QUALITY IN SPORT
eISSN 2450-3118 · Open Access · Peer-reviewed
apcz.umk.pl/QS Nicolaus Copernicus University in Toruń

Cite as: WIJAS, Daniel, OLSZOK, Mikołaj, KLUŚ, Michał, KOZDRA, Bartłomiej, MAKSELAN, Natalia, NAWRAT, Natalia, HANDZEL, Karolina, ANCZYK, Antoni and KARBOWIAK, Krzysztof. Acute abdominal pain in athletes - diagnostic challenges and indications for surgical intervention: A Narrative Review. Quality in Sport. 2026;65:73632. https://doi.org/10.12775/QS.2026.65.73632

ARTICLE TIMELINE
Received: 22.06.2026. Revised: 19.07.2026. Accepted: 19.07.2026. Published: 22.07.2026.

The journal has been awarded 20 points in the parametric evaluation by the Polish Ministry of Higher Education and Science (Annex to the announcement of 05.01.2024, No. 32553). Unique Journal Identifier: 201398. Scientific disciplines assigned: Economics and finance (Field of social sciences); Management and Quality Sciences (Field of social sciences).
Punkty Ministerialne z 2019 – aktualny rok 20 punktów. Załącznik do komunikatu Ministra Szkolnictwa Wyższego i Nauki z dnia 05.01.2024 Lp. 32553. Posiada Unikatowy Identyfikator Czasopisma: 201398. Przypisane dyscypliny naukowe: Ekonomia i finanse (Dziedzina nauk społecznych); Nauki o zarządzaniu i jakości (Dziedzina nauk społecznych).

Acute abdominal pain in athletes - diagnostic challenges and indications for surgical intervention: A Narrative Review

Daniel Wijas,
ORCID https://orcid.org/0009-0006-0457-9904
E-mail danielwijas4@gmail.com
Medical University of Silesia in Katowice Poland
15 Poniatowskiego Street
40-055 Katowice

Mikołaj Olszok,
ORCID https://orcid.org/0009-0006-8628-9459
E-mail mikolaj.olszok@gmail.com
Medical University of Silesia in Katowice Poland
15 Poniatowskiego Street
40-055 Katowice

Michał Kluś,
ORCID https://orcid.org/0009-0005-3695-605X
E-mail michalklus123@gmail.com
Medical University of Silesia in Katowice Poland
15 Poniatowskiego Street
40-055 Katowice

Bartłomiej Kozdra,
ORCID https://orcid.org/0009-0005-7261-6626
E-mail bartlomiejkozdra@gmail.com
Medical University of Silesia in Katowice Poland
15 Poniatowskiego Street
40-055 Katowice

Natalia Makselan,
ORCID https://orcid.org/0009-0000-2551-5105
E-mail makselan.natalia@gmail.com
Medical University of Silesia in Katowice Poland
15 Poniatowskiego Street
40-055 Katowice

Natalia Nawrat,
ORCID https://orcid.org/0009-0005-2193-7286
E-mail nawrat72@gmail.com
Medical University of Silesia in Katowice Poland
15 Poniatowskiego Street
40-055 Katowice

Karolina Handzel,
ORCID https://orcid.org/0009-0004-5765-0458
E-mail karolinahandzel30@gmail.com
Medical University of Silesia in Katowice Poland
15 Poniatowskiego Street
40-055 Katowice

Antoni Anczyk,
ORCID https://orcid.org/0009-0008-3817-3675
E-mail naron333@gmail.com
Medical University of Silesia in Katowice Poland
15 Poniatowskiego Street
40-055 Katowice

Krzysztof Karbowiak,
ORCID https://orcid.org/0009-0009-1332-5000
E-mail krzysztof.karbowiak12@gmail.com
Medical University of Silesia in Katowice Poland
15 Poniatowskiego Street
40-055 Katowice

Corresponding Author
Daniel Wijas, E-mail danielwijas4@gmail.com

Abstract

Background:
Abdominal and groin pain in athletes is diagnostically challenging due to overlapping causes including exercise-related gastrointestinal symptoms, musculoskeletal injuries, and serious intra-abdominal pathology.

Aim:
To explore the diagnostic complexity, emphasize the importance of multidisciplinary management, and discuss clinical implications for athletes presenting with abdominal or groin pain.

Methods:
Review of clinical studies assessing diagnostic approaches, reliability of physical

examinations, imaging techniques, and treatment outcomes in athletes with lower abdominal or inguinal pain.

