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MODERN TREATMENT OF BLUNT PANCREATIC INJURIES IN CHILDREN

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Blunt abdominal traumas constitute the largest portion of intra-abdominal injuries in children. According to their frequency, pancreatic injuries are in the fourth place behind the rupture of the spleen, liver and kidneys. Surgical treatment of minor pancreatic injury is well accepted in clinical practice. Treatment of severe injury with capsular, ductal and parenchymal disruption of the pancreas is controversial and delicate because it requires surgical treatment in strictly selected cases. Posttraumatic pancreatic pseudocysts are the most common complications of traumatic lesions of the pancreas. Proper consideration with correct therapeutic approach in the choice of nonoperative surgical methods of treatment in blunt pancreatic injuries is crucial for the reduction of morbidity and mortality in the pediatric population. *Acta Medica Medianae 2015; 54(2):48-51.*

Key words: *trauma, abdomen, pancreatic pseudocyst*

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Introduction

Pancreatic pseudocyst can be a complication of pancreatitis or abdominal trauma. Pseudocyst as a complication of pancreatitis occurs in about 10 -23% of cases, while the incidence is significantly higher (50-65%) when it comes after abdominal trauma. Typically, pseudocysts are the result of traffic accidents and bicycle handlebar injuries (1,2).

By obstruction or disruption of channels, liberated inactive enzymes are activated in the parenchyma of the pancreas, causing its auto-digestion, inflammation and necrosis. Localized collection of pancreatic secretions, limited with granulomatous tissue within the pancreas can form pseudocysts.

So far, most classifications have been based on pathoanatomical substrate. However, one of the latest proposed by D'Egidio et al. is based on the pathoanatomical changes in the ductal system of the pancreas, which determines the treatment (3).

CT provides the most precise information on the form of pseudocysts, size, location, communication, and is useful in determining the choice of therapeutic procedure. MRCP magnetic resonance holangiopancreatography is less invasive and can present ductal dilatation or stricture and pseudocysts (4,5).

The treatment can be nonoperative (conservative) or surgical. Surgical treatment of pancreatic pseudocysts should be undertaken in order to avoid possible complications such as rupture, hemorrhage, infection. Type of surgical treatment depends on several factors: size of pseudocyst and its position with regard to abdominal organs, abdominal wall and clinical symptoms. Pseudocyst less than 5cm may be observed in 4-6 weeks, with a possibility of spontaneous resolution. If it exceeds 5cm, surgical therapy is necessary. Pancreatic pseudocysts, older than 3 months, are best treated surgically. External, percutaneous US-guided drainage and endoscopic drainage nowadays are the two most trendy and safe procedures applied in the pediatric population.

Aim

The aim of this study was to present our experience with the treatment of pancreatic pseudocysts in children up to the age of fifteen, caused by blunt abdominal trauma.

Materials and methods

Retrospective analysis included eleven children hospitalized at the Department of Pediatric Surgery in the period from April 2006 to August 2010. Pancreatic injuries were determined by taking careful history and performing clinical examination, laboratory analyses (elevated serum amylase), computed tomography (CT), nuclear magnetic resonance (MRI), intraoperative findings and classification given by the American As-

Table 1. AAST classification of pancreatic injuries

Grade	Description of injury
Hematoma	Minimal contusion without ductal injury
Laceration	Laceration on the surface without ductal injury
II Hematoma	Major contusion without ductal and parenchimal injury
Laceration	Major laceration without ductal and parenchimal injury
III Laceration	Distal transaction or parenchymal injury with duct injury
IV Laceration	Proximal laceration or parechymal injury with injury of ampulla
V Laceration	Massive disruption to pancreatic head

sociation for Surgery of Trauma (AAST) (6). The study analyzed gender, age, mechanism of injury, time since injury and hospitalization, serum amylase, applied diagnostic procedures, associated injuries, number, frequency and treatment of posttraumatic pseudocysts. Pancreatic injury grade was established on the basis of the above diagnostic procedures and direct intraoperative visualization based on pre-established criteria (Table 1). Children with high levels of serum amylase after abdominal trauma were classified in the first degree of injury even when there were no radiological and surgical signs of violation of the pancreas.

