

ORIGINAL RESEARCH

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Pancreatic injury due to blunt abdominal trauma in children**Burhan Beger¹, Baran Serdar Kizilyildiz², Metin Simsek³, Huseyin Akdeniz⁴, Bulent Sonmez⁵**¹*Van Yuzuncuyil University Medicine Faculty, Department of Pediatric Surgery, Van, Turkey*²*Van Training and Research Hospital, Clinic of Pediatrics, Van, Turkey*³*Van Training and Research Hospital, Clinic of Pediatric Surgery, Van, Turkey*⁴*Van Yuzuncuyil University Medicine Faculty, Department of Radiology, Van, Turkey*⁵*Van Yuzuncuyil University Medicine Faculty, Department of Pediatric, Van, Turkey*

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Abstract

The diagnosis and management of pediatric pancreatitis is often difficult. Blunt abdominal trauma is one of the most common causes of pancreatitis in childhood. This is a review of patients with blunt pancreatic trauma. Medical records of all children with blunt pancreatic trauma who were admitted to our clinic between July 2007 and December 2017 were analyzed retrospectively. There were 17 patients (7 girls, 10 boys) with a mean age of 9.89 ± 2.57 years (range, 3-14 years). The time from trauma to admittance to the clinic was mean 17 ± 21.43 days (range, 0-63 days). The mechanism of injury was bicycle injuries in 7 (41.66%), a fall from height in 6 (35.29%), motor vehicle accidents in 3 (17.64%), and a fall from a horse in 1 (5.88%). All patients had serum pancreatic amylase elevation on admission (average, 1002.71 ± 966.36 IU/L; range, 116-3163 IU/L). All the children were initially managed non-operatively. In 8 patients (52.94%) the traumatic pancreatitis was complicated by development of a pseudocyst. The average diameter of the pseudocyst was 11.5 ± 3.45 cm. The pseudocysts were resolved in 5 cases with percutaneous ultrasonography-guided fluid drainage and the remaining 3 required open surgery (2 cystogastrostomy, 1 surgical drainage). The average length of hospital stay was 18 ± 15.91 days (range, 2-48 days). There were no deaths and no complications in any patients. Non-operative management of traumatic pancreatitis in the absence of complete duct transection is safe in children. Percutaneous drainage of traumatic pancreatic pseudocysts can be used as an effective and useful treatment option.

Keywords: Pancreas, blunt abdominal trauma, pediatric, pseudocyst**Introduction**

Pancreatitis is characterized by tissue edema, infiltration by leukocytes, necrosis, and hemorrhage within the pancreatic parenchyma [1]. The leading causes of pancreatitis in childhood are drugs, systemic diseases, biliary infections, idiopathic, trauma and anatomic anomalies such as choledochal cysts and abnormal union of the pancreatobiliary junction [1,2].

Blunt abdominal trauma accounts for approximately 85% of the abdominal injuries in children [3]. In addition, it is one of the most common causes of pancreatitis, reported as 10%-40% of all cases in different studies [1,4].

Pancreatic injury secondary to trauma is the fourth most common solid organ injury, following the spleen, liver and kidney injury, and is frequently associated with other clinically important injuries (ie, orthopedic, gastrointestinal, and urinary tract) [4,5]. However,

great advances have been achieved in the management and imaging of children with blunt abdominal trauma which has led to a sharp decline in laparotomy rates. The diagnosis of pancreatic injury may be difficult, because as a retroperitoneal organ the symptoms and signs can be ambiguous and severe parenchymal or ductal injuries may exist despite normal laboratory or radiographic findings [3,5]. In addition, appropriate treatment of pancreatic injury secondary to blunt trauma in children is still controversial. However, several studies have shown that non-operative management has good clinical outcomes with minimal morbidity and mortality [2,5,6].

The aim of this study was to report our experiences of pancreatic injury secondary to blunt abdominal trauma in children and to discuss the benefits of non-operative management of this clinical condition.

Material and Methods

Medical records of all children under 15 years old with pancreatic injury due to blunt abdominal trauma who were admitted to our clinic between July 2007 and December 2017 were analyzed retrospectively. They were evaluated in terms of age/ gender,

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mechanism of injury, management, hospitalization and treatment of complications (Table 1).

Table 1. The table of patients which shows age, gender, mechanism of the injury, hospital stay and complications and management

Case No	Age/Gender	Mechanism of Injury	Hospital stay (days)	Complication	Treatment of Complication
1	12,5/M	Motor vehicle	17	Pseudocyst	Cystogastrostomy
2	9,2/M	Bicycle	4	no	Medical
3	8,6/M	Bicycle	3	no	Medical
4	9,8/M	Fall off a horse	27	Pseudocyst	Percutaneous drainage
5	12,8/F	Bicycle	17	Pseudocyst	Percutaneous drainage
6	6/F	Bicycle	16	Pseudocyst	Percutaneous drainage
7	7,7/M	Bicycle	48	Pseudocyst	Percutaneous drainage
8	5,8/F	Fall	37	Pseudocyst	Cystogastrostomy
9	14/M	Fall	37	Ruptured Pseudocyst	Surgical drainage
10	10/M	Fall	2	no	Medical
11	11/M	Fall	6	no	Medical
12	11/M	Motor vehicle	2	no	Medical
13	4/M	Fall	8	no	Medical
14	16/F	Bicycle	7	no	Medical
15	3/F	Fall	6	Pseudocyst	Percutaneous drainage
16	9/F	Motor vehicle	11	no	Medical
17	8/F	Fall	12	no	Medical

