

Bicycle Handlebar–Related Blunt Abdominal and Pelvic Injuries in Children and Adults: A Radiological Perspective

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ABSTRACT

Objective: Bicycle handlebar–related abdominopelvic trauma can cause clinically significant injuries despite minimal external signs, potentially resulting in delayed diagnosis. Radiological evidence regarding CT injury patterns associated with this mechanism remains limited. This study aimed to evaluate and characterize the CT findings of bicycle handlebar–related blunt abdominal and pelvic injuries in pediatric and adult patients and to describe injury patterns, organ involvement, and clinical management.

Materials and Methods: This retrospective study included patients who presented with bicycle handlebar–related abdominopelvic injuries between July 2010 and November 2025. Patients who underwent contrast-enhanced abdominopelvic CT because of suspected abdominopelvic trauma were analyzed. CT findings were categorized and graded using the AAST injury scale.

Results: Twenty-three patients had CT findings indicative of abdominopelvic injury, with a total of 25 distinct injuries identified. Nineteen patients (82.6%) were pediatric patients aged 6–16 years, and 4 (17.4%) were adults aged 21–30 years; 86.9% were male. The most common organ injuries involved the spleen (24%) and liver (20%). CT was performed within 24 hours in 87.0% of patients, whereas delayed imaging occurred in 13.0%. Of the 19 intra-abdominal organ injuries, 89.5% were AAST grades 1–3, and 10.5% were grades 4–5. Most patients (82.6%) were managed conservatively, whereas 17.4% required surgical or interventional treatment.

Conclusion: Bicycle handlebar–related trauma is a distinctive mechanism of blunt abdominopelvic injury associated with a broad spectrum of CT findings, predominantly affecting school-aged boys but also occurring in adults. Awareness of characteristic CT patterns and standardized injury grading can facilitate timely diagnosis and appropriate management in both pediatric and adult populations.

Keywords: Bicycle, blunt trauma, children, computed tomography, handlebar.



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INTRODUCTION

Bicycle handlebar–related injuries constitute an important subgroup of traumatic injuries, particularly in the pediatric population, because of their potential for serious clinical consequences. The incidence of handlebar–related injuries in children has been reported to be approximately 1.15

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per 100,000.¹ Although less common in adults, several studies have demonstrated that bicycle handlebar injuries can also occur in the adult population.^{2,3} Owing to the small diameter of the handlebar end, a high-speed impact to the abdomen, or even a low-speed fall in which the rider lands on the handlebar, may result in severe intra-abdominal, abdominal wall, and abdominopelvic vascular injuries.^{4,5}

In bicycle falls, handlebar-related trauma is associated with a higher risk of abdominal and pelvic injuries than non-handlebar-related mechanisms. Moreover, because handlebar injuries are typically blunt rather than penetrating, skin inspection may reveal no significant external findings or only minimal signs representing the “tip of the iceberg.”⁶ Because of the nonspecific nature of the clinical symptoms and physical examination findings, previous studies have reported that the diagnosis and treatment of these injuries may be delayed, potentially leading to increased morbidity and mortality.^{7,8} Therefore, greater awareness among clinicians and radiologists is essential to prevent diagnostic and therapeutic delays.

Because of the relative rarity of this injury mechanism, most studies on bicycle handlebar-related injuries have focused primarily on clinical findings, patient management, and clinical outcomes. In these studies, radiological findings have either not been systematically described or have been addressed only briefly.

Computed tomography (CT) is the most frequently used cross-sectional imaging modality for the emergency evaluation of hemodynamically stable patients with abdominal and pelvic trauma because of its rapid acquisition, high sensitivity and specificity for detecting both solid- and hollow-organ abdominopelvic injuries, ability to guide appropriate patient management, relative cost-effectiveness, and widespread availability in most medical centers.^{9,10} Bicycle handlebar-related injuries can likewise be detected and accurately classified using CT, similar to other forms of blunt abdominal trauma.¹¹

The aim of the present study was to comprehensively evaluate the CT findings of bicycle handlebar-related blunt abdominal and pelvic injuries in pediatric and adult patients. By systematically analyzing injury patterns, organ involvement, and associated imaging features, this study sought to contribute to the limited radiological literature on handlebar-related trauma and improve diagnostic awareness among radiologists and clinicians, thereby facilitating timely and appropriate patient management.

