

**BARTOSIŃSKI, Ryszard, SZUSTAK, Jan, WIJATA, Anna, PRZYBYŁEK-STĘPIEŃ, Zuzanna, DUTKIEWICZ, Justyna, MACZYŃSKA, Wiktoria, KĄPA, Maria, SZEPIETOWSKI, Bartosz, KAŻMIERCZAK, Jakub, WIJATA, Michał, RYCERZ, Ewelina, and PASEK, Piotr. Acute Abdominal Injuries in Sports: Review and Management Recommendations. Quality in Sport. 2025;39:58441. eISSN 2450-3118.**

<https://dx.doi.org/10.12775/QS.2025.39.58441>

<https://apcz.umk.pl/QS/article/view/58441>

The journal has been 20 points in the Ministry of Higher Education and Science of Poland parametric evaluation. Annex to the announcement of the Minister of Higher Education and Science of 05.01.2024. No. 32553.

Has a Journal's Unique 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 r. Lp. 32553. Posiada Unikatowy Identyfikator Czasopisma: 201398.

Przypisane dyscypliny naukowe: Ekonomia i finanse (Dziedzina nauk społecznych); Nauki o zarządzaniu i jakości (Dziedzina nauk społecznych).

© The Authors 2024;

This article is published with open access at Licensee Open Journal Systems of Nicolaus Copernicus University in Torun, Poland

Open Access. This article is distributed under the terms of the Creative Commons Attribution Noncommercial License which permits any noncommercial use, distribution, and reproduction in any medium, provided the original author (s) and source are credited. This is an open access article licensed under the terms of the Creative Commons Attribution Non commercial license Share alike. (<http://creativecommons.org/licenses/by-nc-sa/4.0/>) which permits unrestricted, non commercial use, distribution and reproduction in any medium, provided the work is properly cited.

The authors declare that there is no conflict of interests regarding the publication of this paper.

Received: 01.02.2025. Revised: 08.02.2025. Accepted: 06.03.2025. Published: 06.03.2025.

## **Acute Abdominal Injuries in Sports:**

## **Review and Management Recommendations**

**Ryszard Bartosiński**

Provincial Hospital in Bielsko-Biała

Al. Armii Krajowej 101, 43-316 Bielsko-Biała, Poland

[rabartosi@gmail.com](mailto:rabartosi@gmail.com)

<https://orcid.org/0009-0005-3687-015X>

**Jan Szustak**

St. Lucas Hospital

Gimnazjalna 41B, 26-200 Konskie, Poland

j.m.szustak@gmail.com

<https://orcid.org/0009-0006-0690-7211>

**Anna Wijata**

St. Lucas Hospital

Gimnazjalna 41B, 26-200 Konskie, Poland

anna.wijata@icloud.com

<https://orcid.org/0009-0005-7656-8318>

**Zuzanna Przybylek-Stępień**

Provincial Multidisciplinary Center of Oncology and Traumatology  
named after M. Copernicus University

ul. Pabianicka 62, 93-513 Lodz, Poland

przybylekstepienzuzanna@gmail.com

<https://orcid.org/0009-0002-4857-1315>

**Justyna Dutkiewicz**

St. Lucas Hospital

ul. Gimnazjalna 41B, 26-200 Konskie, Poland

justyna.dutkiewicz96@gmail.com

<https://orcid.org/0009-0007-0352-7827>

**Wiktoria Mączyńska**

Saint Lucas Hospital

ul. Gimnazjalna 41B, 26-200 Konskie, Poland

wika.maczynska@gmail.com

<https://orcid.org/0009-0008-9833-7598>

**Maria Kapa**

Medical University of Lodz

al. Tadeusza Kościuszki 4, 90-419 Lodz, Poland

maria.kapa.332@gmail.com

<https://orcid.org/0009-0008-5880-2416>

**Bartosz Szepietowski**

Heliodor Swiecicki Clinical Hospital

ul. Przybyszewskiego 49, 60-355 Poznan, Poland

bartosz.szepietowski@gmail.com

<https://orcid.org/0009-0001-6945-3871>

**Jakub Kaźmierczak**

Medical University of Lodz

al. Tadeusza Kościuszki 4, 90-419 Lodz, Poland

jakub.kazmierczak.md@gmail.com

<https://orcid.org/0009-0002-0701-7983>

**Michał Wijata**

Saint Lucas Hospital

ul. Gimnazjalna 41B, 26-200 Konskie, Poland

wijata.michal@gmail.com

<https://orcid.org/0009-0004-0121-2854>

**Ewelina Rycerz**

Saint Lucas Hospital

ul. Gimnazjalna 41B, 26-200 Konskie, Poland

ewelina.rycerz1@gmail.com

<https://orcid.org/0009-0006-5749-5720>

**Piotr Pasek**

Copernicus Memorial Hospital

ul. Pabianicka 62, 93-513 Lodz, Poland

pasek.piotrus@gmail.com

<https://orcid.org/0009-0001-6218-9887>

## **ABSTRACT**

Acute abdominal injuries in sports present significant diagnostic and therapeutic challenges, requiring prompt medical intervention. This article aims to discuss sports-related abdominal injuries, including their mechanisms, associated symptoms, and current management recommendations. Based on a literature review, the most common injuries identified include damage to abdominal solid organs, perforations of hollow organs, and hemorrhages.