In our clinic, patients with blunt abdominal trauma were routinely checked for serum amylase-lipase levels together with other routine laboratory tests. Radiological diagnosis was put with FAST(focused abdominal sonography) and computered tomography after first aid and stabilization of patients. In hemodynamically stable patientes with suspicion of ductal injury, MRI examination was performed. Patients were divided into two groups; as early applied patients (on the day of the trauma) and the delayed applied patients (more than one day after trauma). Explorative laparotomy was planned in the hemodynamically unstable patients or serious suspicion of complete ductal injury. Conservative approach was preferred in all stable patients who were applied following days after trauma.

Results

There were 17 patients (7 girls, 10 boys) with a mean age of of 9.89 ± 2.57 years (range, 3-14 years). The time from trauma to admittance to the clinic was mean 17 ± 21.43 days (range, 0-63 days). The mechanism of injury was bicycle injuries in 7 (41.66%), a fall from height in 6 (35.29%), motor vehicle accidents in 3 (17.64%), and a fall from a horse in 1 (5.88%). At initial presentation, all patients complained of abdominal pain, and 6 had abdominal tenderness, and abdominal mass in 3 on physical examination. Pancreatic injury was documented by elevated serum amylase level, imaging by computed tomography (CT) and ultrasonography (Figure 1). All patients had serum pancreatic amylase elevation on admission (average, 1002.71 ± 966.36 IU/L; range, 116-3163 IU/L). All the children were initially managed non-operatively. In 8 patients (52.94%) the traumatic pancreatitis was complicated by development of a pseudocyst. The average diameter of the pseudocyst was 11.5 ± 3.45 cm. The pseudocysts were resolved in 5 cases with percutaneous ultrasonography-guided fluid drainage and the remaining 3 required open surgery (2 cystogastrostomy, 1 surgical drainage). The average length of hospital stay was 18 ± 15.91 days (range, 2-48 days). There were no deaths and no additional complications in any patients.

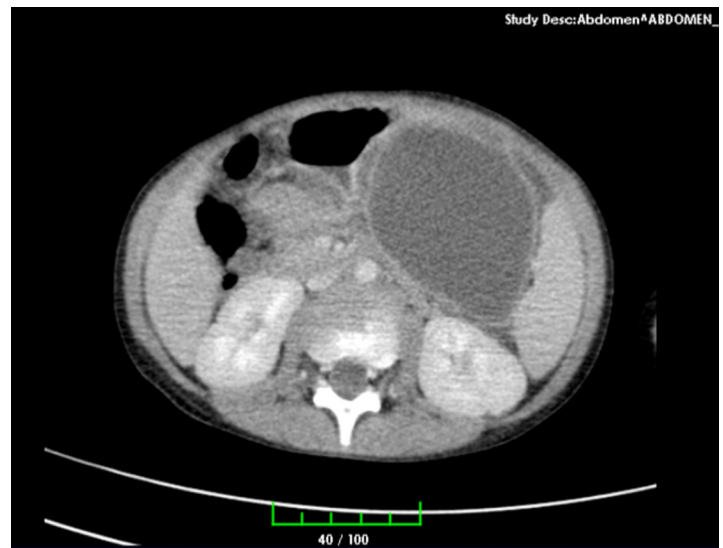


Figure 1. CT scan shows pseudocyst



Figure 1. Handlebar mark on upper quadrant

Discussion

Trauma can be seen in 10%-40% of children with acute pancreatitis. The most common causes in children are motor vehicle crashes, sports injuries, run-overs, accidental falls and sexual abuse [1,7]. In the current study, bicycle-related injuries and falls were the most common causes of pancreatic injury.

Bicycling is a good form of sport as well as a means of transportation worldwide but also entails some risks of trauma [8]. Bicycle-related injuries are one of the leading causes of emergency department visits for children with mortality incidence of 900 deaths per year and approximately 1.2 million physician visits per year reported in the United States [8,9].

The main mechanism of injury when cycling is the handlebars striking the body. Namely, after the child has lost control of the bicycle, the front wheel rotates and becomes perpendicular to the body and so the rigid edge of the handlebars can cause serious truncal injury [10].

A review of literature for blunt abdominal trauma related to bicycle accidents revealed that pancreatic injury is a rare condition. Shah reported that fractures (52.9%) were the leading injury pattern followed by traumatic brain injury (33.7%) including skull fractures and intracranial injury in children. Thorax, abdomen, and pelvic injuries were encountered in 15.5% of hospitalized children [9]. Alkan reported 3 pancreatic lacerations after blunt trauma from a bicycle handlebar in a study of 8 children [11]. Similarly, in another study of 32 children with injuries related to handlebars, 3 had traumatic pancreatitis and 2 had transection of the pancreas [12].

