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Operative blunt duodenal injury in children: a multi-institutional review

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Abstract

Background/Aim: Operative blunt duodenal injury in children is rare. The purpose of this analysis is to describe the clinical presentation, current management, and outcome of children with operative blunt duodenal injury.

Methods: The American Pediatric Surgical Association Trauma Committee solicited data from its members on children with blunt intestinal injuries identified at autopsy or operation from January 2002 through August 2006.

Results: Fifty-four children from 16 hospitals with operative blunt duodenal injuries were identified: 0.67 patients per hospital per year. The most common mechanisms of injury were motor vehicle crashes (35%), bicycle crashes (22%), and nonaccidental trauma (20%). Forty-nine patients (90%) had positive physical examination findings on initial presentation, including peritonitis in 18 patients (33%). Twenty-five computed tomographic (CT) scans performed demonstrated free fluid, and 13 (52%), free air. Eleven CT scans used enteral contrast, and only 2 (18%) showed extravasation. Fifty-two patients (96%) survived to operation. The overall complication rate was 42%.

Conclusion: Operative blunt duodenal injury occurs less than once per year in the typical pediatric trauma center. Most of the patients have pertinent physical examination findings on arrival. Computed tomographic scans with enteral contrast do not seem to be helpful in diagnosis of duodenal injuries. Postoperative complications are frequent, but most children survive.

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Injuries to the duodenum are reported to occur in 2% to 10% of children with blunt abdominal trauma [1]. The most common mechanism associated with duodenal injury is a direct blow to the epigastrium with 25% injuries resulting from road traffic collisions and sports trauma (handlebar injury) [2]. When present, traumatic duodenal injuries present a diagnostic and surgical challenge. The reported morbidity and mortality are 48% and 19%, respectively, and increase when there is a delay in diagnosis [3,4]. There is substantial evidence to support the nonoperative management of duodenal hematomas; however, early recognition of those patients who require surgical treatment may be helpful in decreasing morbidity and mortality [1,5]. The purpose of this analysis is to describe the clinical presentation of children with operative blunt duodenal injury and its current management and outcome.

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1. Methods

The American Pediatric Surgical Association Trauma Committee solicited data from its members on children with blunt intestinal injuries. To avoid variation in radiographic diagnosis, only injuries identified at autopsy or operation from January 2002 through August 2006 were included. The following parameters were reviewed for each patient: demographics, mechanism of injury, hemodynamic status, physical examination findings, Glasgow Coma Score, laboratory values, radiologic imaging, number of associated injuries, management, and outcome. This study set is composed of children listed as having experienced a duodenal injury verified at the time of laparotomy or autopsy. All participating centers obtained institutional review board approval (Children's Hospital Boston protocol IRB-P00000436). The data were analyzed using PASW Statistics 18 (SPSS Inc, Chicago IL, USA), release 18.0.0. Values are presented as mean ± SD.

2. Results

Fifty-four children from 16 participating hospitals with operative blunt duodenal injuries were identified: 0.67 patients per hospital per year. The mean age was 8.35 ± 3.9 years (range, 3 months to 16 years), and 60% of injuries occurred in males. The most common mechanisms of injury were motor vehicle crashes (35%), bicycle crashes (22%), nonaccidental trauma (20%), and all-terrain vehicle crashes (12%). Table 1 summarizes the initial clinical presentations. Laboratory values obtained included white blood cell count 16.10 ± 4.57 K/μL and amylase 261 ± 285 U/L. Ninety percent of patients had positive physical examination findings, which included abdominal abrasions and contusions, seatbelt signs, handlebar marks, palpation, and percussion tenderness. It should be noted that 11 patients (20%) had a rigid abdomen and 10 (19%) were in hemodynamic shock at the time of presentation. Those patients in shock were taken directly to the operating room.

Preoperative imaging studies were performed in 36 patients (67%). Abdominal x-rays demonstrated free air in 36% of patients of those imaged with this modality. Twenty-five computed tomographic (CT) scans were performed, and all demonstrated free fluid; however, free air was noted in only 13 patients (52%). Of the 25 CT scans performed, 11 used enteral contrast in addition to intravenous contrast. Only 2 (18%) of the CT scans with oral contrast showed extravasation (Table 2). Associated solid organ injuries noted on initial CT scans included liver (n = 7), spleen (n = 3), kidney (n = 2), and pancreatic injuries (n = 2).

A laparoscopic exploration was attempted in 7 patients; however, they were all converted to open explorations. Information localizing the injury to a specific duodenal portion was not provided in this review. Isolated duodenal injuries were found in 39 children (75%) with 27 (70%) having full-thickness tears. Repair of full-thickness tears was performed primarily in 16 children (60%) and required duodenal resection with reconstruction in 11 (40%). There were 12 patients (30%) who were noted to have duodenal serosal hematomas with other associated hollow viscus injuries; of these, most did not require any intervention except for 2 who underwent evacuation of the hematoma and 1 who had a bolstering procedure with omentum to reinforce the bowel wall.

Postoperatively, parenteral nutrition was used in 40 patients (76%). The mean number of days on parenteral nutrition was 15.03 ± 7.80. The mean number of days to achieve full enteral intake was 24.91 ± 20.36. Table 3 summarizes early and late complications. The overall complication rate was 42%, but nearly half of these consisted of a postoperative prolonged ileus, which was defined as lasting more than 7 days. Wound infections occurred in less than 10% of children, and postoperative abscesses (3%) and fistulae (4%) were thankfully less common. Patients had a mean length of hospital stay of 20.7 ± 11.6 days.

Fifty-two patients (96%) survived to operation, and 2 patients died before surgical management. The first mortality occurred in a patient who arrived to the emergency department in extremis, and the other occurred in a patient

Table 1 Presenting signs and symptoms in children with duodenal trauma (n = 54)

GCS, mean ± SD	13.8 ± 2
ISS, mean ± SD	17.4 ± 8.3
Pulse, mean ± SD	112 ± 30
BP (mm Hg), mean ± SD	104 ± 13/61 ± 10
RR, mean ± SD	22 ± 5.9
Patients with positive physical examination findings (abdominal abrasions and contusions, seatbelt sign, handlebar marks, abdominal tenderness), n (%)	49 (90)
Patients with rigid abdomen, n (%)	11 (20)
Patients in hemodynamic shock, n (%)	10 (19)

Abbreviations: GCS, Glasgow Coma Scale; ISS, Injury Severity Score; BP, blood pressure; RR, respiratory rate.

Table 2 Imaging studies in children with blunt duodenal injuries

Imaging study	Finding	n (%)
Abdominal x-ray (n = 11)	Free air	4 (36)
CT abdomen (n = 25)	Free fluid	25 (100)
	Free air	13 (52)
	Bowel wall thickening	13 (52)
	Mesenteric hematoma	2 (8)
CT abdomen with oral contrast (n = 11)	Contrast extravasation	2 (18)

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