The critical role of imaging diagnostics, particularly ultrasonography in the FAST protocol and computed tomography, is highlighted in assessing the location and extent of injuries and determining the appropriate therapeutic strategy. The principles of management are discussed, encompassing both conservative treatment and surgical interventions. The article also emphasizes the importance of early recognition of life-threatening conditions such as internal hemorrhage or injuries leading to peritoneal signs, which may be challenging to detect without specialized diagnostic tools.

The aim of this paper is to comprehensively discuss the problem of acute abdominal injuries in sports, including their epidemiology, mechanisms of development and clinical characteristics. The authors wish to present the current state of knowledge on the diagnosis and treatment of such injuries, with particular emphasis on ultrasound in the FAST (Focused Assessment with Sonography for Trauma) protocol as an essential diagnostic procedure.

The article also presents recommendations for the treatment of acute abdominal injuries in sports, taking into account the role of medical support during training and competition. The authors emphasize the importance of medical education among coaches, athletes, physiotherapists and the rest of the sports teams and medical staff, which aims to increase risk awareness and improve the effectiveness of preventive and interventional activities.

The conclusions and recommendations presented in the article aim to raise awareness of acute abdominal injuries among sports medicine physicians, surgeons, emergency medical personnel, coaches, athletes and other sports staff, and to improve treatment outcomes through appropriate training and the availability of diagnostic equipment.

**KEYWORDS:** Abdominal injuries, FAST protocol, sport-related injuries, imaging tests, internal bleeding

## INTRODUCTION

Acute abdominal injuries in sports are relatively rare but potentially life-threatening events that require prompt diagnosis and appropriate management. Many sports disciplines, especially contact sports such as football, rugby, ice hockey, and martial arts, are associated with the risk of direct injuries caused by impact or abrupt movements. However, even in other individual sports disciplines, such as athletics, cycling or skiing, situations can arise that lead to damage to abdominal organs due to falls or overexertion (1) (See Table 1. and Table 2.).

Due to the variety of injury mechanisms, the clinical symptoms of acute abdominal injuries are often nonspecific, making early recognition challenging. Misdiagnosis or delayed assessment of such injuries can result in postponed treatment, increasing the risk of life-threatening complications such as internal hemorrhage, peritonitis, or permanent organ damage. Therefore, familiarity with injury mechanisms, warning symptoms, and modern diagnostic methods, such as FAST ultrasonography and Computed Tomography, is of crucial importance (1,2).

## EPIDEMIOLOGY AND TYPES OF ABDOMINAL INJURIES IN SPORTS

Abdominal injuries among athletes are less common than muscle or head injuries, but their potential severity and risk of complications make them a significant problem in sports medicine. According to epidemiological studies that have documented injuries in athletes, abdominal or chest injuries account for fewer than 2% of all injuries, with the frequency of their occurrence depending on the type of sports discipline and the level of advancement (3).

Acute abdominal injuries in sports can be divided into:

- Blunt - the most common and are caused by impacts, collisions or falls. They can lead to damage to parenchymal organs, including the liver, spleen or kidneys, as well as to injuries to the intestines or blood vessels (1).
- Penetrating - less common and are usually associated with accidental damage caused by sports equipment with sharp edges (4).

Some injuries can be caused not only by a direct blow or penetration, but also by sudden deceleration or by a displaced fragment of a broken rib (1).

**Table 1.** Most often injured internal organs in College athletes (5)

<b>Organ</b>	<b>Percentage of sport-related internal traumas</b>
Kidneys	46.3
Spleen	19.5
Liver	9.8
Intestine	9.8

The highest risk of abdominal injuries is seen in contact sports such as American football, rugby, and ice hockey, where collisions between players and falls are common. In sports using equipment, such as baseball, lacrosse, and other racket sports, abdominal injuries may result from direct impact with the ball. In addition, in combat sports, injuries may result from direct force to the abdominal area, and in cycling or track and field, they may result from falls and contusions (6,7).

**Table 2.** Sports with the Highest Risk of Abdominal Injuries (5)

<b>Sport discipline</b>	<b>Injury Rate (per 1,000,000 athlete exposures)</b>
American Football	11.7
Lacrosse	10.0
Ice Hockey	7.9
Rugby	7.5
Wrestling	6.2

Acute abdominal injuries are more common in male athletes and also depend on age (rib cage is more susceptible to traumas) and pathoanatomical variations such as liver or spleen enlargement. Factors such as improper exercise technique or lack of appropriate protective equipment increase the risk of injury (1,5,8).

