture</td>
<td>no</td>
<td>93%</td>
<td>after 6-8 weeks</td>
</tr>
<tr>
<td>Kumar et al. (30)</td>
<td>retrospective</td>
<td>35</td>
<td>approximation of the external abdominal oblique muscle fascia and its support with a prolene suture</td>
<td>yes</td>
<td>93%</td>
<td>after 14 weeks</td>
</tr>
<tr>
<td>Stelle et al. (31)</td>
<td>retrospective</td>
<td>47</td>
<td>modified Bassini reconstruction with prosthesis implantation</td>
<td>yes</td>
<td>77%</td>
<td>after 14 months</td>
</tr>
</tbody>
</table>
“Sportsman’s hernia”. Part one: pathophysiology, nomenclature and treatment

<table>
<thead>
<tr>
<th>Author</th>
<th>Study type</th>
<th>Number of patients</th>
<th>Type of inguinal repair</th>
<th>Prosthesis</th>
<th>Positive results</th>
<th>Return to activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polglase et al. (32)</td>
<td>retrospective</td>
<td>64</td>
<td>Bassini reconstruction with transverse fascia</td>
<td>no</td>
<td>62.5% satisfied 31% partially satisfied 4.7% dissatisfied</td>
<td>after 8 months</td>
</tr>
<tr>
<td>Brannigan et al. (33)</td>
<td>retrospective</td>
<td>85</td>
<td>modified Souldice procedure</td>
<td>no</td>
<td>96%</td>
<td>after 15 weeks</td>
</tr>
<tr>
<td>Joesting (34)</td>
<td>retrospective</td>
<td>45</td>
<td>modified Lichtenstein procedure</td>
<td>yes</td>
<td>90%</td>
<td>time not specified</td>
</tr>
<tr>
<td>Van der Donckt et al. (35)</td>
<td>prospective</td>
<td>41</td>
<td>Bassini procedure + percutaneous adductor tenotomy (in 14 cases – bilateral)</td>
<td>no</td>
<td>90%</td>
<td>after 6-15 months</td>
</tr>
<tr>
<td>Kluij et al. (4)</td>
<td>prospective</td>
<td>14</td>
<td>TAPP</td>
<td>yes</td>
<td>93%</td>
<td>after 12 weeks</td>
</tr>
<tr>
<td>Edelman et Selnick (36)</td>
<td>retrospective</td>
<td>10</td>
<td>TEP</td>
<td>yes</td>
<td>100%</td>
<td>after 4 weeks 1 patient did not respond to the procedure</td>
</tr>
<tr>
<td>Paajanen et al. (37)</td>
<td>retrospective</td>
<td>41</td>
<td>TEP</td>
<td>yes</td>
<td>94%</td>
<td>after 4 weeks</td>
</tr>
<tr>
<td>Van Veen et al. (38)</td>
<td>prospective</td>
<td>55</td>
<td>TEP</td>
<td>yes</td>
<td>100%</td>
<td>after 3 months</td>
</tr>
<tr>
<td>Susmallian et al. (39)</td>
<td>prospective</td>
<td>35</td>
<td>TEP</td>
<td>yes</td>
<td>97%</td>
<td>time not specified</td>
</tr>
<tr>
<td>Gentisaris et al. (40)</td>
<td>retrospective</td>
<td>131</td>
<td>TAPP</td>
<td>yes</td>
<td>96.90%</td>
<td>after 2-3 weeks</td>
</tr>
<tr>
<td>Azurin et al. (41)</td>
<td>retrospective</td>
<td>8</td>
<td>TAPP</td>
<td>yes</td>
<td>100%</td>
<td>after 2-3 weeks</td>
</tr>
<tr>
<td>Srinivasan et Schuricht (42)</td>
<td>retrospective</td>
<td>15</td>
<td>TEP</td>
<td>yes</td>
<td>87%</td>
<td>after 3-6 weeks</td>
</tr>
</tbody>
</table>

**SUMMARY**

Several factors are responsible for pain complaints in the groin. Damage of muscular structures of the inguinal canal, excessive development of muscles as well as a preperitoneal lipoma in the groin, all can result in pain complaints. Physical examination is unable to sufficiently evaluate the inguinal canal. Therefore other diagnostic modalities, such as US imaging, CT and MRI are required to make the diagnosis. Revision of the inguinal canal in unclear cases may result in resolution of complaints.