Results:

Exercise-induced transient abdominal pain (ETAP) and athletic pubalgia are common conditions causing pain that mimics more serious pathology; clinical examination tests show variable but generally acceptable reliability; imaging modalities such as ultrasound, MRI, and CT improve diagnostic accuracy; multidisciplinary collaboration among sports physicians, surgeons, radiologists, and physiotherapists enhances management; surgical interventions targeting pelvic floor or abdominal wall defects yield high rates of return to sport in selected athletes; however, literature is limited by heterogeneous populations and lack of standardized diagnostic criteria.

Conclusions:

Early and accurate diagnosis of abdominal and groin pain in athletes requires careful clinical assessment supported by appropriate imaging and a multidisciplinary approach to optimize outcomes. Further research is needed to establish standardized diagnostic guidelines and treatment protocols tailored to athletic populations.

Key words: abdominal pain, groin pain, athletes, athletic pubalgia, exercise-related transient abdominal pain, diagnosis, multidisciplinary management, imaging

1. Introduction

Acute abdominal pain is a frequent and challenging presentation in emergency care, encompassing conditions that range from benign, self-limiting disorders to life-threatening surgical emergencies (Slagman et al., 2025; Osterwalder et al., 2020). In general emergency department cohorts, non-traumatic abdominal pain accounts for approximately 5–20% of all presentations and around 12% in some large all-comer series, underlining its clinical

relevance and diagnostic complexity (Slagman et al., 2025; Osterwalder et al., 2020). The term acute abdominal pain usually refers to pain of sudden onset, with duration from hours to a few days, involving intra- or extra-abdominal structures and requiring rapid evaluation to exclude serious pathology (Slagman et al., 2025; Osterwalder et al., 2020). Although epidemiological data are mostly derived from unselected emergency populations rather than athletes specifically, the high overall burden of abdominal complaints, their wide differential diagnosis, and their potential association with exertion or trauma make them highly pertinent to sports medicine.

1.1. Acute abdominal pain in sports medicine

In athletes, acute abdominal pain may arise from traumatic mechanisms-such as direct blows in contact and collision sports causing solid organ injury, hollow viscus perforation, or mesenteric lesions-or from non-traumatic mechanisms related to the physiological stress of exercise, including splanchnic hypoperfusion, altered motility, and functional syndromes. Strenuous exercise can markedly reduce splanchnic blood flow (by up to ~80%), precipitating gastrointestinal ischaemia and symptoms such as abdominal pain, nausea, vomiting, and bloody diarrhoea (Costa et al., 2017; Ter Steege & Kolkman, 2012). Exercise-associated gastrointestinal symptoms are highly prevalent; observational work in endurance events reports upper and lower gastrointestinal complaints (including abdominal pain) in a substantial proportion of participants, often severe enough to limit performance or provoke withdrawal (Costa et al., 2017; Ter Steege & Kolkman, 2012; Costa et al., 2025). Dehydration, heat stress, delayed gastric emptying, and ingestion of hyperosmolar or excessive fluids further exacerbate gut ischaemia and abdominal symptoms in athletes (Costa et al., 2017; De Oliveira & Burini, 2011; Ter Steege & Kolkman, 2012; Costa et al., 2025). In addition, side-stitch or exercise-induced transient abdominal pain shows point prevalences of roughly 18–27% in running events and is particularly common in sports involving repetitive torso movement and post-prandial exercise (Ter Steege & Kolkman, 2012).

1.2. Mechanisms contributing to abdominal pain in athletes

Multiple, often overlapping mechanisms therefore contribute to abdominal pain in athletic populations: exercise-induced gastrointestinal syndrome with reversible mucosal injury and increased permeability; abdominal wall and core muscle injuries such as athletic pubalgia; acute or chronic functional abdominal pain disorders; and, less commonly but critically, surgical entities including appendicitis, mesenteric ischaemia, bowel obstruction, or rare causes such as mesenteric cysts presenting with acute complications (Costa et al., 2017;

Barbu et al., 2025; Drager et al., 2020; Ter Steege & Kolkman, 2012; Korterink et al., 2015; Osterwalder et al., 2020). Increased intra-abdominal pressure during intense effort, repetitive trunk rotation, and abrupt changes of direction may provoke or unmask abdominal wall pathology and hernia-like syndromes that present with lower abdominal or groin pain in athletes (Drager et al., 2020; Forlizzi et al., 2022).