## CLINICAL SIGNS AND DIAGNOSTICS OF SPORT-RELATED ACUTE ABDOMINAL INJURIES.

Abdominal injuries in sports can present with a variety of symptoms, depending on the mechanism of injury, the organs affected, and the extent of damage. Early diagnosis of abdominal injuries is crucial to minimize complications and initiate appropriate treatment (2,9).

Symptoms of abdominal injuries can be divided into local (See Table 3.):

- abdominal pain (sharp, localized or blunt, diffused)
- tenderness and muscle tension of abdominal wall
- swelling, bruise or visible deformity in the abdominal cavity

and general:

- symptoms of developing shock such as increased Heart Rate, low Blood Pressure, pale skin, cold sweats.
- nauseas, vomiting, blood vomiting (*haematemesis*) due to injury of digestive tract
- reduced diuresis or blood in the urine (*haematuria*) in case of kidney or urinary tract injury (10).

**Table 3.** Symptoms of injuries to most often affected abdominal organs among athletes(1,11–13).

Injured organ	Clinical symptoms
Spleen	Left Upper Quadrant pain, guarding. Kehr's sign, signs of haemodynamic shock.
	Right Upper Quadrant pain, guarding,

Liver	nauseous, vomiting, signs of haemodynamic shock.
Kidney	Focal pain and haematuria, palpable mass in the anatomical projection of the kidney.

In order to make a diagnosis, it is also important to interview the injured person or their relatives and collect information about any chronic diseases or diseases that the athlete has recently suffered from (1,14).

## IMAGING TESTS IN THE DIAGNOSIS OF ABDOMINAL INJURIES

Unlike penetrating abdominal trauma in blunt abdominal injuries in athletes, which are often difficult to diagnose based on history and physical examination alone, imaging tests have a crucial meaning in the diagnosis. Proper selection and interpretation of imaging tests enable rapid diagnosis of internal organ injuries and appropriate treatment planning. Technological advances in imaging diagnostics have significantly contributed to improving the quality of care for athletes with abdominal injuries. Modern methods such as Computed Tomography (CT), FAST ultrasound, or angiography have made it possible to quickly and precisely diagnose even subtle damage to internal organs. Modern imaging tests allow for early implementation of appropriate treatment, which effectively reduces the risk of post-traumatic complications and improves patient prognosis. The use of these tests has also reduced the time needed for diagnostics, which is crucial in critically complicated traumas such as massive internal bleeding. In addition, more accurate assessment of injuries allows for greater precision in treatment planning, including the use of minimally invasive techniques without the need for vast surgical intervention (2,15).

Ultrasounds are one of the most important diagnostic tools used in the assessment of acute abdominal injuries. Due to its availability, speed of performance and non-invasiveness, it is often used in emergency conditions. The FAST (Focused Assessment with Sonography for Trauma) protocol plays a special role in diagnostics, which was developed to quickly detect potentially life-threatening complications, such as internal bleeding (2,15–17)



The FAST protocol is a specific application of ultrasound, focused on assessing the presence of fluid in the abdominal and thoracic cavities. In the case of acute abdominal sport-related injuries, this protocol allows for:

- Detection of internal bleeding: identification of fluid in the peritoneal cavity, which may indicate damage to internal organs or vessels.
- Quick assessment of the patient's condition: allows for decisions on further treatment, including the need for observation in hospital condition or surgical intervention.
- Acceleration of initial diagnostics - the FAST protocol examination usually takes a few minutes, which is crucial in the context of acute injuries (2,15).

In diagnostics of acute abdominal injuries the FAST protocol is extremely important in case of internal organ traumas such as the liver, spleen or kidneys, which can lead to internal bleeding, and injuries to vascular structures by detection of fluid in the spaces may indicate massive bleeding requiring urgent intervention. Due to its quick availability and non-invasive nature, it can be repeated many times to monitor the injured athlete's condition (2,16,18).

The FAST protocol includes four key areas where fluid is assessed:

- Hepatorenal - most common site for fluid detection in FAST,
- Splenorenal - critical for diagnosing splenic injuries,
- Pelvic and Pouch of Douglas - assessment of the space behind the urinary bladder indicative of pelvic or intestinal injuries,
- Pericardial - aimed at conditions of direct threat to life such as cardiac tamponade (19).(See Table.4)

This article will discuss the FAST protocol for acute abdominal injuries in athletes.

