



# A Child with Acute Appendicitis Secondary to Blunt Abdominal Trauma: A Case Report and Review of the Literature

## Künt Batın Travmasına İkincil Akut Apandisit Gelişen Bir Çocuk Olgu: Olgu Sunumu ve Literatürün Taraması

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### Abstract

We present a child with abdominal pain and vomiting after blunt abdominal trauma (BAT). He had tenderness, guarding and rebound on the bilateral lower quadrant of the abdomen. He had no abrasion on the abdominal skin surface. He had marked leukocytosis and increased C-reactive protein level. Contrast-enhanced abdominal computed tomography revealed inflamed appendicitis. He was operated by pediatric surgeons and, an perforated appendix was illustrated on pathological examination. BAT and acute appendicitis (AA) are independently very frequent issues. In pediatric emergency departments, BAT and AA are very frequent issues, however, coexistence of these two condition in the same patient is rare. This case report and review of the literature showed that occurrence of AA after BAT should be considered by emergency physicians.

**Keywords:** Child, appendicitis, abdominal injuries

### Öz

Bu raporda künt batın travması (BAT) sonrasında karın ağrısı ve kusma ile çocuk acil servisine başvuran bir olgu sunulmaktadır. Başvuru anında, hastanın karın muayenesinde yaygın hassasiyet, bilateral alt kadrantlarda defans ve rebound mevcuttu. Laboratuvar tetkiklerinde belirgin lökositoz ve artmış C-reaktif protein değeri tespit edildi. Kontrastlı batın tomografisinde akut apandisit görülen hasta, çocuk cerrahisi tarafında ameliyat edildiğinde makroskopik ve mikroskopik olarak perfore apandisit ile uyumlu olduğu belirlendi. BAT ve akut apandisit (AA) acil servislerde birbirinden bağımsız olarak sıklıkla karşılaşılan durumlar olmasına karşın nadir de olsa aynı anda görülebilmektedir. Travmanın AA gelişiminde bir etken olup olmadığı konusunda literatürde kısıtlı bilgiler mevcuttur. Bu olguyu sunmaktaki amacımız, acil hekimlerinin BAT sonrasında AA gelişebileceği konusunda farkındalığını arttırmaktır.

**Anahtar Kelimeler:** Çocuk, apandisit, abdominal yaralanma

### Introduction

Acute appendicitis (AA) is the most common disease which requires surgical intervention in pediatric emergency settings.<sup>1</sup> Although there are various factors in the pathophysiology, the main cause of AA is obstruction of the lumen with stool,

food, lymphoid nodules, appendicolitis or neoplasms.<sup>2</sup> In the literature, there are limited data on the fact that trauma may cause AA.<sup>3</sup> Here, we present a case of perforated appendicitis occurring after blunt abdominal trauma (BAT). We aimed to emphasize that emergency physicians should consider BAT as a rare cause of AA.

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**Received/Geliş Tarihi:** 07.11.2017 **Accepted/Kabul Tarihi:** 23.01.2018

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Journal of Pediatric Emergency and Pediatric Intensive Care published by Galenos Yayınevi.