Results

Out of eleven hospitalized children, there were six girls (54.5%) and five boys (45.5%) aged from three to fifteen years, aged 8 years on average. The most common mechanism was bicycle handlebar injury to the abdomen in nine patients (81.9%). One injury was caused by traffic accidents (9.1%) and one more by fall on a hard surface (9.1%) (Table 2).

Table 2. Mechanism of injuries

Mechanism	Number of patients	%
Handlebar injuries	9	81.9
Traffic accidents	1	9.1
Fall on hard surface	1	9.1
Total	11	100

Table 3. Serum amylase levels on admission, after 24 and 48 hours

Amylase	Range(U/L)	Average
On admission	49,2-701	402,3
After 24 h	77-1035	610,6
After 48 h	212-3445	820,0

Table 4. Levels of amylase in serum of patients with pseudocyst in the first 48 hours

Amylase	Range(U/L)	Average
On admision	95-175	124
After 24 h	77-993	613
After 48 h	476-3445	2023

Table 5. Levels of lipase in serum of patients with pseudocyst in the first 48 hours

Lipase	Range(U/L)	Average
On admision	76-224	127,5
After 24 h	81-722	360,2
After 48 h	93-924	405,5

The average time from the moment of sustaining an injury until admission was 65 minutes. Seven patients (63.6%) came from urban areas and four from rural areas (34.6%). Isolated pancreatic injuries were registered in eight children (72.7%), while the associated injuries were recorded in three patients (27.3%) and included: liver injury in one child (9.1%), two spleen injuries (18.2%), stomach injury (9.1%) and a violation of the kidney (9.1%) in one patient, respectively.

In all hospitalized children, serum amylase was determined after admission, after 24, 48 hours and in the further course of hospitalization. Hospitalized children had elevated serum amylase, with the admission value ranging from 49-701 U/l (average 402.3/L). In the first 24 hours, the values ranged from 77 to 1035 U/L, (average of 610 U/L). The values after 48 hours ranged from 212 to 3445 U/L (Table 3).

Children who developed pancreatic pseudocysts were analyzed separately, and their values of serum amylase were high, ranging from 95 (on admission) to 3445 U/L (after 48h). (Table 4). Due to the higher sensitivity in patients with pancreatic lesions, serum lipase were determined and they ranged from 76 (on admission) to 924 U/L (after 48h) (Table 5).

All hospitalized children were diagnosed in the first 24 hours by US and MRI. US has its own importance in the further continuous monitoring of patients who developed posttraumatic pancreatic pseudocyst. MRI specified the degree of injury. Gr I injuries were recorded in seven children (63.6%), Gr III in three (27.3%), while one child had Gr IV injuries (9.1%). Three patients underwent surgery because of associated abdominal injuries. One patient had Gr III pancreatic injury associated with liver and stomach injuries, while two patients had associated injuries of the spleen and kidney. In a child with liver and stomach injury, pancreatic pseudocysts with fistula were developed in the region of the operative laparotomy. In a child with concomitant splenic injury, open pseudocyst drainage was performed, while in the child with Gr