**Table 4.** Key Aspects of the FAST Protocol in the Diagnosis of Acute Abdominal Injuries (16,19).

Examined Area	Characteristics of Detected Findings
Hepatorenal recess	Free fluid indicating bleeding from the liver or leakage from other structures

Splenorenal recess	Free fluid resulting from spleen damage or other structures
Pouch of Douglas	Free fluid indicating bleeding or leakage from lower abdominal organs

Despite the irreplaceability of ultrasound in screening of acute abdominal injuries among athletes, it is often impossible to make a clear diagnosis based on it, then it is necessary to extend the diagnostics with highly specialized imaging tests such as Computed Tomography (CT) or Magnetic Resonance Imaging (MRI) (15,20).

Computed tomography (CT) is very accurate in diagnosing acute abdominal injuries, especially in athletes who have suffered blunt trauma from blows, falls, or collisions. CT scans with intravenous contrast allow for a detailed structural assessment of internal organs, especially: liver, spleen and kidneys, and the detection of even minor injuries that were not visualized on ultrasound, and gives an ability to detect arterial contrast extravasation, pseudoaneurysm formation. CT helps identify perforated organs and locate the source of active bleeding. Precise diagnostics using CT enables the decision on conservative treatment or need for surgical intervention (15,20).

Magnetic resonance imaging (MRI) is less commonly used in acute abdominal trauma, mainly due to the longer examination time and limited availability especially in emergency cases. However, in specific clinical situations, MRI can be extremely useful, especially in the diagnosis of organ-specific injuries or their complications. MRI acts a significant role in hepatobiliary and pancreatic injuries. These injuries can have non-specific appearances at CT but undiagnosed can lead to serious complications (21).

In some cases like traumatic perforations of gastrointestinal tract classic abdominal X-ray might be helpful in diagnosis. Many acute abdominal injuries diagnostics should be extended to include laboratory tests of blood and urine to determine further treatment (17,22).

## FACTORS DELAYING THE DIAGNOSIS OF ACUTE ABDOMINAL INJURIES IN SPORTS

The delay in diagnosing acute abdominal injuries in sports can result from various factors that hinder prompt identification. The most significant include:

- **Unclear or Absent Clinical Symptoms**

Abdominal injuries may present with nonspecific symptoms such as abdominal pain, nausea, or a sense of discomfort, which are often mistaken for less serious conditions. Some abdominal injuries, such as internal organ contusions, may initially be asymptomatic or exhibit delayed onset of symptoms, further complicating early detection (4,9).

- **Neglect of Injury by the Athlete**

Athletes, particularly at elite levels, may downplay injuries out of fear of missing competitions. They often continue physical activity despite experiencing pain, which can mask the progression of more severe symptoms (23).

- **Lack of Immediate Access to Qualified Medical Assistance**

In many sports disciplines, there is often no immediate access to a medical specialist. Initial aid is frequently provided by individuals without medical qualifications, who may not be adequately trained to recognize potentially serious internal injuries (24,25).

- **Complexity of Diagnostics**

The diagnosis of internal organ injuries often requires advanced imaging techniques, such as ultrasonography, computed tomography (CT), or magnetic resonance imaging (MRI). In the setting of sports events, performing these diagnostic procedures is frequently impossible (15,20,21).

## CONSEQUENCES AND COMPLICATIONS OF DELAYED DIAGNOSIS OF ACUTE ABDOMINAL INJURIES IN SPORTS

Improper or delayed diagnosis of acute abdominal injuries can lead to severe consequences that pose a threat to both the health and life of the athlete. The most common effects and complications include:

- **Progressive Damage to Internal Organs**

Delays in medical intervention can result in further damage to organs such as the spleen, liver, or pancreas. The rupture of a parenchymal organ can lead to massive internal bleeding (9,26–28).

- **Hypovolemic Shock**

Blood loss associated with internal organ injuries can cause hypovolemic shock, a life-threatening condition that requires immediate medical intervention (9,28).

- **Peritonitis**

Injuries to the gastrointestinal tract may result in perforation and leakage of intestinal contents into the peritoneal cavity, leading to severe peritonitis. Peritonitis can also develop from complicated injuries to other organs or bile ducts (9,29)

- **Multiple Organ Dysfunction Syndrome (MODS)**

Prolonged undetected organ injuries can result in multiple organ dysfunction syndrome (MODS), often necessitating intensive care and associated with high mortality rates (4,30).

- **Loss of Ability to Continue a Sports Career and Psychological Consequences**

Complications stemming from delayed diagnosis may require prolonged rehabilitation or lead to permanent disability, often preventing a return to full physical activity at a competitive level. This can adversely affect the psychological well-being of the affected individual, potentially resulting in depression or anxiety disorders (31,32).

## MANAGEMENT OF ACUTE ABDOMINAL INJURIES IN SPORTS

After providing first aid and conducting an initial examination, the athlete should be transported to hospital for further management. The decision to implement treatment is based on the initial diagnosis of the injury. Due to the nature of the injury and its complications, two paths can be taken:

- **conservative** including continuous assessment of vital signs in the hospital setting and regular imaging to monitor injury recovery with administration of painkillers, antibiotics (in risk of infections) and drugs supporting organ regeneration,
- **interventional** essential in the event of: hemodynamic instability, active internal bleeding or perforation of the gastrointestinal tract, confirmed by diagnostic imaging or penetrating injuries that lead to damage to abdominal organs which can be performed by laparotomy, laparoscopy or angioembolization (4,33,34).