The diagnosis of pancreatic injury requires a substantial degree of suspicion [4] as there are no specific physical signs or laboratory findings and therefore diagnosis is often delayed [13].

Elevated amylase levels have low specificity and sensitivity in traumatic pancreatitis but elevated serum amylase levels should still suggest pancreatic injury [14].

In previous reports, repeated serum amylase levels associated with severe injury have been reported to be statistically significant [5] but amylase levels have failed to predict or correlate with the degree of injury or reveal potential ductal disruption, especially when obtained in the early post-trauma period [5,13]. Repeated amylase values are important in the absence of emergency laparotomy, when radiographic images are inconclusive, and in children with ongoing abdominal pain. Serum lipase levels after blunt abdominal trauma are non-specific and poor indicators, but they are frequently used clinically for acute pancreatitis [5]. Elevated levels of lipase may provide a clue to a severe injury requiring further investigation [14].

In the diagnosis of pancreatic injury, ultrasonography is easy to perform and cost-effective, but its use is limited due to the presence of gastrointestinal gas [13,15]. However, it is useful for the detection of pancreatic ascites and pseudocyst formation, which often occur in cases with traumatic pancreatitis [15].

In hemodynamically stable patients, computed tomography can show pancreatic injuries in detail with 80 % specificity [16]. If the

CT is performed earlier than 12 hours after the pancreatic trauma, the results can be deceptive because soft tissue changes may be delayed [13,15].

In the past, ERCP was the only method available for evaluating pancreatic duct integrity. More recently MRCP has been used as an alternative, non-invasive diagnostic tool for direct imaging of the pancreatic duct and it is being used more frequently to assess injury to the ductal component [15].

In parallel with the radiological developments, the pathophysiology of blunt abdominal trauma has become better understood and this has reduced the laparotomy rates [3]. Although there are some consensual treatment methods for adults, it is difficult to establish a clear treatment protocol for children [2].

The management of pancreatic injury secondary to blunt abdominal trauma still remains controversial [6,14]. Most authors have accepted that non-operative management should be the first choice of treatment in grade 1 and 2 pancreatic injury. However, in grade 3 and 4 injuries, which show proximal transection or parenchymal injury with probable duct injury or combined pancreatic and duodenal injury, many centres have recommended an aggressive surgical approach to minimize the incidence of later pseudocyst formation and prolonged hospitalization [5,6,14,16].

Non-operative management has become the standard care of most solid organ injuries in hemodynamically stable children but in the treatment of pancreatic injury it is controversial [6]. Non-operative management of pancreatic trauma has been reported to be associated with minimal morbidity and mortality [4,6,17]. In cases of pancreatic injury, non-operative management consists of fasting, total parental nutrition, octreotide, antibiotherapy for secondary microbial infections and serial radiological imaging and clinical observation to be aware of complications [4].

Octreotide is a synthetic somatostatin analogue that inhibits pancreatic secretions, but its effects are controversial [4]. Non-operative treatment is the first choice in Grade 1-2 injuries and the main debate concerns grade 3-4 injuries. Authors who have suggested aggressive surgery claim that surgery may reduce complications, morbidity and a long hospital stay [16,17]. Others recommend non-operative treatment in absence of complete duct transection. But, potential complications that can be treated with a minimally invasive approach should be kept in mind. [16].

The most important complication after blunt pancreatic trauma is the development of pseudocysts, for which the reported incidence is high (range, 44%-56%) [4,6] and it has been associated with grade 3-4 pancreatic duct injury [6]. Pseudocysts are localised collections of pancreatic secretions, lacking an epithelial lining, which occur secondary to pancreatic inflammation or ductal disruption. [18]. Other complications are abscesses and duct stricture, including peritonitis, intestinal obstruction, gastrointestinal bleeding, endocrine or exocrine insufficiency, splenic artery pseudoaneurysm formation or rupture and splenic vein thrombosis [15].

The size of the pseudocyst is important in respect of the treatment, which can be planned for pseudocysts >6cm that do not resolve spontaneously over 6 weeks. In a previous study all ruptured cysts were reported to be >10 cm in diameter [18]. CT-guided drainage,

ultrasonography-guided drainage, and cystogastrostomy are methods performed in the treatment of pseudocyst.

To limited of our study; all of the patients who applied to our clinic were hemodynamically stable and non of them had complete ductal duct injury. So we could treat them all conservatively.

Conclusion

In conclusion, the diagnosis of traumatic pancreatitis due to blunt abdominal trauma requires a high level of suspicion. Non-operative management of traumatic pancreatitis in children is safe in the absence of complete duct transection, with close monitoring for potential complications and there is minimal morbidity. Percutaneous drainage of traumatic pancreatic pseudocysts can be used as an effective and useful treatment option. The use of octreotide in pseudocysts <6 cm may provide spontaneous resolution.

Competing interests

The authors declare that they have no competing interest.

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Ethical approval

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