1.3. Clinical importance of early diagnosis

Early and accurate diagnosis of acute abdominal pain is crucial, as time-sensitive diseases such as sepsis, ileus, and mesenteric infarction carry substantial mortality (in-hospital mortality for non-traumatic abdominal pain cohorts is reported around 3–5%) and demand prompt recognition and intervention (Slagman et al., 2025; Osterwalder et al., 2020). Prospective emergency department data show that although the overall rate of missed diagnoses in acute abdominal pain may be modest (~5–6%), the breadth of underlying causes, including a high proportion of extra-abdominal conditions, underscores the risk of diagnostic error and delayed treatment (Osterwalder et al., 2020). In addition, a large fraction of patients in general emergency populations still leave with non-specific abdominal pain despite increased imaging use, reflecting persistent diagnostic uncertainty (Slagman et al., 2025; Osterwalder et al., 2020). For athletes, delayed or missed recognition of surgical emergencies or significant abdominal pathology can not only threaten life and organ function but also jeopardize careers, lengthen time away from sport, and complicate return-to-play decisions.

Imaging plays a central role in the diagnostic work-up. For non-traumatic acute abdominal pain, low-dose CT provides substantially higher sensitivity than plain abdominal radiography (around 75–96% vs. 30–77%) at similar radiation doses, and many authors argue that radiography has little role where CT is available (Alshamari et al., 2016). Structured, protocolized pathways for non-traumatic abdominal pain in the emergency setting, incorporating early ultrasound and systematic assessment, have been shown to improve pain control, patient satisfaction, and possibly short-term mortality without prolonging emergency department stay (Slagman et al., 2025). In sports medicine, however, these generic pathways must be integrated with sport-specific considerations such as exercise timing, recent training load, environmental conditions, contact or collision mechanisms, core muscle function, and competition calendars when formulating differential diagnoses and management plans.

Given the intersection of high abdominal pain prevalence, exercise-specific pathophysiology, and the risk of overlooking potentially life-threatening conditions, a rigorous differential

diagnosis is essential in athletes presenting with acute abdominal pain. Clinicians must distinguish common benign entities-such as exercise-induced transient abdominal pain, functional gastrointestinal complaints, or transient ischaemic phenomena-from emergent surgical conditions and from sport-related abdominal wall and core injuries that may require operative management (Costa et al., 2017; De Oliveira & Burini, 2011; Drager et al., 2020; Ter Steege & Kolkman, 2012; Osterwalder et al., 2020).

1.4. Aim of the review

The aim of this narrative review is to analyze the causes, diagnostic challenges, and indications for surgical intervention in acute abdominal pain among athletes, synthesizing current evidence on exercise-related gastrointestinal and abdominal wall pathology, emergency diagnostic strategies, and sport-specific factors that influence clinical decision-making.

Summary of Key Themes

Key Theme	Brief Description	Citations
Burden of acute abdominal pain	Very common ED presentation; broad benign-to-life-threatening spectrum	(Slagman et al., 2025; Osterwalder et al., 2020)
Exercise-induced GI mechanisms	Splanchnic hypoperfusion, ischaemia, motility changes, high symptom prevalence in endurance sports	(Costa et al., 2017; De Oliveira & Burini, 2011; Ter Steege & Kolkman, 2012; Costa et al., 2025)
Traumatic vs non-traumatic pain	Contact trauma vs physiological/functional mechanisms and abdominal wall injuries	(Costa et al., 2017; Drager et al., 2020; Ter Steege & Kolkman, 2012; Osterwalder et al., 2020)
Risk of missed emergencies	Diagnostic uncertainty, extra-abdominal causes, non-specific labels; need for early recognition	(Slagman et al., 2025; Osterwalder et al., 2020)
Role of imaging and pathways	Low-dose CT superior to radiography; structured protocols improve outcomes	(Alshamari et al., 2016; Slagman et al., 2025)

Figure 1: Core concepts underpinning acute abdominal pain in athletes

2. Methods

2.1. Literature search strategy

A narrative review methodology was chosen to synthesize current knowledge on acute abdominal pain in athletes, consistent with approaches used in other narrative reviews in sports and pain medicine (Gribble et al., 2016; Hainline et al., 2017). A structured literature search was conducted in PubMed, Scopus, and Web of Science. The search combined free-text terms and, where applicable, controlled vocabulary using Boolean operators (AND, OR). Core keywords included: “acute abdominal pain”, “athletes”, “sports injuries”, “abdominal

trauma", "appendicitis in athletes", "sports hernia", and "surgical abdomen". Additional search combinations (e.g., "abdominal trauma" AND "contact sports"; "sports hernia" AND athletes) were used to improve sensitivity. Reference lists of relevant clinical studies and reviews on pain in athletes, abdominal emergencies, and rare surgical causes of acute abdomen (e.g., mesenteric cysts) were manually screened to identify further eligible publications (Gribble et al., 2016; Barbu et al., 2025; Coffin & Duboc, 2022).