In high-level athletes who have sustained a spleen injury, despite the possibility of attempting conservative treatment, elective splenectomy is performed at the patient's request, after which the recovery time may be shortened; however, this procedure is associated with risks (35).

Following the surgical treatment, care includes follow-up tests, both imaging and laboratory, antithrombotic prevention, sometimes antibiotic therapy and vaccinations (in the case of splenectomy) (33–35).

## RETURN TO PLAY AFTER AN ACUTE ABDOMINAL INJURY

Returning to activity after acute abdominal injuries is a key stage in the rehabilitation process, requiring a precise assessment of the athlete's health, the effectiveness of treatment and the risk of recurrence. The decision to resume training must be made individually, taking into account the nature of the injury, the treatment used and the discipline and its level. The limitation of physical activity depends on the organs affected by the injury and their grade. In contact sports, the return to play should take a longer time than in individual sports. An important role is also played by the athlete's mental state and his readiness to return to sports activity. The course of rehabilitation and treatment should be monitored using specialist tests. In the case of injuries to organs such as the spleen, liver or kidneys, computed tomography is of significant use in assessing recovery. Returning to intense physical activity too early can lead to aggravated

damage to internal organs and complications that make it difficult or even impossible to continue your sports career (32,35,36).

## ACUTE ABDOMINAL INJURY PREVENTION IN SPORTS

Preventing abdominal sport-related injuries is a key element in ensuring the safety of athletes. Prevention requires a comprehensive approach that includes proper training of athletes, the use of appropriate protective equipment, and support from a qualified medical team.

In the prevention of injuries, an important role is played by the medical education of coaches, physiotherapists and athletes themselves regarding the mechanisms of injury, methods of avoiding them, and recognizing the symptoms of acute abdominal injuries such as pain or shock symptoms and how to deal with them, regular training for medical personnel and sports teams in the management of emergencies. To protect themselves from injury, athletes should use appropriate protective equipment suited to the activity they are undertaking, along with regular checks of the technical condition of the equipment (37–40).

The organization of training and sports competitions is also of great importance in the prevention and effective treatment of acute abdominal injuries, by creating safe conditions for sports activities, including: proper preparation of the surface, removal or securing of objects that may become a source of injury for athletes. It is also important to introduce appropriate rules and regulations in games that allow for reducing the risk of serious injuries, as well as appropriate protection by qualified medical personnel (37).

## THE ROLE OF THE MEDICAL TEAM DURING SPORTS GAMES AND TRAINING IN THE PREVENTION AND MANAGEMENT OF ACUTE ABDOMINAL INJURIES.

The presence of a medical support team at sports competitions is crucial for the safety of athletes. Thanks to a quick response to injuries with immediate provision of qualified first aid, the use of initial diagnostics such as ultrasound in the FAST protocol, stabilization of patient parameters with possible administration of medications and the possibility of quick transport to a medical facility, the negative consequences of an injury can be significantly reduced. In addition, the medical team assesses the potential risk associated with a given activity, monitors the health of athletes before and after the competition, and implements appropriate preventive measures (41).

## RECOMMENDATIONS FOR THE MANAGEMENT OF ACUTE ABDOMINAL INJURIES IN SPORTS:

### 1. Use of the FAST protocol in abdominal injuries in athletes

- The FAST protocol should be a standard tool used by medical teams in the evaluation of acute abdominal injuries, especially in the sport field.
- Medical teams should be equipped with portable ultrasound devices that will enable rapid on-site diagnosis.
- Medical staff should be regularly trained in the use of the FAST protocol to improve the effectiveness of the test and the correct interpretation of the results.
- The FAST protocol ultrasound results should determine the algorithm for further treatment, including the decision to transport the athlete to the hospital and extend the diagnostics to more advanced imaging tests.

### 2. The Role of Medical Education Among Sports Teams

- Education of coaches, players and physiotherapists in recognizing the symptoms of acute abdominal injuries and providing first aid in the event of their occurrence.
- Organizing medical simulations during training can improve reaction times and skills in dealing with crisis situations.

### 3. Medical coverage and trauma care monitoring

- Sports competitions should be secured by a qualified medical team with access to basic diagnostic equipment.
- Monitoring of conservative and interventional treatment should be based on the results of examinations, including imaging tests such as ultrasound, CT, MRI, and conducted throughout the rehabilitation period.