METHODS

This retrospective study was conducted at Osmangazi University Hospital and included both pediatric and adult patients who presented to the emergency department with

KEY MESSAGES

- Bicycle handlebar trauma may present with minimal external findings despite a clinically significant spectrum of abdominopelvic injuries on CT, posing a risk of delayed diagnosis.
- Although most cases occur in school-aged boys, a notable proportion occur in adults, with the spleen and liver being the most frequently injured solid organs.
- Most injuries are low to moderate grade (AAST grades 1–3) and are managed conservatively, whereas a smaller subset requires surgical or interventional treatment.

bicycle handlebar-related injuries between July 2010 and November 2025. Ethical approval was obtained from Eskişehir Osmangazi University Non-Interventional Clinical Research Ethics Committee (Approval Number: 2025-435, Date: 04.11.2025). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Patients were retrospectively identified through the electronic medical record system using the Turkish keywords “bisiklet” and “gidon,” which mean “bicycle” and “handlebar,” respectively. Among these patients, those who underwent CT because of suspected abdominopelvic trauma were included in the dataset. Electronic medical records were independently reviewed by at least two investigators. Demographic data, including age and sex, as well as the clinical course and medical or surgical management, were recorded for each patient.

Abdominopelvic injuries were diagnosed based on CT findings. All CT images were independently evaluated by two radiologists, one of whom had at least 10 years of radiology experience. In cases of disagreement, a third radiologist was consulted to reach a consensus. Patients who presented with bicycle handlebar-related trauma and underwent abdominopelvic CT because of suspected injury were included in the study. Patients without CT imaging and those with bicycle injuries unrelated to the handlebar were excluded. Clinical findings, treatment approaches (conservative or surgical), and patient outcomes were obtained from hospital records. CT findings were systematically categorized according to the involved organ systems and corresponding AAST injury grades.

Statistical Analysis

All data were analyzed using descriptive statistical methods. Continuous variables were summarized as the mean±standard deviation (SD) and range, whereas categorical variables were

Table 1. Demographic, radiological, and clinical features of bicycle handlebar-related injuries

Demographics		Number of patients, n=23
Mean age, years		12.47±6.23
Male, n (%)		20 (86.9%)
Mean length of hospital stay, days		5.5±3.47
Pediatric patients, n (%)		19 (82.6%)
Injuries, n (%)		Number of injuries, n=25 (100%)
Spleen		6 (24%)
Liver		5 (20%)
Kidney		3 (12%)
Pancreas		2 (8%)
Small bowel		3 (12%)
Abdominal wall hematoma		5 (20%)
Abdominal wall hernia		1 (4%)
Number of CT examinations, n (%)		23 (100%)
CT performed within 24 h		20 (87.0%)
CT performed after 24 h		3 (13.0%)
Intraperitoneal hemorrhage on CT		10 (43.5%)
AAST injury grade on CT, n (%)		Number of intra-abdominal organ injuries, n=19 (100%)
Low grade (1–3)		17 (89.5%)
High grade (4–5)		2 (10.5%)
Management, n (%)		23 (100%)
Conservative		19 (82.6%)
Surgical/interventional		4 (17.4%)

CT: Computed tomography; AAST: American Association for the Surgery of Trauma.

expressed as frequencies and percentages. Statistical analyses were performed using the Statistical Package for the Social Sciences, version 26.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

The electronic medical record search initially yielded 4,698 entries based on the keywords “bicycle” and “handlebar.” Because of the broad nature of these terms and the extended study period, many records included nonspecific trauma cases. Therefore, all records were manually reviewed in detail. During this screening process, cases that did not meet the inclusion criteria—such as motorcycle accidents, collisions between bicycles and motor vehicles, pedestrians struck by bicycles, falls from bicycles without direct handlebar

impact, and cases involving patients who had not undergone CT—were excluded. Following this step, 114 patients with confirmed handlebar-related trauma who had undergone CT imaging were identified.