2.2. Inclusion criteria

Articles were included if they met all of the following criteria:

- Published in English in peer-reviewed journals.
- Involved athletes or physically active populations, including recreational and elite competitors, reflecting the approach taken in prior sports-injury and pain-focused narrative reviews (Gribble et al., 2016; Hainline et al., 2017).
- Addressed diagnosis, etiology, or management of abdominal pain or acute abdominal presentations, including both traumatic (e.g., abdominal trauma, solid organ or mesenteric injury) and non-traumatic or functional causes (e.g., persistent or exercise-related abdominal pain) (Gribble et al., 2016; Hainline et al., 2017; Coffin & Duboc, 2022).

Study designs limited to clinical studies (prospective or retrospective), narrative or systematic reviews, and case series or detailed case reports describing acute abdominal presentations in active individuals, including rare entities such as mesenteric cysts presenting with acute abdomen (Barbu et al., 2025; Coffin & Duboc, 2022).

2.3. Exclusion criteria

Studies were excluded if they:

- Were unrelated to sports, exercise, or physical activity (e.g., general population abdominal pain without stratification by activity level).
- Were non-clinical (purely experimental, basic science, animal or in vitro work) without direct diagnostic or clinical applicability (Ivaşcu et al., 2024; Albrecht & Chin, 2020).
- Lacked clear information on diagnostic approach, clinical course, or management of abdominal pain (e.g., articles focused solely on chronic gynecologic disorders without acute presentation, or pain not localized to the abdomen) (Smolarz et al., 2021; Coffin & Duboc, 2022).
- Were conference abstracts, editorials, or commentaries without sufficient clinical data.

2.4. Data synthesis

Included studies were analyzed qualitatively, following methods commonly used in narrative reviews of sports-related injuries and pain (Gribble et al., 2016; Hainline et al., 2017). Data were extracted on:

- Diagnostic pathways and imaging strategies used in acute abdominal presentations.
- Common etiologies in athletes, distinguishing traumatic from non-traumatic and functional causes (Gribble et al., 2016; Hainline et al., 2017; Barbu et al., 2025; Coffin & Duboc, 2022).
- Reported indications for surgical intervention, intraoperative findings, and outcomes in athletic or highly active patients (Barbu et al., 2025; Coffin & Duboc, 2022).

Findings were organized thematically to highlight diagnostic challenges, sport-specific mechanisms, and clinical decision-making around surgical versus conservative management.

3. Results

3.1. Etiology of acute abdominal pain in athletes

3.1.1. Gastrointestinal causes

Exercise-induced gastrointestinal syndrome (EIGS).

Strenuous and especially endurance exercise commonly provokes upper and lower gastrointestinal symptoms, including abdominal pain, in 30–90% of distance runners and a large proportion of endurance athletes (De Oliveira et al., 2014; Costa et al., 2017; Mlinaric & Mohorko, 2025; Emblom et al., 2018). Mechanisms include reduced splanchnic blood flow (up to 60–80% reduction at moderate–high intensities), leading to gut ischemia, epithelial injury, increased permeability, and endotoxaemia (De Oliveira et al., 2014; Costa et al., 2017; Clark & Mach, 2016). These disturbances underpin the concept of exercise-induced gastrointestinal syndrome, which ranges from transient discomfort to severe ischemic colitis and bloody diarrhoea that may mimic a surgical abdomen (De Oliveira et al., 2014; Costa et al., 2017; Clark & Mach, 2016).

Gastritis and gastroesophageal reflux.