**REFERENCES**

12. Ścierski A: Anatomia przepuklin pachwino-
ych. W: Przepukliny pachwinowe i udowe u doros-
13. Chassin IL: The subcutaneous inguinal ring: A
14. Thiel W: Photographischer Atlas der Prakti-
ischen Anatomie. Springer Verlag Berlin, Heidel-
15. Bendavid R: Complications of groin hernia
surgery. Surg Clin North Am 1998; 78: 1089-
1103.
17. Magee RK: Genitofemoral causalgia (a new
18. Skandalakis JE, Skandalakis LJ, Colborn GL:
Testicular atrophy and neuropathy in hernior rho-
19. Deysine M, Deysine GR, Reed Jr. WP: Groin
pain in the absence of hernia: a new syndrome.
20. Spaw AT, Ennis BW, Spaw LP: Laparoscopic
1: 269-77.
anatomische Aspekte zur laparoskopischen Leisten-
22. Brittenden J, Robinson P: Imaging of pelvic
23. Ścierski A, Roechte F: Przydatność badań ul-
trasonograficznych w diagnostyce przepuklin pachwi-
24. Ścierski A: Badanie kliniczne, diagnostyka,
wskazania do zabiegów operacyjnych. W: Przepu-
kliny pachwinowe i udowe u dorosłych. Wyd. Alfa-
Medica 2011; str. 64.
25. Ścierski A, Roechte F: Changes of important
anatomical structures in the inguinal region after
a herniorrhaphy: observations during treatment of recurrent hernia using TEP. Videochirurgia 2007;
2/1: 13-17.
26. Morales-Conde S, Socos M, Barranco A: Spor-
tmen hernia: what do we know? Hernia 2010; 14:
5-15.
27. Gilmore OJA: Groin pain in the soccer athlete:
17: 787-93.
28. Meyers WC, Foley DO, Garrett WE et al.: Ma-
agement of severe lower abdominal or inguinal
pain in high-performance athletes. Performing
athletes with abdominal or inguinal neuromuscular
28: 2-8.
29. Malycha P, Lovell G: Inguinal surgery in ath-
letes with chronic groin pain: “Sportsman’s” hernia.
30. Kumar A, Doran J, Batt ME: Results of inguinal
canal repair in athletes with sports hernia. J R Coll
31. Stelle P, Annear P, Grove JR: Surgery for po-
terior inguinal wall deficiency in athletes. J Sci
32. Polglase AL, Frydman GM, Framer KC: Ingu-
inal surgery for debilitating chronic groin pain in
33. Brannigan AE, Kerin MJ, McEntee GP: Gilmo-
34. Joesting DR: Diagnosis and treatment of sport-
24.
35. Van Der Donckt K, Steenbrugge F, Van Den
Abbeele K: Bassini’s hernial repair and adductor
longus tenotomy in the treatment of chronic groin
36. Edelman DS, Selesnick H: “Sports” Hernia:
treatment with biologic mesh (Surgisis). Surgical
Endoscopy 2006; 20: 971-73.
37. Paajanen H, Syvähuoko I, Airo I: Totally ex-
traperitoneal endoscopic (TEP) treatment of sports-
man’s hernia. Surg Laparosc Endosc Percutan Tech
38. van Veen RN, de Baat P, Heijboer MP et al.: Su-
ccessful endoscopic treatment of chronic groin
repair of “sportsman’s hernia” in soccer players as
treatment of chronic inguinal pain. Med Sci Moni-
40. Gentisaris M, Goulimaris I, Sikas N: Laparo-
scopic repair of chronic groin pain in athletes. Am J
41. Azurin DJ, Go LS, Schuricht A et al.: Endosco-
pic preperitoneal herniorrhaphy in professional
athletes with groin pain. J Laparoendoscopic Ad-
42. Srinivasan A, Schuricht A: Long-term follow-up
of laparoscopic preperitoneal hernia repair in pro-
fessional athletes. J Laparoendoscopic Adv Surg
43. Rauber/Kopsch: Anatomie des Menschen Tom
1. Leonhard H. i wsp. (red.) Wyd. Georg Thieme
Verlag, Stuttgart, New York, 1987; Str. 295.