

World Journal of *Clinical Cases*

World J Clin Cases 2023 September 26; 11(27): 6318-6669



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The WJCC is now abstracted and indexed in Science Citation Index Expanded (SCIE, also known as SciSearch®), Journal Citation Reports/Science Edition, Current Contents®/Clinical Medicine, PubMed, PubMed Central, Reference Citation Analysis, China National Knowledge Infrastructure, China Science and Technology Journal Database, and Superstar Journals Database. The 2023 Edition of Journal Citation Reports® cites the 2022 impact factor (IF) for WJCC as 1.1; IF without journal self cites: 1.1; 5-year IF: 1.3; Journal Citation Indicator: 0.26; Ranking: 133 among 167 journals in medicine, general and internal; and Quartile category: Q4.

RESPONSIBLE EDITORS FOR THIS ISSUE

Production Editor: *Ying-Yi Yuan*; Production Department Director: *Xiang Li*; Editorial Office Director: *Jin-Lei Wang*.

NAME OF JOURNAL

World Journal of Clinical Cases

ISSN

ISSN 2307-8960 (online)

LAUNCH DATE

April 16, 2013

FREQUENCY

Thrice Monthly

EDITORS-IN-CHIEF

Bao-Gan Peng, Jerzy Tadeusz Chudek, George Kontogeorgos, Maurizio Serati, Ja Hyeon Ku

EDITORIAL BOARD MEMBERS

<https://www.wjgnet.com/2307-8960/editorialboard.htm>

PUBLICATION DATE

September 26, 2023

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INSTRUCTIONS TO AUTHORS

<https://www.wjgnet.com/bpg/gerinfo/204>

GUIDELINES FOR ETHICS DOCUMENTS

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<https://www.wjgnet.com/bpg/gerinfo/240>

PUBLICATION ETHICS

<https://www.wjgnet.com/bpg/GerInfo/288>

PUBLICATION MISCONDUCT

<https://www.wjgnet.com/bpg/gerinfo/208>

ARTICLE PROCESSING CHARGE

<https://www.wjgnet.com/bpg/gerinfo/242>

STEPS FOR SUBMITTING MANUSCRIPTS

<https://www.wjgnet.com/bpg/GerInfo/239>

ONLINE SUBMISSION

<https://www.f6publishing.com>



Acute peritonitis secondary to post-traumatic appendicitis: A case report and literature review

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Specialty type: Medicine, research and experimental

Provenance and peer review:

Unsolicited article; Externally peer reviewed.

Peer-review model: Single blind

Peer-review report's scientific quality classification

Grade A (Excellent): 0
Grade B (Very good): B, B
Grade C (Good): C
Grade D (Fair): D, D
Grade E (Poor): 0

P-Reviewer: Gu GL, China; Hori T, Japan; Shelat VG, Singapore

Received: April 13, 2023

Peer-review started: April 13, 2023

First decision: May 31, 2023

Revised: July 30, 2023

Accepted: August 25, 2023

Article in press: August 25, 2023

Published online: September 26, 2023



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Abstract

BACKGROUND

Blunt abdominal trauma has rarely been reported as a cause of acute appendicitis in the literature. However, the coexistence of the two conditions can cause issues for the patient. We present here a systematic review of cases of traumatic appendicitis as well as our own experience with a 12-year-old male patient.

CASE SUMMARY

A 12-year-old male was admitted 3 d after abdominal trauma, experiencing peritoneal syndrome. A pelvic formation was discovered during abdominal ultrasound, and surgical exploration revealed a perforated appendix. A literature review was conducted applying the keywords "appendicitis," "abdominal," and "trauma" to the PubMed, Embase, and Medline databases. Our initial search included 529 papers published between 1991 and 2022, of which 33 papers were finally included. They revealed 51 reported cases. The trauma mechanisms included road traffic accidents, falls, assaults, ball accidents, a horse kick, and a colonoscopy. Eight patients underwent surgical exploration with no prior radiological investigation, and twenty-six patients underwent an initial radiological examination. All reports indicated a perforated appendix.

CONCLUSION

Acute traumatic appendicitis represents a diagnostic quandary that can be misdiagnosed resulting in significant morbidity and potential mortality. A high level of suspicion combined with radiological examination may aid in the diagnosis and treatment of this condition.

Key Words: Appendicitis; Abdominal; Trauma; Pediatric; Surgery; Case report

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Core Tip: Appendicitis and abdominal trauma represent the two most common surgical emergencies in both adults and children. However, their coexistence may pose a diagnostic dilemma depending on whether the finding is incidental. Appendicitis should be considered in the differential diagnosis of right lower quadrant pain after abdominal or perineal trauma.