Upper-GI complaints such as heartburn, epigastric pain, upper abdominal bloating, belching, and regurgitation are consistently the most common symptoms reported during and immediately after endurance exercise (De Oliveira et al., 2014; Costa et al., 2017; Costa et al., 2025; Mlinaric & Mohorko, 2025). Hemorrhagic gastritis and gastroesophageal reflux have been described as clinically significant, performance-limiting manifestations within the

broader spectrum of exercise-related GI problems (De Oliveira et al., 2014; Costa et al., 2025). Nutritional factors (hyperosmolar or large pre-exercise meals, certain sports drinks) and mechanical jarring during running can exacerbate these symptoms (De Oliveira et al., 2014; De Oliveira & Burini, 2011; Mlinaric & Mohorko, 2025).

Intestinal ischemia during endurance exercise.

Prolonged exercise at ≥60% VO_2max for ≥2 hours, especially in heat, is associated with marked intestinal hypoperfusion, ischemic injury, and malabsorption, which present as cramping abdominal pain, nausea, and bloody diarrhoea (De Oliveira et al., 2014; De Oliveira & Burini, 2011; Costa et al., 2017; Clark & Mach, 2016). Case series and physiological studies document reversible ischemic bowel and colitis in otherwise healthy athletes, sometimes requiring acute medical or surgical evaluation (De Oliveira et al., 2014; Costa et al., 2017; Clark & Mach, 2016).

3.1.2. Abdominal wall and musculoskeletal injuries

Overuse or acute injuries of the abdominal wall are frequent causes of lower abdominal and groin pain in athletes in cutting, pivoting, or kicking sports. Rectus abdominis insertional injury, adductor longus tendinopathy, and osteitis pubis form a spectrum often grouped as athletic pubalgia / sports hernia / core muscle injury (Drager et al., 2020; Elattar et al., 2016; Kraeutler et al., 2021; Forlizzi et al., 2022; Zoga et al., 2008; Emblom et al., 2018).

Muscle strains of the abdominal wall and rectus abdominis injuries.
Acute or repetitive overload across the rectus abdominis–pubic symphysis interface can cause strains, partial tears, or aponeurotic plate injury, leading to focal lower abdominal pain exacerbated by trunk flexion, coughing, or sprinting (Drager et al., 2020; Elattar et al., 2016; Forlizzi et al., 2022; Zoga et al., 2008; Emblom et al., 2018). MRI frequently demonstrates rectus abdominis or adductor tendon pathology in athletes with chronic groin or lower abdominal pain, and rectus insertional injury is strongly associated with the need for surgical repair (Zoga et al., 2008; Emblom et al., 2018).

Athletic pubalgia (“sports hernia”).

Athletic pubalgia is characterized by activity-related lower abdominal and deep groin pain without a true inguinal hernia, linked to weakness or tearing of the posterior inguinal wall, rectus abdominis insertion, and/or adductor origin (Drager et al., 2020; Elattar et al., 2016; Kraeutler et al., 2021; Forlizzi et al., 2022; Zoga et al., 2008). Symptoms may be acute or

insidious, often worsening with cutting, kicking, and twisting. When conservative treatment fails, surgical techniques (mesh repair, rectus reattachment, adductor tenotomy) achieve high return-to-play rates (often >90%) (Drager et al., 2020; Elattar et al., 2016; Kraeutler et al., 2021; Emblom et al., 2018).

3.1.3. Traumatic abdominal injuries

Blunt abdominal trauma in contact and collision sports can cause solid-organ and mesenteric injuries presenting with acute abdominal pain and signs of internal bleeding. Splenic and hepatic injuries are the most commonly reported solid-organ lesions after blunt trauma, with non-operative management now standard in hemodynamically stable or stabilizable patients (Rossaint et al., 2023; Spahn et al., 2019; Ruscelli et al., 2019; Larsen et al., 2023). Success rates of non-operative management for blunt liver and splenic injuries exceed 90% in selected patients, but ongoing hemorrhage or hemodynamic instability mandates urgent intervention (Rossaint et al., 2023; Spahn et al., 2019; Ruscelli et al., 2019; Larsen et al., 2023).

Isolated mesenteric injuries are rare but may present with nonspecific abdominal pain, rapidly progressive shock, and large intraperitoneal hematoma; delayed recognition increases morbidity, whereas early laparotomy and repair are usually curative (Ming et al., 2025). Internal bleeding from solid-organ or mesenteric injury is therefore a critical etiology to consider in any athlete with abdominal pain following significant impact.