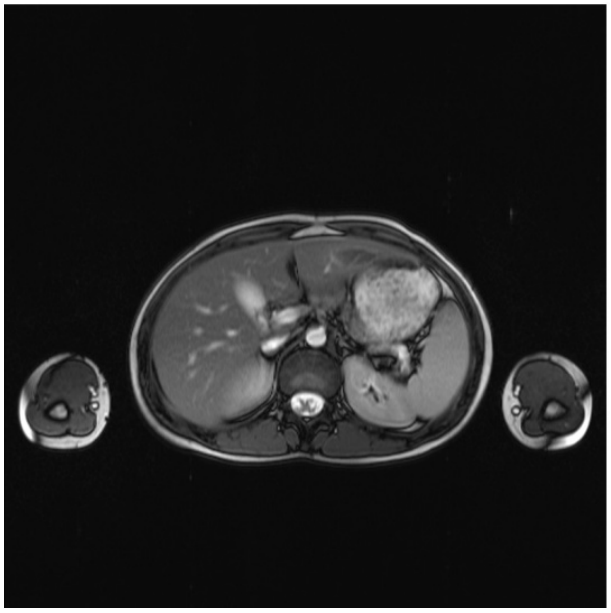

Figure 1. Pancreatic pseudocyst treated nonoperatively

IV pancreatic injury associated with spleen and kidney injury distal spleno-pancreatectomy was performed. Seven children with Gr I injury had not developed pseudocysts. Four children (36.4%) had posttraumatic pancreatic cyst, while in one patient with Gr IV injury (9.1%) with pseudocysts the accompanying fistula had achieved spontaneous resolution (Figure 1).

Two children (18.2%) underwent percutaneous drainage of a pseudocyst under ultrasound control.

In our results, pseudocyst size ranged from 31x23x21mm to 70x110x120mm at most. The mean size of pseudocyst which requires drainage was greater than 10cm.

Discussion

Blunt pancreatic trauma occurs as result of the spinal column compression to the pancreas (at the junction of the pancreatic body and tail) (1). Nearly half of all pancreatic injuries in children occur at the age of 5-9 because it is the period of greatest children's activities. As compared to the adult population, pancreatic injuries in children are isolated in 62-73% of patients. In our material, isolated pancreatic injuries occurred in eight children (72.7%). Abdominal pain, nausea, vomiting and febrile episodes should arouse the suspicion of a violation of the pancreas. Unfortunately, physical examination and labora-tory analysis of pancreatic injuries are not specific and sensitive enough. Also, the initial absence of major bleeding can lead to delays in diagnosis. Initial elevation of serum amylase in 70% of children, with an increasing trend in the first 24-48 hours, is not often correlated with the severity of pancreas injuries. Higher serum values are recorded in those with more severe injuries compared to those who have minor injuries. The persistent increase in amylase is found in all children who developed pseudocyst, which was also reported in results. Numerous studies suggest the advantage of nonoperative treatment because of a smaller percentage of mortality and no residual morbidity (7-10). The main goal of conservative treatment is to achieve adequate rehydration, analgesia, pancreas rest and the achievement of metabolic homeostasis. In our study, in therapeutic approach we used antacids, proton pump inhibitors, H2 antihistamines with analgesics and accompanying antibiotic prophylaxis. Gastric secretion must be reduced to a minimum, because the acidity in the duodenum is the main stimulus of pancreatic secretion. Octreotide acetate and its analogues in the pediatric population is based on the therapeutic results in adults. Growth control of pseudocysts and ductal recovery is controlled by pancreatic secretion (11).

The inhibition of pancreatic secretion was dose-dependent, with 15 micrograms per kilogram of body weight per hour, which is more than sufficient to reduce the concentration of protein and pancreatic output. In Gr I and Gr II pancreatic injuries, conservative methods of treatment are absolutely acceptable. The complexity and severity of the decision focuses on Gr III and Gr IV injuries. The most important complication of blunt pancreatic trauma is pseudocyst. In our series, posttraumatic pseudocyst occurred in four cases (36.3%), which indicates a high incidence.

One pseudocyst was localized anteriorly, one in the area of bursa omentalis. Next two cysts had lateroventral position in the region of pancreatic tail. Spontaneous resolution of the pseudocyst required 25 days with the use of octreotide acetate and TPN. Successful percutaneous drainage of pseudocysts was done in two cases, with no adverse complications and recurrence, although there are studies that do not favor an open drain due to therapeutic errors and recurrence (12).

Conclusion

Pancreatic trauma in children is rare, generally due to blunt trauma and is generally isolated without associated intra-abdominal injuries. The majority of injuries is sustained by bike handlebars and are more common in children in the urban areas. Diagnostic methods except laboratory analyzes are US, CT and MRI. Treatment of pancreatic injury is generally conservative (inoperable), and it is primarily for the Gr I and Gr II pancreatic injuries, while Gr III and Gr IV injuries in hemodynamically unstable children must be treated surgically especially if those are associated injuries. As for the pseudocysts of the pancreas, as well as complications of blunt pancreatic trauma, they usually can be treated conservatively. The degree of modern diagnostics of pancreatic injury using concomitant therapy procedures, efficient and timely assessment greatly reduces the morbidity and mortality due to blunt pancreatic injuries in

the pediatric population.