## DISCUSSION

Acute abdominal injuries associated with sports activity pose a significant challenge in sports medicine. Although they occur less frequently than other types of injuries, such as limb or head injuries, they can lead to serious complications, including damage to internal organs. The article

emphasizes that rapid diagnosis and appropriate management are crucial to minimize the risk of permanent complications. Analyzing the available data, the authors noted that most abdominal injuries in sports are caused by blunt trauma, e.g. during contact with another athlete, sports equipment or a fall. Penetrating injuries are less common. Although ultrasonography is a basic diagnostic tool, there are still no uniform guidelines for its use in field conditions. The recommendations proposed in the article regarding the management of acute abdominal injuries in sports can contribute to improving treatment outcomes and shortening the time needed for the athlete to fully recover. However, it is especially important to consider preventive aspects - wearing appropriate protective gear, educating athletes, coaches and physiotherapists, and developing standards of procedure in case of suspected damage to internal organs.

## CONCLUSION

Acute abdominal injuries in sports require rapid and accurate diagnosis to minimize the risk of complications and enable athletes to quickly return to activity. A key tool in the assessment of such injuries is ultrasound in the FAST (Focused Assessment with Sonography for Trauma) protocol, which, thanks to its availability, non-invasiveness and relatively short execution time, is increasingly used in the sports environment. Incorporating it into the standard equipment of medical teams can significantly improve the effectiveness of the first assessment of injuries and decisions about further management.

Equally important is the medical education of sports teams, including training coaches, players, physiotherapists and other support staff in recognizing the symptoms of acute abdominal injuries and providing first aid for them. Increasing awareness of the mechanisms of injury and early warning signs can reduce the risk of injury progression and its potential complications, as well as improve cooperation between the sports team and medical staff.

An essential element of the strategy for preventing and treating acute abdominal injuries in sports is also the presence of appropriate medical support during training and competitions. The presence of qualified medical personnel, equipped with appropriate diagnostic tools and knowledge, allows for immediate intervention in the event of suspected damage to internal organs, which is crucial for the safety of athletes.

Effective management of acute abdominal injuries in sports requires a combination of modern diagnostic tools, such as ultrasound in the FAST protocol, education of sports teams and



constant presence of medical support at the venue of sports events. Only a comprehensive approach can ensure the highest standards of safety and health protection of athletes.

#### AUTHOR'S CONTRIBUTION:

Conceptualization: Ryszard Bartosiński, Michał Wijata, Jan Szustak  
Methodology: Zuzanna Przybyłek-Stępień, Justyna Dutkiewicz, Ryszard Bartosiński  
Software & Check: Bartosz Szepietowski, Wiktoria Mączyńska, Anna Wijata  
Formal Analysis & Investigation: Jakub Kaźmierczak, Ewelina Rycerz, Jakub Kaźmierczak  
Resources & Data Curation: Maria Kapa, Justyna Dutkiewicz, Wiktoria Mączyńska  
Writing-Rough Preparation: Zuzanna Przybyłek-Stępień, Piotr Pasek, Ewelina Rycerz  
Writing-Review and Editing: Michał Wijata, Jan Szustak, Bartosz Szepietowski  
Visualization: Anna Wijata, Maria Kapa, Piotr Pasek  
Supervision & Project Administration: Ryszard Bartosiński, Jan Szustak, Maria Kapa

The Study Did Not Receive Special Funding.

Institutional Review Board Statement: Not Applicable.

Informed Consent Statement: Not Applicable.

Data Availability Statement: Not Applicable.

Conflict Of Interest: The authors declare no conflict of interest.

#### REFERENCES

1. Adam J, De Luigi AJ. Blunt Abdominal Trauma in Sports. *Curr Sports Med Rep*. październik 2018;17(10):317. <https://doi.org/10.1249/jsr.0000000000000519>
2. Finnoff JT, Ray J, Corrado G, Kerkhof D, Hill J. Sports Ultrasound. *Sports Health*. September 2016;8(5):412–7. <https://doi.org/10.1177/1941738116664041>
3. Finch CF. The risk of abdominal injury to women during sport. *J Sci Med Sport*. March 2002;5(1):46–54. [https://doi.org/10.1016/S1440-2440\(02\)80297-3](https://doi.org/10.1016/S1440-2440(02)80297-3)
4. Barrett C, Smith D. RECOGNITION AND MANAGEMENT OF ABDOMINAL INJURIES