3.1.4. Surgical emergencies

Several true surgical emergencies may initially mimic benign exercise-related pain in athletes:

- Acute appendicitis can coexist with or be mistaken for exercise-related GI symptoms, requiring prompt surgical evaluation when pain localizes, intensifies, or is accompanied by systemic signs.
- Incarcerated inguinal hernia may present as acute groin or lower abdominal pain, distinct from athletic pubalgia by the presence of a palpable hernia and obstructive or ischemic features.
- Gallbladder disease (e.g., cholelithiasis with biliary colic or cholecystitis) and bowel obstruction can manifest with colicky abdominal pain, vomiting, and distension, and have been implicated in case reports of exercise-related transient abdominal pain where adhesions or gallbladder pathology required surgical correction (Morton & Callister, 2014).

In athletes, the challenge lies in distinguishing common, often benign exercise-induced gastrointestinal or musculoskeletal pain from less frequent but time-critical surgical conditions.

Etiologies of Acute Abdominal Pain in Athletes

Etiologic group	Typical mechanisms in athletes	Clinical concern	Citations
Exercise-induced GI syndrome	Splanchnic hypoperfusion, heat, nutritional factors	Range from transient pain to ischemic colitis	(De Oliveira et al., 2014; De Oliveira & Burini, 2011; Costa et al., 2017; Costa et al., 2025; Mlinaric & Mohorko, 2025; Clark & Mach, 2016; Emblom et al., 2018)
Gastritis/GERD	Mechanical jarring, reflux, hyperosmolar drinks	Upper abdominal/epigastric pain, heartburn	(De Oliveira et al., 2014; Costa et al., 2017; Costa et al., 2025; Mlinaric & Mohorko, 2025)
Intestinal ischemia	≥60% VO_2max, ≥2 h, heat	Cramping pain, bloody diarrhoea, possible surgical abdomen	(De Oliveira et al., 2014; De Oliveira & Burini, 2011; Costa et al., 2017; Clark & Mach, 2016)
Abdominal wall strains/rectus injury	Overuse, hyperextension–rotation	Focal lower abdominal pain, worse with flexion	(Drager et al., 2020; Elattar et al., 2016; Forlizzi et al., 2022; Zoga et al., 2008; Emblom et al., 2018)
Athletic pubalgia / sports hernia	RA–adductor aponeurotic injury, posterior wall weakness	Chronic or acute groin/lower abdominal pain; may need surgery	(Drager et al., 2020; Elattar et al., 2016; Kraeutler et al., 2021; Forlizzi et al., 2022; Zoga et al., 2008; Emblom et al., 2018)
Traumatic solid-organ/mesenteric injury	Blunt impact in contact sports	Internal bleeding, shock, surgical/IR intervention	(Rossaint et al., 2023; Ming et al., 2025; Spahn et al., 2019; Ruscelli et al., 2019; Larsen et al., 2023)

Figure 1: Main etiologic categories of abdominal pain in athletes.

3.2. Diagnostic challenges

3.2.1. Overlapping symptoms

Visceral pathology (appendicitis, cholecystitis, obstruction) and benign exercise-induced pain can both present with diffuse or localized abdominal pain, nausea, and vomiting, making early differentiation difficult (Stoker et al., 2009; Diaz et al., 2025). Chronic groin and lower-abdominal pain from core muscle injury/athletic pubalgia overlaps with intra-articular hip and other pelvic disorders, further complicating diagnosis (Doege et al., 2021; Forlizzi et al., 2022; Hölmich et al., 2004; Drager et al., 2020). Distinguishing “pain” from true “injury”

is critical to avoid over- or undertreatment (Hoegh et al., 2021; Smith et al., 2018; Sluka et al., 2018).

3.2.2. Clinical examination

Structured examination of adductors, iliopsoas, rectus abdominis insertion, and symphysis (resisted adduction, palpation, stretching) shows good intra- and interobserver reliability and helps separate abdominal wall/core muscle injury from intra-abdominal disease (Hölmich et al., 2004). For core muscle injury, pain localized proximal to the inguinal ligament and tenderness at the rectus abdominis insertion are highly suggestive (Doege et al., 2021; Forlizzi et al., 2022; Drager et al., 2020). Red flags for surgical pathology include rebound/guarding, progressive focal tenderness, systemic signs, and hemodynamic instability, particularly after trauma (Stoker et al., 2009; Diaz et al., 2025).