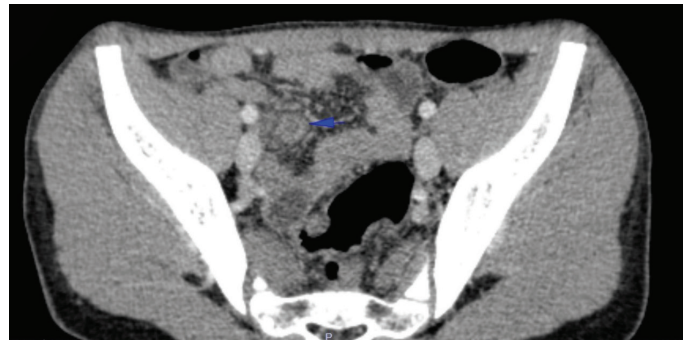
## Case

A-12-year-old boy was admitted to the pediatric emergency department (ED) with abdominal pain and vomiting. He had a history of fall from a swing that had caused BAT one day before admission. On admission, he was conscious but anxious because of abdominal pain. The body temperature was 36.2 °C, heart rate was 84/minute, and arterial blood pressure was 105/60 mmHg. The chest was clear, breath sounds vesicular and he had a respiratory rate of 22/minute. There was tenderness, guarding and rebound bilaterally on the lower quadrant of the abdomen, and no abrasion on the abdominal skin surface. In the laboratory tests, his leukocyte count was 21020/ $\mu$ L, absolute neutrophil count was 18730/ $\mu$ L, and C-reactive protein level was 3.56 mg/dL. His liver and renal function tests were normal. In the urine sample test, there was ketonuria but no hematuria or pyuria. Plain abdominal x-ray revealed diffuse air-fluid levels (Figure 1). Abdominal computed tomography was performed for traumatic injury and showed that there was no vital organ injury, but inflamed acute appendix and minimal pelvic free fluid (Figure 2). Under general anesthesia, surgical resection of the inflamed and perforated appendix was performed by pediatric surgeons, and no complication was observed.

Pathological examination was consistent with AA and also bleeding on the tip of the appendix was noted. The patient healed completely without complication and was discharged three days after operation.



**Figure 1.** Plain radiograph shows diffuse air - fluid levels



**Figure 2.** Computed tomography reveal that appendicitis by thickening of the appendix wall, and contrast - enhancing (Blue arrow)

## Discussion

Trauma is a rare cause of AA. However, there is still a debate about whether this is a real cause or just a coincidence. Ciftci et al.<sup>4</sup> enrolled 554 children in their study and reported that the incidence of BAT as a causative factor for AA was 0.9%. Additionally there are few case reports in the literature. Fowler<sup>5</sup> defined five essential criteria for AA caused by BAT in their study which was reported in the 1938. First of all, there must be no history of abdominal pain attack suggestive of AA before trauma and secondly, the mechanism of trauma must be directly related to abdominal region and affect the appendix. The effect of injury must be experienced immediately after the occurrence of AA symptoms. Besides, the traumatic lesion of the appendix must be demonstrated operatively and the pathologic diagnosis of AA must be made. To our knowledge, there are 22 pediatric cases, including our patient, meeting the criteria for BAT-related AA in the literature (Table 1).<sup>3,4,6-14</sup> Most of these patients were boys (86.4%), and the mean  $\pm$  standard deviation age of the patients was 10.0 (3.3) years. The median (interquartile range) time between admission and injury was 4.0 (1.0-12.0) hours. Abdominal tenderness and fever were prominent findings in most of the cases. Our patient had diffuse abdominal tenderness, rebound, and guarding as well but no fever. Leukocytosis was the remarkable laboratory test in all patients as in our patient. Eleven (50%) patients had associated injury. Pathological investigation of all cases had revealed findings of AA. Perforation was noted in six patients (27.2%).

The mechanism of occurrence of BAT-related AA is not clear. There are a few theories. Fowler<sup>5</sup> defined that occurrence of BAT-related AA can be caused by direct or indirect pressure on the abdomen. Sharma et al.<sup>15</sup> proposed a theory based on LaPlace's law; when intra abdominal pressure increased instantly, the caecum, the widest part of the intestine, becomes the most susceptible region for the surface tension. An increase in the caecum surface tension can cause obstruction of the orifice of the appendix secondary to the mucosal

**Table 1. Characteristics of the blunt abdominal trauma related pediatric acute appendicitis patients in the literature**