- AT ATHLETIC EVENTS. *Int J Sports Phys Ther.* August 2012;7(4):448–51.
5. Kucera KL, Currie DW, Wasserman EB, Kerr ZY, Thomas LC, Paul S, et al. Incidence of Sport-Related Internal Organ Injuries Due to Direct-Contact Mechanisms Among High School and Collegiate Athletes Across 3 National Surveillance Systems. *J Athl Train.* February 2019;54(2):152–64. <https://doi.org/10.4085/1062-6050-271-17>
  6. Rainey CE. Determining the Prevalence and Assessing the Severity of Injuries in Mixed Martial Arts Athletes. *North Am J Sports Phys Ther NAJSPT.* November 2009;4(4):190–9.
  7. Johnson BK, Comstock RD. Epidemiology of Chest, Rib, Thoracic Spine, and Abdomen Injuries Among United States High School Athletes, 2005/06 to 2013/14. *Clin J Sport Med Off J Can Acad Sport Med.* July 2017;27(4):388–93. <https://doi.org/10.1097/jsm.0000000000000351>
  8. Prieto-González P, Martínez-Castillo JL, Fernández-Galván LM, Casado A, Soporki S, Sánchez-Infante J. Epidemiology of Sports-Related Injuries and Associated Risk Factors in Adolescent Athletes: An Injury Surveillance. *Int J Environ Res Public Health.* 2 May 2021;18(9):4857. <https://doi.org/10.3390/ijerph18094857>
  9. O'Rourke MC, Landis R, Burns B. Blunt Abdominal Trauma. StatPearls Publishing; 2023
  10. MSD Manual Consumer Version. Overview of Abdominal Injuries - Injuries and Poisoning. Available at: <https://www.msdmanuals.com/home/injuries-and-poisoning/abdominal-injuries/overview-of-abdominal-injuries>
  11. Waseem M, Bjerke S. Splenic Injury. Treasure Island (FL): StatPearls Publishing; 2025. Available at: <http://www.ncbi.nlm.nih.gov/books/NBK441993/>
  12. Ray R, Lemire JE. Liver laceration in an intercollegiate football player. *J Athl Train.* October 1995;30(4):324–6.
  13. Erlich T, Kitrey ND. Renal trauma: the current best practice. *Ther Adv Urol.* 10 lipiec 2018;10(10):295–303. <https://doi.org/10.1177/1756287218785828>
  14. Nabhan D, Taylor D, Hedges A, Bahr R. The Value of the Patient History in the Periodic Health Evaluation: Patient Interviews Capture 4 Times More Injuries Than Electronic Questionnaires. *J Orthop Sports Phys Ther.* January 2021;51(1):46–51. <https://doi.org/10.2519/jospt.2021.9821>
  15. Jansen JO, Yule SR, Loudon MA. Investigation of blunt abdominal trauma. *BMJ.* 26 kwiecień 2008;336(7650):938–42. <https://doi.org/10.1136/bmj.39534.686192.80>
  16. Bloom BA, Gibbons RC. Focused Assessment With Sonography for Trauma. Treasure Island (FL): StatPearls Publishing; 2025. Available at:

<http://www.ncbi.nlm.nih.gov/books/NBK470479/>

17. Achatz G, Schwabe K, Brill S, Zischek C, Schmidt R, Friemert B, et al. Diagnostic options for blunt abdominal trauma. *Eur J Trauma Emerg Surg Off Publ Eur Trauma Soc.* October 2022;48(5):3575–89. <https://doi.org/10.1007/s00068-020-01405-1>
18. Yazıcı MM, Yavaşı Ö, Çelik A, Altuntaş G, Altuntaş M, Bilir Ö, et al. The role of repeated extended FAST in patients with stable blunt thoracoabdominal trauma. *Turk J Trauma Emerg Surg.* 2 may 2023;29(5):553–9. <https://doi.org/10.14744/tjtes.2022.93529>
19. Desai N, Harris T. Extended focused assessment with sonography in trauma. *BJA Educ.* February 2018;18(2):57–62. <https://doi.org/10.1016/j.bjae.2017.10.003>
20. Rifat SF, Gilvydis RP. Blunt abdominal trauma in sports. *Curr Sports Med Rep.* April 2003;2(2):93–7. <https://doi.org/10.1249/00149619-200304000-00008>
21. Odedra D, Scaglione M, Basilico R, Patlas MN. Magnetic resonance imaging in abdominal trauma—More relevant than ever. *Can Assoc Radiol J.* 1 November 2022;73(4):612–3. <https://doi.org/10.1177/08465371221080058>
22. Hafner J, Tuma F, Hoilat GJ, Marar O. Intestinal Perforation. Treasure Island (FL): StatPearls Publishing; 2025 [cytowane 11 styczeń 2025]. Available at: <http://www.ncbi.nlm.nih.gov/books/NBK538191/>
23. Sung CK, Kim KH. Missed injuries in abdominal trauma. *J Trauma.* August 1996;41(2):276–82. <https://doi.org/10.1097/00005373-199608000-00013>
24. Hirschhorn RM, Kerr ZY, Wasserman EB, Kay MC, Clifton DR, Dompier TP, et al. Epidemiology of Injuries Requiring Emergency Transport Among Collegiate and High School Student-Athletes. *J Athl Train.* September 2018;53(9):906–14. <https://doi.org/10.4085/1062-6050-340-17>
25. Carrard J, Morais Azevedo A, Gojanovic B, Edouard P, Pandya T, Robinson DG, et al. Sport and exercise medicine around the world: global challenges for a unique healthcare discipline. *BMJ Open Sport — Exerc Med.* 29 March 2023;9(1):e001603. <https://doi.org/10.1136/bmjsem-2023-001603>
26. Prasena A, K T, Jose R, G K. Abdomen (A Pandora’s Box): A Delayed Presentation of Blunt Abdominal Injury With a Mesenteric Tear Leading to Gangrenous Bowel. *Cureus.* 16(8):e67002. <https://doi.org/10.7759/cureus.67002>
27. Shebrain S, Zelada J, Lipsky AM, Putnam B. Mesenteric injuries after blunt abdominal trauma: delay in diagnosis and increased morbidity. *Am Surg.* October 2006;72(10):955–61. <https://doi.org/10.1177/000313480607201026>