3.2.3. Imaging techniques

Modality	Main role in this context	Citations
Ultrasound	First-line in acute abdominal pain; best for cholecystitis, biliary disease; can detect hernias and guide muscle/tendon assessment in sport	(Stoker et al., 2009; Sarto et al., 2021)
CT	Primary technique for most acute abdominal pain; accurate for appendicitis, obstruction, perforation, solid-organ/mesenteric injury; cost-effective in appendicitis	(Stoker et al., 2009; Diaz et al., 2025)
MRI	Key for soft-tissue and core muscle injury (athletic pubalgia, rectus/adductor tears); also expanding for 3-D bone and musculoskeletal assessment without radiation	(Doege et al., 2021; Forlizzi et al., 2022; Florkow et al., 2022; Drager et al., 2020)

Figure 1: Imaging roles in athletes with abdominal pain.

3.3. Indications for surgical intervention

3.3.1. Emergency surgical conditions

Appendicitis still generally requires appendectomy, with algorithms emphasizing rapid diagnosis and cost-effective imaging (US then CT) (Stoker et al., 2009; Diaz et al., 2025). Internal bleeding or organ rupture after trauma is managed according to hemodynamic status; CT is central for grading injury (Stoker et al., 2009). Incarcerated/strangulated inguinal hernias need urgent repair; early (<6 h) surgery reduces bowel resection, and mesh/laparoscopic repairs lower recurrence and length of stay (Farrell et al., 2025).

3.3.2. Elective surgical treatment in athletes

Athletic pubalgia/core muscle injury often progresses to surgery after failed ≥12 weeks of non-operative care; typical findings are posterior inguinal wall deficiency and distal rectus abdominis injury (Elattar et al., 2016; Doege et al., 2021; Forlizzi et al., 2022; Drager et al., 2020). Mesh repair and rectus reattachment, sometimes with adductor procedures, yield high return-to-play rates (Elattar et al., 2016; Doege et al., 2021; Forlizzi et al., 2022; Drager et al., 2020). Chronic abdominal wall defects or post-traumatic sequelae are similarly considered for elective repair when performance is impaired.

3.3.3. Return-to-sport considerations

After isolated sports hernia repair, return to play is often permitted around 4 weeks; concurrent adductor release can extend this to ~12 weeks (Doege et al., 2021). Most groin-surgery series report high rates of return to high-level competition (Elattar et al., 2016; Doege et al., 2021; Drager et al., 2020). More broadly, RTS literature stresses that definitions vary and should distinguish return to participation, performance, and preinjury competitive level (Sieroń, 2025). Successful RTS is associated with adequate rehabilitation volume, functional hop/jump capacity, and psychological readiness, including confidence and low fear of re-injury (Ardern et al., 2014; Niederer et al., 2025; DiSanti et al., 2018).

4. Discussion

4.1. Diagnostic complexity in athletic populations

Athletes frequently present with abdominal or groin pain where benign exercise-related causes coexist with true surgical or structural pathology, making diagnosis and management challenging in clinical and sports settings (Costa et al., 2017; Forlizzi et al., 2022; Drager et al., 2020). Research on athlete-specific abdominal presentations is limited, but related work on groin/core injuries, exercise-induced gastrointestinal (GI) syndromes, and emergency imaging helps frame key discussion points (Elattar et al., 2016; Costa et al., 2017; Wu et al., 2024; Costa et al., 2025).

4.2. Importance of multidisciplinary management

Management of abdominal and groin pain in athletes benefits from coordinated input by sports physicians, surgeons, radiologists, and physiotherapists. Multidisciplinary frameworks are already emphasized for complex hip/groin conditions such as femoroacetabular impingement and athletic pubalgia (Elattar et al., 2016; Griffin et al., 2016; Costa et al., 2017; Forlizzi et al., 2022; Drager et al., 2020). Broader return-to-play (RTP) literature also shows that shared decision-making in multidisciplinary teams, integrating surgical, rehab, psychological and sport-specific input, is preferred and more athlete-centred (Lampert et al., 2024; Chetty et al., 2025).

