

## Serum Amylase, Lipase and Urine Amylase as Predictor Factors for Outcomes of the Children with Blunt Abdominal Trauma

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### Abstract

**Introduction:** Severity of injury and serum amylase and lipase concentrations are parameters used to assess the grade of pancreatic injury. It is still unclear in what way amylase and lipase are related to the grade of injury or the injury outcome. We thus hypothesize that the serum amylase and lipase concentrations as well the urine amylase one maybe prediction biomarkers in blunt pancreatic trauma cases.

**Methods:** The study took place in a Tertiary Pediatric Hospital of Athens-Greece. The initial elevation of the serum amylase and lipase concentrations as well as the urine amylase ones were analyzed and related to age, ISS score and outcomes.

**Results:** Fifteen patients were included (eight males and seven females). The mean age was nine years old (3–15 years old) and the mean ISS score was 5 (2–9). Four patients developed post-traumatic pancreatic pseudocyst (P.P.C). Patients with increased serum amylase, lipase and urine amylase concentrations and ISS score more than 8 developed P.P.C.

**Conclusion:** The increased serum amylase and lipase values as well as the urine amylase ones, combined with a high ISS score grade may have prediction value in blunt pancreatic trauma cases

**Keywords:** Serum amylase; Lipase; Abdominal trauma

### Introduction

Blunt abdominal trauma is a frequent reason for hospital admission and a significant cause of death in children older than 1 year of age. Mechanisms causing abdominal injuries are predominantly motor vehicle accidents, falls, and intentional injuries [1]. Blunt upper abdominal trauma is the primary mechanism for pancreatic injury [2].

Pancreatic trauma is uncommon, having been reported to account for only 0.2%-6% across all abdominal trauma cases [2]. However, associated injuries are responsible for the high mortality rate of 13.8%-31% [3]. Furthermore, pancreatic injuries management remains challenging. Areas of uncertainty and controversy exist with respect to diagnosis, relevant prognostic factors and treatment. Thus, there has been an ongoing debate on the optimal approach to treating pancreatic injuries. Blood amylase and lipase are frequent and repetitive laboratory tests used to identify and manage traumatic pancreatic injury [4-8]. The utility and cost-effectiveness of serum amylase and lipase test as a screening tool for pediatric pancreatic trauma have been questioned by Adamson et al. [4], arguing for their low sensitivity and specificity. On the other hand, Matusno et al. [6] and Tsunemasa et al. [9] assessed the sensitivity and specificity of delayed amylase and lipase levels and suggested that they may be of some utility in identifying pancreatic injury cases.

The aim of our study is to assess the possible prognostic value of the serum amylase, lipase and urine amylase concentrations in the outcome of patients suffering from pediatric blunt abdominal traumas.

### Materials and Methods

All children, between 3 and 15 years old, with a suspected blunt abdominal trauma in their admission in our hospital during the period 2007–2013, were recorded. Patients that initially had elevated serum amylase and/or lipase concentrations were included in the study. Patients with viral infection and elevated enzymes were excluded. Gender, immunization status, medications, injury severity score (ISS) score and other coexisting epidemiological indicators were recorded. After the documentation all the patients with elevated enzymes and any complication from the trauma were included in the study. Pancreatic injury grades according to the American Association for the Surgery of Trauma guidelines were used. The study had conducted under the approval of the Hospital's Board of Ethics.

### Results

Fourteen patients (n=14) were studied, eight males and seven females (53 % males versus 46% females). Mean age was 9 years old (min: 3 years old, max: 15 years old) with peak age 4-5, 5 years old (Table 1). The participants were fully immunized and only 3 of the patients had coexisting health problems.

Sex	Age*	Peak
Male (n=8)	3-15	4-5,5
Female (n=9)	3-15	4-5,5

**Table 1:** Age and sex related with trauma, \*mean age 9 years old.

Four patients suffered from posttraumatic pancreatic pseudocyst (P.P.C), two males and two females. One male was treated with endoscopic transgastric drainage, one female with percutaneous drainage while the other two were treated conservatively with total parental nutrition and somatostatin administration. Patients with pancreatic pseudocyst had in their admission elevated blood amylase (higher than 1194 mg/dl), elevated blood lipase (higher than 5954 mg/dl) and elevated urine amylase (higher than 5900 mg/d) concentrations. I.S.S. score among these patients was more than 8. The rest of the patients didn't suffered from any complication (Table 2).