28. Freiwald S. Late-Presenting Complications After Splenic Trauma. *Perm J*. 2010;14(2):41–4. <https://doi.org/10.7812/TPP/09-101>
29. Chen Q, Zhu T, Liu JK, Ding J, Chen L. Conservative management of multi-trauma induced peritonitis: Experience, outcomes, and indications. *World J Clin Cases*. 6 September 2023;11(25):5897–902. <https://doi.org/10.12998/wjcc.v11.i25.5897>
30. Cole E, Gillespie S, Vulliamy P, Brohi K. Multiple organ dysfunction after trauma. *Br J Surg*. March 2020;107(4):402–12. <https://doi.org/10.1002/bjs.11361>
31. Leddy M H, Lambert M J, Ogles B M. Psychological Consequences of Athletic Injury among High-Level Competitors. ResearchGate [Internet]. 22 October 2024 Available at: [https://www.researchgate.net/publication/15313513\\_Psychological\\_Consequences\\_of\\_Athletic\\_Injury\\_among\\_High-Level\\_Competitors](https://www.researchgate.net/publication/15313513_Psychological_Consequences_of_Athletic_Injury_among_High-Level_Competitors).  
<https://doi.org/10.1080/02701367.1994.10607639>
32. Gajardo-Burgos R, Valdebenito-Tejos C, Gálvez-García G, Bascour-Sandoval C. Pain and Psychological Readiness to Return to Sport in Elite Volleyball Players: A Cross-Sectional Study. *Int J Environ Res Public Health*. 30 January 2023;20(3):2492. <https://doi.org/10.3390/ijerph20032492>
33. Ashley JR, Burczak KW, Cotton BA, Clements TW. Management of blunt abdominal trauma. *Br J Surg*. 1 July 2024;111(7):znae168. <https://doi.org/10.1093/bjs/znae168>
34. Jang JY, Kang WS, Keum MA, Sul YH, Lee DS, Cho H, et al. Antibiotic use in patients with abdominal injuries: guideline by the Korean Society of Acute Care Surgery. *Ann Surg Treat Res*. January 2019;96(1):1–7. <https://doi.org/10.4174/astr.2019.96.1.1>
35. Juyia RF, Kerr HA. Return to Play After Liver and Spleen Trauma. *Sports Health*. May 2014;6(3):239–45. <https://doi.org/10.1177/1941738114528468>
36. Shoobridge JJ, Corcoran NM, Martin KA, Koukounaras J, Royce PL, Bultitude MF. Contemporary Management of Renal Trauma. *Rev Urol*. 2011;13(2):65–72.
37. Vriend I, Gouttebarga V, Finch CF, van Mechelen W, Verhagen EALM. Intervention Strategies Used in Sport Injury Prevention Studies: A Systematic Review Identifying Studies Applying the Haddon Matrix. *Sports Med Auckl Nz*. 2017;47(10):2027–43. <https://doi.org/10.1007/s40279-017-0718-y>
38. Tee JC, McLaren SJ, Jones B. Sports Injury Prevention is Complex: We Need to Invest in Better Processes, Not Singular Solutions. *Sports Med*. 1 April 2020;50(4):689–702. <https://doi.org/10.1007/s40279-019-01232-4>
39. Smith DD. INVITED CLINICAL SUGGESTION: “ON THE SIDELINES”-

EMERGENCY CARE BASICS FOR THE SPORTS PHYSICAL THERAPIST. *Int J Sports Phys Ther.* March 2011;6(1):59–62.

40. Sharma H, Baviskar A, Sippy N, Kubal N. High-fidelity Simulation in Sports Field Emergencies: Applications, Benefits, Challenges, and Future Prospects. *J Med Acad.* 5 July 2024;7(1):13–7. <https://doi.org/10.5005/jp-journals-11003-0140>
41. Lenjani B, Rashiti P, Shabani G, Demiri A, Pelai B, Demi A, et al.. Emergency Medical Care and Management of Sports Injuries on the Football Court. *OSP J Health Care Med.* 2020;2(1):1–5. <https://doi.org/10.32391/ajtes.v5i1.172>