During the subsequent evaluation, 91 patients were excluded because the trauma involved regions outside the abdominopelvic area (e.g., the extremities, thorax, head, or neck) or because the CT findings were negative. Patients with only minimal findings, such as mild skin thickening or superficial soft tissue edema of the abdominal or pelvic wall, were considered CT-negative. Ultimately, 23 patients with isolated bicycle handlebar-related abdominopelvic trauma and positive CT findings were included in the final analysis.

All abdominopelvic CT examinations were performed with intravenous contrast and acquired during the portal venous phase. Of the 23 patients, 19 (82.6%) were in the pediatric group (aged 6–16 years), and 4 (17.4%) were in the adult group (aged 21–30 years). The mean age at the time of injury was 12.47 years (SD, 6.23). Of the 23 patients, 87.0% were male (n=20), and 13.0% were female (n=3) (Table 1).

A total of 25 abdominal and pelvic injuries were identified in 23 patients. The most commonly injured intra-abdominal organs were the spleen (n=6, 24%) and liver (n=5, 20%) (Fig. 1). Injuries involving the kidney (n=3, 12%), pancreas (n=2, 8%), small bowel (n=3, 12%), abdominal wall hematoma (n=5, 20%), and abdominal wall hernia (n=1, 4%) were also identified (Fig. 2, 3). Intraperitoneal hemorrhage accompanied other injuries in 10 of the 23 patients (43.5%). In 20 of the 23 patients (87.0%), CT imaging was performed within 24 hours of trauma. However, diagnosis was delayed in 3 patients; CT was performed within 24–48 hours in 2 patients and within 72–96 hours in 1 patient. Overall, 18 patients sustained 19 intra-abdominal organ injuries. Of these 19 injuries, 17 (89.5%) were classified as AAST grades 1–3 (mild to moderate), whereas 2 (10.5%) were classified as grades 4–5 (severe) on CT imaging (Table 1).

Among the 23 patients, 1 patient with a splenic injury underwent splenectomy, and 1 patient with a small bowel injury and perforation underwent surgical repair. One patient underwent diagnostic peritoneal lavage because of suspected intraperitoneal hemorrhage, and 1 patient with a pancreatic injury was treated with percutaneous pseudocyst drainage by interventional radiology. The remaining 19 patients (82.6%) were managed conservatively without surgical or interventional procedures. No deaths occurred following bicycle handlebar-related trauma in this cohort. The mean hospital length of stay was 5.5 days (SD, 3.47). Nineteen cases occurred between May and September, when weather conditions are generally favorable.