Citation: Habachi G, Aziza B, Ben-Ammar S, Maherzi O, Houas Y, Kerkeni Y, Sahli S, Jouini R. Acute peritonitis secondary to post-traumatic appendicitis: A case report and literature review. *World J Clin Cases* 2023; 11(27): 6491-6497

URL: <https://www.wjgnet.com/2307-8960/full/v11/i27/6491.htm>

DOI: <https://dx.doi.org/10.12998/wjcc.v11.i27.6491>

INTRODUCTION

Appendicitis and abdominal trauma represent the two most common surgical emergencies in both adults and children. However, their coexistence may pose a diagnostic dilemma depending on whether the finding is incidental. Traumatic appendicitis has been a rarely reported but was first recognized in the case of Harry Houdini[1]. In this case, the Hungarian escapologist allowed his student to punch him repeatedly in the right side of his abdomen, and he subsequently died from appendicular peritonitis.

Herein, we reported the case of a 12-year-old male patient who was admitted with acute appendicitis following a blunt abdominal trauma. In addition, we reviewed the literature regarding this uncommon condition.

CASE PRESENTATION

Chief complaints

A 12-year-old male was admitted to the emergency department 3 d after sustaining a fall injury.

History of present illness

The trauma was minor as the patient had fallen from his own height, landing on a concrete floor on his right side and injuring his right hand.

History of past illness

The patient had no surgical history and appeared to be in good health prior to the accident.

Personal and family history

The patient had no relevant personal or family history.

Physical examination

Initially, the patient had attended a consult at a local clinic where a physical examination provided normal findings apart from a fifth metacarpal fracture. There were no bruises or tenderness on the abdomen. No further investigation was performed, and the patient was discharged with a plaster cast.

Later that day, he experienced abdominal pain and emesis. By the 3rd day, he developed bilious vomiting and diarrhea prompting his evaluation in the emergency department. Upon examination, his blood pressure, heart rate, and respiratory rate were all normal. His temperature was 37.7 °C. He developed hypogastric tenderness with no rebound or guarding.

Laboratory examinations

Laboratory results revealed an elevated white blood count of $14.5 \times 10^9/L$ (normal range: $4.5-11.0 \times 10^9/L$) and C-reactive protein level of 243 mg/L (normal range: 0.3-1.0 mg/L). Serum electrolytes, lipase, and urinalysis results were all normal.

Imaging examinations

A plain abdominal X-ray revealed multiple gas-fluid levels with no free peritoneal gas (Figure 1). Abdominal ultrasound revealed intestinal dilation as well as a well-limited hypoechoic pelvic formation associated with infiltration of the adjacent intestinal loops.

FINAL DIAGNOSIS

Acute traumatic appendicitis.



DOI: 10.12998/wjcc.v11.i27.6491 Copyright ©The Author(s) 2023.

Figure 1 Abdominal X-ray revealed gas-fluid levels.

TREATMENT

An urgent exploratory laparotomy was performed. Abdominal exploration revealed an intra-abdominal pelvic abscess surrounded by a perforated mesocolic appendix. There were no associated lesions. Appendectomy was performed, and the stump was managed by double ligation.

OUTCOME AND FOLLOW-UP

The postoperative course was uneventful with no postoperative complications. The patient received intravenous triple antibiotic therapy that consisted of cefotaxime, metronidazole, and gentamicin for 10 d. He was then discharged home with no associated treatment. The histopathological examination confirmed the diagnosis of acute appendicitis.

DISCUSSION

Blunt abdominal trauma is a rare cause of acute appendicitis. However, the direct association is difficult to establish. Ciftci *et al*[2] discovered a higher incidence of appendicitis after blunt abdominal trauma in pediatric patients. Fowler[3] developed four essential criteria for defining traumatic appendicitis: (1) No history of previous abdominal attacks; (2) Direct abdominal trauma or severe indirect abdominal wall trauma; (3) Symptom onset soon after the trauma; and (4) Progressive symptoms requiring treatment and diagnosis of appendicitis. In this review, all patients met the inclusion criteria, and the diagnosis was confirmed by a histopathological study.