Morbidity and mortality rate in blunt pancreatic injuries in the pediatric population is significantly reduced due to precise grading of pancreatic injury, efficient and timely assessment, and modern therapy concept.

References

1. Arkovitz MS, Johnson N, Garcia VF. Pancreatic trauma in children mechanismus of injury. J Trauma 1997; 42:49-53. [CrossRef] [PubMed]
2. Jacombs AS, Wines M, Holland A, Ross FI, Shun A, Cass DT. Pancreatic trauma in children. J Pediatr Surg 2004; 39:96-9. [CrossRef] [PubMed]
3. D'Edigio A, Schein M. Pancreatic pseudocysts: a proposed classification and its management implications. Br J Surg 1991; 78: 981-4. [CrossRef] [PubMed]
4. Jurkovich GJ, Carrico CJ. Pancreatic trauma. Surg Clin North Am 1994; 70:575-93. [PubMed]
5. Ahmed N, Vernick JJ. Pancreatic injury. South Med J 2009; 102(12):1253-6. [CrossRef] [PubMed]
6. Moore EE, Cogbill TH, Malangoni MA, Jurkovich GJ, Champion HR, Gennarelli TA, et al. Organ injury scaling, II: pancreas, duodenum small bowel, colon and rectum. J Trauma 1990; 30:1427-9. [CrossRef] [PubMed]
7. Mattix KD, Tataria M, Holmes J, Kristoffersen K, Brown R, Groner J, et al. Pediatric pancreatic trauma predictors of nonoperative managements failure and asociated outcomes. J Pediatric Surg 2007; 42:340-44. [CrossRef] [PubMed]
8. Shilyansky J, Sena LM, Kreller M, Chait P, Babyn PS, Filler RM, Pearl RH. Nonoperative management of pediatric injuries in children. J Pediatric Surg 1998; 33:343-9. [CrossRef] [PubMed]
9. Keller MS, Stafford PW, Vane DW. Conservative management of pancreatic trauma in children. J Trauma 1997;42:1097-100. [CrossRef] [PubMed]
10. de Blaauw I, Winkelhorst JT, Rieu PN, van der Staak FH, Wijnen MH, Severijnen RS, et al. Pancreatic injury in children good outcome of nonoperative treatment. J Pediatr Surg 2008; 43:1640-3. [CrossRef] [PubMed]
11. Heikenen JB, Pohl JF, Werlin SL, Bucuvalas JC. Octeroide in pediatric patients. J Pediatr Gastroenterol Nutr 2002; 35:600-9. [CrossRef] [PubMed]
12. Karaguzel G, Senocak ME, Büyükpamukçu N, Hiçsönmez A. Sugical management of the pancreatic pseudocyst in children a long term evaluation. J Pediatr Surg 1995; 30:777-800. [CrossRef] [PubMed]

SAVREMENI TRETMAN TUPIH POVREDA PANKREASA KOD DECE

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Tupe traume abdomena su najčešće procenat intraabdominalne povrede kod dece. Povrede pankreasa nalaze se na četvrtom mestu po učestalosti povređivanja svih organa, iza povreda slezine, jetre i bubrega. Neoperativni tretman minimalnih povreda pankreasa je dobro prihvaćen u kliničkoj praksi. Tretman težih povreda sa kapsularnom, duktalnom i parenhimskom disrupcijom pankreasa kontroverzan je i delikatan, jer zahteva operativni tretman u strogo selektovanim slučajevima. Posttraumatske pseudociste pankreasa najčešće su komplikacije u traumatskim lezijama pankreasa. Pravilno sagledavanje i ispravan terapijski pristup u izboru neoperativnih operativnih metoda lečenja kod tupe povrede pankreasa osnova su za smanjenje morbiditeta i mortaliteta u pedijatrijskoj populaciji. *Acta Medica Medianae 2015;54(2):48-51.*

Ključne reči: *trauma, abdomen, pseudocista, pankreas*