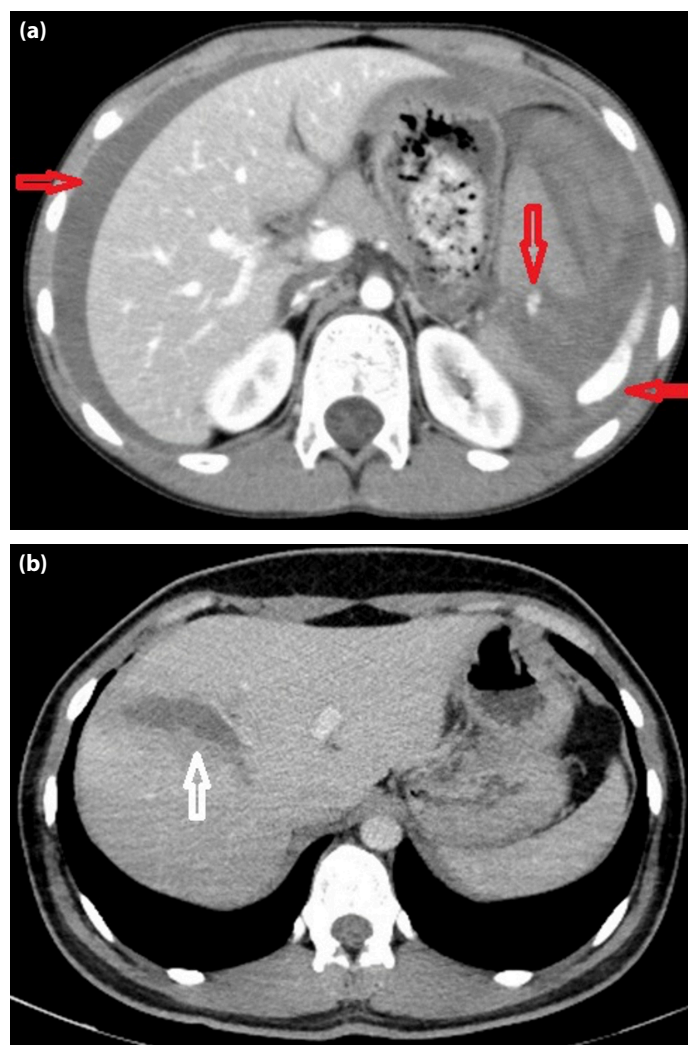


Figure 1. (a) A large splenic laceration with active intraparenchymal hemorrhage, contrast extravasation adjacent to the spleen, and hemorrhage extending toward the liver is observed (red arrows). The findings are consistent with an AAST grade 5 splenic injury. **(b)** Liver laceration in a 23-year-old woman with a handlebar injury to the right upper abdomen. Axial contrast-enhanced CT image shows an AAST grade 3 laceration (arrow) in the right hepatic lobe.

DISCUSSION

Although bicycle handlebar-related injuries are relatively uncommon, they can result in serious clinical consequences and therefore warrant careful attention. In our study, bicycle handlebar trauma was associated with a broad spectrum of injuries involving various abdominopelvic organs and tissues. Consistent with previous reports, injuries occurred most frequently in pediatric patients, particularly boys.^{12,13}