Limited data are available regarding the pathogenesis of traumatic appendicitis. Direct trauma may cause edema and inflammation of the appendicular lymphoid tissue, resulting in obstruction and acute appendicitis. In cases of indirect trauma, an increase in intra-abdominal pressure may cause an increase of intra-cecal pressure resulting in rapid appendiceal distension and appendicitis. Direct trauma of the mesoappendix has also been reported[4]. One patient developed traumatic appendicitis following a perineal trauma[5]. These mechanisms could be isolated or combined, but they are still speculative. Wangenstein *et al*[6] demonstrated the development of acute appendicitis following direct trauma with no luminal obstruction in a rabbit model. However, this study represents the only experimental theory.

We identified a high incidence of traumatic appendicitis in pediatric patients (52.9%). This can be explained by the smaller abdominal cavity and quality of the muscular anterior abdominal wall in pediatric cases. As a result, clinicians should be suspicious of traumatic appendicitis after blunt abdominal trauma particularly in children. In addition, children are at higher risk of trauma from gaming accidents, such as from balls and bicycles, and animal-related injuries (being kicked by a horse[7]).

Initially, the clinical and radiological signs of traumatic appendicitis may be nonspecific and/or misleading. Routine hematological and biochemical investigations are ineffective as well. Only a strong suspicion of this pathology may lead to a diagnosis. The difficulty of diagnosis may come from the unfamiliarity of traumatic appendicitis and the numerous differential diagnoses of the causes of abdominal pain after an abdominal trauma. However, ultrasound has proven to be beneficial in several cases[4] (Table 1).

In our case, ultrasound did not aid in the diagnosis of appendicitis but did rule out other clinical entities. An X-ray revealed a mechanical obstruction, which led us to perform surgery. Computed tomography scans and magnetic resonance imaging scans are more sensitive for diagnosis. However, a computed tomography scan was normal in 1

Table 1 Literature review of post-traumatic appendicitis

Ref.	Year	Cases, n	Age in yr	Mechanism of injury	Time of presentation	WBC as / mm ³	Investigations	Surgery	Findings
Hennington <i>et al</i> [13]	1991	2	46; 12	RTA; fall	48 h; 12 h	16900; 13000	CT (free fluid); none	Laparotomy; laparotomy	Isolated; isolated
Bangs[14]	1991	1	20	RTA	A few hours	3250	CT	Laparotomy	Isolated
Musemeche and Baker[15]	1995	1	4	RTA	A few hours	22900	CT	Laparotomy	Isolated
Stephenson and Shandall [16]	1995	1	32	Seat belt	120 h	NA	NA	Laparotomy	Wedge fracture of T10
Serour <i>et al</i> [17]	1996	3	11; 8; 7	Assault; fall; assault	1 h; 3 h; 7 d	4500; 20100; NA	CT; none; CT	Laparotomy; laparotomy; laparotomy	Isolated; isolated; isolated
Ciftci <i>et al</i> [2]	1996	5	8; 5; 13; 14; 7	RTA; fall; ball; RTA; assault	2 h; 6 h; 12 h; 4 h; 12 h	9800-18000	NA; NA; NA; US; US	Laparotomy; laparotomy; laparotomy; laparotomy; laparotomy	Head injury; rib fracture; isolated; head injury; head injury
Edwards <i>et al</i> [11]	1999	1	41	RTA	Hours	NA	CT	Laparotomy	Ileocecal lesion and ileocecal resection
Osterhoudt[8]	2000	1	9	RTA	Hours	NA	CT (NL)	Laparotomy	Isolated
Takagi <i>et al</i> [18]	2000	1	45	Seat belt	24 h	NA	NA	Laparotomy	Isolated
Ramsook[19]	2001	1	12	Assault	7 h	15400	CT	Laparotomy	Isolated
Houry <i>et al</i> [20]	2001	1	5	Fall	1 h	NA	CT	Laparotomy	Isolated
Hagger <i>et al</i> [21]	2002	1	60	Fall	72 h	NA	CT	Laparotomy	Incarcerated direct hernia
Ramesh <i>et al</i> [22]	2002	1	11	Bicycle	48 h	NL	US	Laparotomy	Isolated
Karavokyros <i>et al</i> [23]	2004	1	21	Assault	Hours	NA	US	Laparotomy	Isolated
Etensel <i>et al</i> [10]	2005	5	5; 8; 14; 9; 13	RTA; RTA; RTA; fall; RTA	4 h; 1 h; 1 h; 1 h; 15 min	18700; 19500; 12200; 17700; 19400	US; US; US; US; CT; CT	Laparotomy; laparotomy; laparotomy; laparotomy; laparotomy	Multiple hepatic lacerations; right diaphragmatic rupture, liver laceration, and retroperitoneal hematoma; retroperitoneal hematoma; isolated; left diaphragmatic rupture, splenic laceration, and left ureteropelvic junction rupture
Volchok and Cohn[24]	2006	1	60	Colonoscopy	60 h	13700	CT	Laparoscopy	Isolated
Derr and Goldner[25]	2009	1	41	Fall	24 h	NA	US, CT	Laparoscopy	Isolated
Amir <i>et al</i> [5]	2009	1	10	Fall	2 h	NL	US, CT	Laparotomy	Isolated
Toumi <i>et al</i> [26]	2010	1	11	Assault	3 d	NA	CT	Laparotomy	Isolated
O'Kelly <i>et al</i> [27]	2012	1	29	Ball	24 h	17470	CT	Laparotomy	Isolated
Paschos <i>et al</i> [28]	2012	1	17	Bicycle	12 h	12700	US	Laparotomy	Isolated
Wani[29]	2013	8	9-63	3 falls; 4 assaults; 1 bicycle	24 h-4 d	NA	US, CT	Laparotomy	Isolated
Bouassria <i>et al</i> [4]	2013	1	24	Stab	24 h	14000	US (2 nd)	Laparotomy	Retroperitoneal hematoma