Authors	No	Age	Sex	Mechanism	The interval between injury and admission	Associated injuries	Perforation	WBC / $\mu$ L	Fever $^{\circ}$ C	Physical findings
Ciftci et al. <sup>4</sup>	1	8	M	MVA	2 h	HI	+	N/A	N/A	DT, guarding
Ciftci et al. <sup>4</sup>	2	5	F	Fall	6 h	Rib fracture		N/A	N/A	RLQT
Ciftci et al. <sup>4</sup>	3	13	F	Struck by ball	12 h	NIL		N/A	N/A	RLQT
Ciftci et al. <sup>4</sup>	4	14	M	MVA	4 h	HI	+	N/A	N/A	DT, guarding
Ciftci et al. <sup>4</sup>	5	7	M	Assault	12 h	HI		N/A	N/A	RLQT, guarding
Etensel et al. <sup>14</sup>	6	5	M	MVA	4 h	HL	-	18700	36.5	DT
Etensel et al. <sup>14</sup>	7	8	M	MVA	1 h	DR, HL, RH	-	19500	38.5	DT
Etensel et al. <sup>14</sup>	8	14	M	MVA	1 h	LC, RF, RH, FF	-	18700	36.8	DT, rebound
Etensel et al. <sup>14</sup>	9	9	M	Fall	1 h	LC, FF	-	17700	36.7	Mild tenderness
Etensel et al. <sup>14</sup>	10	13	M	MVA	15 minute	DR, SL, UPH	-	19400	37.1	DT
Hennington et al. <sup>8</sup>	11	12	M	Bicycle handlebar injury	12 h	-	-	13000	38.2	DLQT, guarding
Musemeche and Baker <sup>9</sup>	12	4	M	MVA	72 h	HL, SL, PE	+	22900	39.5	Abdominal distention, DT
Osterhoudt <sup>10</sup>	13	9	M	MVA	1 h			N/A	N/A	RLQT, guarding
Ramesh et al. <sup>11</sup>	14	11	M	Bicycle handlebar injury	48 h	-	+	Raised	Raised	DLQT
Ramsook <sup>12</sup>	15	12	M	Kick	7 h	-	-	15400	38.6	DT
Serour et al. <sup>13</sup>	16	11	M	Punch	18 h	-	-	11400	38.0	RLQT, guarding
Serour et al. <sup>13</sup>	17	8	M	Fall	3 h	-	-	20100	38.2	Ecchymosis, RLQT, guarding, rebound
Serour et al. <sup>13</sup>	18	7	M					N/A	40	DT, rebound, guarding
Amir et al. <sup>6</sup>	19	10	M	Fall	2 h	-	-	N/A	36.5	Ecchymosis, DT
Paschos et al. <sup>7</sup>	20	17	F	Bicycle handlebar injury	1 h	-	-	12700	37.5	Ecchymosis, DT
Toumi et al. <sup>3</sup>	21	11	M	Fall	3 h	-	-	Raised	Raised	RLQT
Our patient	22	12	M	Fall	24 h	-	+	21020	36.2	DRQT, Rebound, guarding

MVA: Motor vehicle accident, HI: Head injury, HL: Hepatic laceration, SL: Splenic Laceration, DR: Diaphragmatic rupture, UPH: Ureteropelvic rupture, PE: Pancreatic edema FF: Fibula fracture, DT: Diffuse tenderness, DLQT: Diffuse low quadrant tenderness, RLQT: Right low quadrant tenderness

straining, hemorrhage, and clot formation. Hennington et al.<sup>8</sup> reported that edema formation, hematoma, and/or lymph node hyperplasia can result from trauma, and may cause obstruction of the appendix lumen. Our patient's pathological examination revealed that there was a mucosal hemorrhage on the tip of the appendix which was consistent with the mechanism proposed by Hennington et al.<sup>8</sup>

In pediatric emergency departments, BAT and AA are very frequent issues. Although rare, they might occur coincidentally in the same patient. This case report and review of the literature showed that occurrence of AA after BAT should be kept in mind by emergency physicians.

## Ethics

**Informed Consent:** Written consent was obtained.

**Peer-review:** Externally and internally peer-reviewed.

## Authorship Contributions

Surgical and Medical Practices: A.Ç., A.E., H.A., Ö.A., P.G., S.G., T.Ç., Concept: A.Ç., A.E., H.A., Design: A.Ç., A.E., İ.Ç., Data Collection or Processing: A.Ç., Ö.A., Analysis or Interpretation: A.Ç., A.E., H.A., Ö.A., P.G., S.G., T.Ç., Literature Search: A.Ç., A.E., T.Ç., Writing: A.E., İ.Ç.

**Conflict of Interest:** No conflict of interest was declared by the authors.

**Financial Disclosure:** The authors declared that this study received no financial support.

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