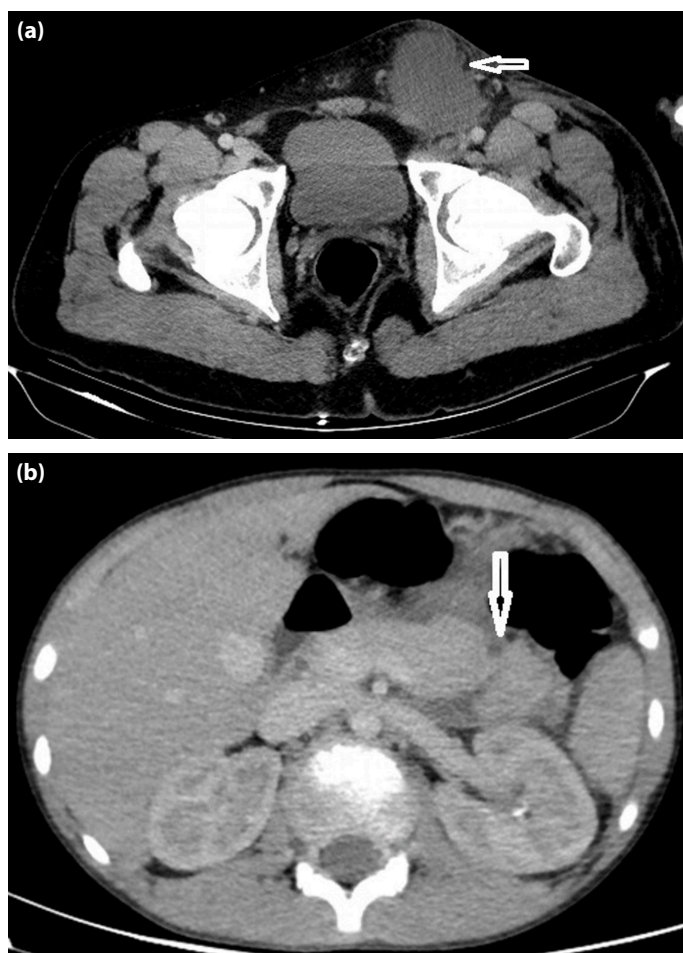


Figure 2. (a) Abdominal wall hematoma in a 30-year-old man with a handlebar injury. Axial contrast-enhanced CT image demonstrates an anterior pelvic wall hematoma (arrow) at the site of injury. **(b)** In a different patient, pancreatic transection consistent with an AAST grade 3 injury is present in the distal pancreas (white arrow).

In blunt abdominal trauma, the spleen is generally recognized as the most commonly injured organ.¹⁴ In our cohort, the most frequently injured solid organs were the spleen (24%) and liver (20%). Compared with other mechanisms of blunt abdominal trauma, pancreatic injuries have also been reported in association with bicycle handlebar trauma.^{15,16} In our cohort, 2 patients (8%) had AAST grade 3 pancreatic injuries.

Our study focused exclusively on bicycle handlebar-related injuries. However, handlebar-type trauma is not limited to bicycles; similar injury mechanisms may occur with motorcycles, kick scooters, and electric scooters. Injuries associated with these vehicles have been increasingly reported in the literature.¹⁷ Notably, the use of electric scooters has

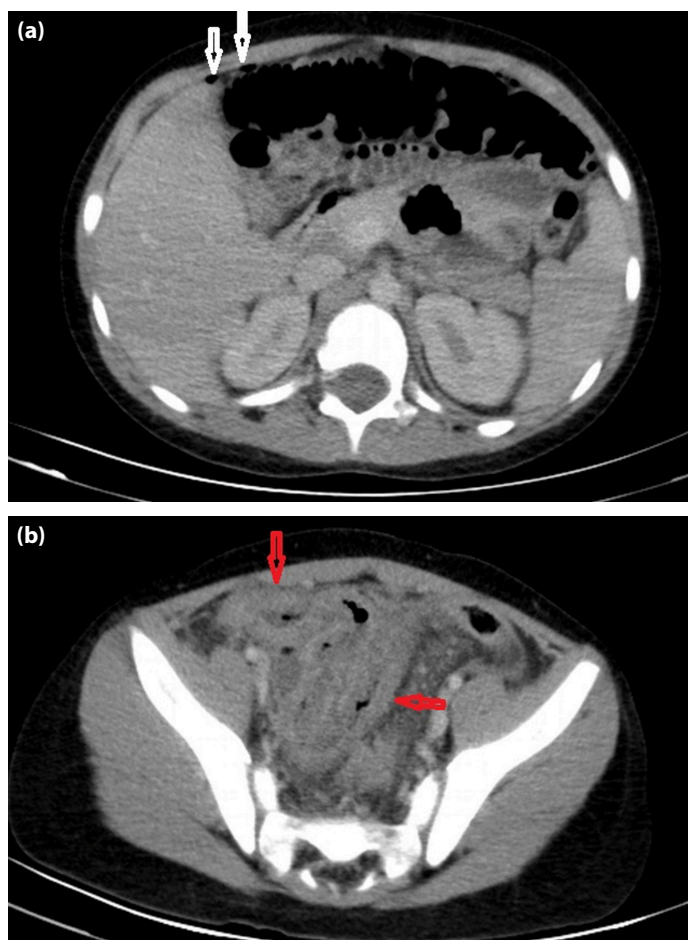


Figure 3. Small bowel perforation in a 6-year-old boy with a handlebar injury. **(a)** Axial contrast-enhanced CT image demonstrates free intraperitoneal air (white arrows). **(b)** Small bowel wall thickening is observed (red arrows). During surgical exploration, an ileal perforation was identified.

increased substantially among the pediatric population, and a corresponding rise in handlebar-related blunt abdominopelvic trauma may be anticipated.