Moslemi <i>et al</i> [30]	2013	1	13	Bicycle	6 h	14700	US, CT	Laparotomy	Rupture of the small bowel mesentery
Go <i>et al</i> [31]	2016	1	23	Seat belt	0.5	NA	US, CT	Laparotomy	Tearing of the distal ileum mesentery
Khilji <i>et al</i> [32]	2017	1	43	RTA	2 h	11000	US, CT	Laparoscopy	Isolated
Cobb [33]	2017	1	17	RTA	24 h	10800	CT	Laparoscopy, laparotomy	Isolated
Aljaberi <i>et al</i> [34]	2018	1	24	Seat belt	24 h	NA	CT	Laparotomy	Transection of the omentum
Çağlar <i>et al</i> [35]	2018	1	12	Fall	24 h	21020	CT	Laparotomy	Isolated
Siddiqui <i>et al</i> [36]	2018	1	22	Fall	3 h	7500	CT	Laparoscopy	Isolated
Zvizdic <i>et al</i> [7]	2019	1	7	Horse kick	10 h	11500	US, CT	Laparotomy	Isolated
Salinas-Castro <i>et al</i> [37]	2023	1	14	Soccer ball	6 h	NA	US, CT	Laparoscopy	Isolated
Goldman <i>et al</i> [38]	2022	1	11	Assault	24 h	22000	MRI	Laparoscopy	Isolated
Our study	2023	1	12	Fall	3 d	14500	US	Laparotomy	Isolated

CT: Computed tomography; MRI: Magnetic resonance imaging; NA: Not available; NL: Normal; RTA: Road traffic accident; US: Ultrasound; WBC: White blood cell.

patient with traumatic appendicitis[8]. These imaging modalities also may not be accessible in all circumstances.

Contrary to other visceral injuries, traumatic appendicitis may have few early indirect signs of its presence[9], which causes a significant delay in diagnosis and increases the risk of an abscess, peritonitis, and mortality. Moreover, the underdevelopment of the omentum in children may result in the diffusion of the infection. Thus, we emphasize the importance of repeated examinations.

In all cases, surgical treatment is required. Due to the trauma and the risk of associated hemorrhagic lesions that may necessitate additional treatment, laparotomy is commonly performed[10]. Laparoscopy may be indicated in stable cases with a positive preoperative diagnosis. In cases of isolated appendicular lesions, an appendectomy with ligation or plication of the appendicular stump may be curative, and resection of the injured bowel along with the appendectomy may be performed[11,12].

CONCLUSION

Traumatic appendicitis is rarely reported due to the difficulty of associating the trauma as a direct cause. The causative relationship is proposed based on the basis of circumstantial evidence. It should, however, be considered in the differential diagnosis of right lower quadrant pain after abdominal or perineal trauma. There are also legal implications of traumatic appendicitis because the trauma can occur from aggression or road traffic accidents.

FOOTNOTES

Author contributions: Habachi G analyzed the data and wrote the manuscript; Aziza B contributed to the literature review; All authors have read and approve the final manuscript.

Informed consent statement: Consent was obtained from the patient for anonymized publication of this case.

Conflict-of-interest statement: All the authors report no relevant conflicts of interest for this article.

CARE Checklist (2016) statement: The authors have read CARE Checklist (2016), and the manuscript was prepared and revised according to CARE Checklist (2016).

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S-Editor: Li L

L-Editor: Filipodia

P-Editor: Yuan YY

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