4.3. Limitations of current literature

Limitation	**Evidence in related fields**	**Citations**
Few athlete-specific abdominal studies	Core muscle/groin pain and exercise-GI work highlight small, selected cohorts and narrative reviews rather than large trials (Elattar et al., 2016; Costa et al., 2017; Forlizzi et al., 2022; Drager et al., 2020)	(Elattar et al., 2016; Costa et al., 2017; Forlizzi et al., 2022; Drager et al., 2020)
Heterogeneous populations	Studies mix elite, sub-elite, and recreational athletes, various sports, and both sexes, limiting generalisability (Heijboer et	(Heijboer et al., 2023; Costa et al., 2017; Wu et al., 2024; Chetty et

	al., 2023; Costa et al., 2017; Wu et al., 2024; Chetty et al., 2025)	al., 2025)
Lack of standardised diagnostic/RTP criteria	Consensus exists for some conditions (e.g. FAI) but not for abdominal pain; RTP decisions for MSK injuries often lack clear, standardised frameworks (Griffin et al., 2016; Haider et al., 2017; Chetty et al., 2025)	(Griffin et al., 2016; Haider et al., 2017; Chetty et al., 2025)

Figure 1: Key methodological gaps constraining athlete-specific evidence.

4.4. Implications for clinical practice

Early, structured imaging and careful clinical assessment appear to improve outcomes in acute abdominal presentations. In emergency settings, faster CT access in acute abdominal pain reduces length of stay and costs and is linked to better diagnostic performance (Guo et al., 2025; Wu et al., 2024). Rising CT and ultrasound use has been accompanied by increased test positivity, suggesting more appropriate imaging rather than overuse (Wu et al., 2024). For athletes, integrating this with detailed history, groin-focused examination, and targeted MRI/ultrasound for abdominal wall or core muscle injury can reduce delayed diagnosis and avoid unnecessary surgery (Elattar et al., 2016; Costa et al., 2017; Forlizzi et al., 2022; Drager et al., 2020). Preventive management of exercise-induced GI syndromes through hydration and nutrition strategies may also decrease benign but confusing symptom presentations (Costa et al., 2017; Costa et al., 2025; Jardine et al., 2023).

5. Conclusions

Abdominal and groin pain in athletes presents significant diagnostic challenges due to overlapping symptoms from exercise-induced gastrointestinal issues, musculoskeletal injuries like athletic pubalgia (core muscle injury), and serious intra-abdominal pathologies such as appendicitis or mesenteric cysts. Clinical examination focusing on the inguinal region, combined with imaging modalities-ultrasound for initial assessment, CT for acute abdominal emergencies, and MRI for soft tissue and core muscle evaluation-is essential for accurate diagnosis. However, current literature is limited by heterogeneous study populations, small sample sizes, and lack of standardized diagnostic and return-to-play criteria, underscoring the need for prospective athlete-specific research to optimize diagnostic pathways and treatment strategies in this population.

Disclosure

AI

AI was used in this study for two main purposes. First, it supported the analysis of clinical

reasoning narratives by facilitating the identification of linguistic patterns. Second, it assisted in improving the academic English of the manuscript, enhancing clarity, consistency, and compliance with scientific writing standards. In addition, AI tools were used for further linguistic editing, including improvements in grammar, style, and the clarity of the results presentation. Importantly, all AI applications served strictly as supportive tools under human supervision. The interpretation of results, classification of errors, and formulation of conclusions were performed exclusively by human experts in clinical medicine and formal logic. Thus, AI contributed to increasing the efficiency of data processing, pattern recognition, and language editing, but it did not replace human judgment at any stage of the analytical process.

Author Contributions

Conceptualization: Daniel Wijas, Mikołaj Olszok, Michał Kluś, Bartłomiej Kozdra, Natalia Makselan, Natalia Nawrat, Karolina Handzel, Antoni Anczyk, Krzysztof Karbowiak

Methodology: Mikołaj Olszok, Krzysztof Karbowiak, Michał Kluś, Bartłomiej Kozdra
Formal analysis: Daniel Wijas, Mikołaj Olszok, Natalia Makselan, Krzysztof Karbowiak
Investigation: Daniel Wijas, Antoni Anczyk, Michał Kluś, Bartłomiej Kozdra
Supervision: Antoni Anczyk, Karolina Handzel
Writing - original draft preparation: Mikołaj Olszok, Bartłomiej Kozdra, Natalia Nawrat
Writing - review and editing: Daniel Wijas, Karolina Handzel, Michał Kluś, Natalia Makselan,
Project administration: Mikołaj Olszok, Krzysztof Karbowiak, Antoni Anczyk, Natalia Nawrat

All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.
Institutional Review Board Statement: Not applicable.
Informed Consent Statement: Not applicable.
Data Availability Statement: Not applicable.
Acknowledgements: Not applicable.
Conflicts of Interest: The authors declare no conflict of interest.

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