Traumatic abdominal wall hernia has frequently been described in this patient group.^{18–20} We identified this condition in 1 patient. Given its potential to be overlooked during the initial post-trauma assessment, heightened awareness and careful evaluation by radiologists are important.

Handlebar-related abdominopelvic injuries represent a distinct trauma mechanism that may present in the emergency department with nonspecific and subtle clinical findings, potentially leading to delayed diagnosis and increased morbidity and mortality.^{6,7} In our study, diagnosis was delayed in 3 patients (13%), largely because symptoms and signs were

relatively mild during the initial clinical examination and CT was performed more than 24 hours after trauma. Therefore, more liberal use of imaging in this patient group may help prevent delayed diagnosis and reduce morbidity and mortality. In contrast, a study conducted in Türkiye reported that, among 293 patients presenting to the emergency department with non-handlebar-related bicycle injuries, 46.1% had lower extremity trauma, 22.5% had upper extremity trauma, 20.1% had head trauma, and 9.6% had thoracic trauma, whereas only 1.7% had abdominal trauma.²¹ This distribution highlights the relative rarity of abdominal involvement in general bicycle trauma and further supports the notion that handlebar-related mechanisms represent a distinct injury pattern with a disproportionately high risk of abdominopelvic injury.

Studies of bicycle handlebar-related injuries in the literature have predominantly focused on the pediatric population, whereas reported cases in adults have generally been rare and mostly limited to case reports.^{22,23} Although this specific trauma mechanism may be less common in adults, 18% of the patients in our cohort were adults, suggesting that it may not be as rare as previously assumed.

Cevik et al.²⁴ and other studies^{25,26} have reported high rates of surgical intervention following bicycle handlebar injuries. Consistent with the literature, our findings suggest that patients with bicycle handlebar trauma have relatively high rates of surgical or interventional management and hospitalization.

From a radiological perspective, bicycle handlebar-related abdominopelvic trauma poses a distinct diagnostic challenge because clinical findings may be subtle and external signs may be minimal despite clinically significant internal injuries. Notably, the radiology-focused literature on this mechanism remains limited, and imaging findings have often been reported only briefly or nonsystematically. Further imaging-based studies involving larger patient cohorts are needed to better characterize the full spectrum of CT findings, refine injury pattern recognition, and strengthen the evidence base for radiology-driven diagnostic pathways for this distinct trauma mechanism.

Limitations

This study has several limitations. First, its retrospective, single-center design and relatively small sample size, particularly the limited number of adult patients, may restrict the generalizability of our findings. Second, inclusion was limited to patients who underwent contrast-enhanced abdominopelvic CT, introducing selection bias toward hemodynamically stable patients and potentially underrepresenting milder injuries managed without CT. Third, case identification relied on electronic medical record keyword searches, which may have

missed eligible patients because of incomplete documentation or variability in coding. Finally, CT examinations were acquired only during the portal venous phase; therefore, some injury components, such as arterial bleeding, subtle bowel or mesenteric injuries, or evolving pancreatic injury, may have been underestimated.

CONCLUSION

Bicycle handlebar-related trauma is an important and distinctive mechanism of blunt abdominopelvic injury that predominantly affects school-aged boys and is associated with a broad spectrum of CT findings involving both solid organs and the abdominal wall. Because external signs may be minimal and symptoms may be nonspecific, delayed diagnosis remains a concern. Awareness of characteristic injury patterns and a low threshold for CT in appropriately selected patients may facilitate timely diagnosis, optimize management decisions, and reduce morbidity in both pediatric and adult populations.

Ethics Committee Approval: Ethics committee approval was obtained from Eskişehir Osmangazi University Non-Interventional Clinical Research Ethics Committee (Approval Number: 2025-435, Date: 04.11.2025).

Informed Consent: Due to the retrospective nature of the study, the ethics committee waived the requirement for informed consent.

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