Blood (mg/dl)	amylase	Urine (mg/dl)	amylase	Blood (mg/dl)	lipase	ISS score
1993		5900		6543		8
145		752		81		4
211		618		515		4
109		69		69		2
125						2
397		3065		2621		4
995		17482		9489		4
3380		25430		12690		9
255		1269		383		4
1194		12870		5954		9
285		2459		730		4
1547		27340		14496		9
177		1898		303		4
165		474		858		4

**Table 2:** Enzyme measurements and ISS score related with trauma.

All of our patients underwent a follow up examination with abdominal ultrasound after their discharge. None of them develop any complication while the patients (n=13), treated conservatively after a few weeks presented complete recovery.

As for the I.S.S. score, all patients that developed P.P.C had I.S.S. score more than 8 while patients that not developed P.P.C had I.S.S. score less than 8 (Table 2).

## Discussion

Blunt abdominal trauma occurs in 10 to 15 percent of injured children [10]. Solid organ injuries are common in children who sustain major trauma, with isolated injury to the spleen occurring most frequently [11]. Injuries to the liver, spleen, and pancreas occur in two typical scenarios: isolated injury caused by a direct blow to the upper

abdomen, or multi-system trauma caused by high-energy mechanisms (eg, motor vehicle or all-terrain vehicle crash, fall from a great height) [10]. Isolated injuries to these organs are more common, but those associated with multi-system injury are more life-threatening with reported mortality as high as 12 percent [12].

Major pancreatic injuries are much less common than liver or spleen injuries. The clinical features include a history of a direct blow to the epigastrium with local pain and tenderness. The serum amylase and lipase are usually elevated [13]. The most useful test for suspected pancreatic trauma is computed tomography (CT) with fine cuts through the pancreas. Endoscopic retrograde cholangiopancreatography (ERCP) or magnetic resonance cholangiopancreatography (MRCP) does have a role when a major duct disruption is suspected based upon clinical findings and imaging [14,15]. Pancreatic injuries fall into three main groups (Table 3).

Grade	Description	AIS-90
I	Hematoma Minor contusion without duct injury	2
	Laceration Superficial laceration without duct injury	2
II	Hematoma Major contusion without duct injury or tissue loss	2
	Laceration Major laceration without duct injury or tissue loss	3
III	Laceration Distal transection or parenchymal / duct injury	3
IV	Laceration Proximal transection or parenchymal injury involving ampulla	4
V	Laceration Massive disruption of pancreatic head	5

**Table 3:** Pancreas injury scale, \*Advance one grade for multiple injuries up to grade III.

### Injury without major ductal disruption

This injury type comprises the largest group of patients with pancreatic trauma. Most cases have simple contusions or hematomas, although some probably have parenchymal disruption. The diagnosis is usually suspected on the basis of elevated serum amylase and lipase levels and is confirmed by CT, which shows swelling and hemorrhage in and around the pancreas, but no evidence of transection or other major parenchymal or ductal disruption. The treatment is non-operative, including restriction of oral intake initially, intravenous hydration, and parenteral nutrition. For example, in a case series of 43 children with pancreatic injury after blunt trauma, the 18 children with grade I injuries were all managed non-operatively without complications [8].

### Injury with major ductal disruption

Pancreatic trauma with ductal disruption is difficult to be suspected/ diagnosed/identified, although it is often suggested by CT. Reports argued the use of ERCP or MRCP to confirm the diagnosis [8,16]. Once it is accurately recognized (or in the early stages), distal duct disruption can be treated by distal pancreatectomy; proximal injuries can usually be managed with gut rest and observation [17], although some experts have recommended proximal ductal stenting [16]. Even if missed at an early stage, these injuries almost always resolve with gut

rest and total parenteral nutrition, although the course may be prolonged over many weeks. Pseudocysts develop in up to 50 percent of children with ductal disruption who are initially treated non-operatively and up to 10 percent subsequently require surgery [18].

### Pseudocyst

These patients mainly present anorexia, vomiting, weight loss, abdominal pain and tenderness, and a palpable upper abdominal mass, days to weeks after the injury. CT or ultrasound can be used to confirm the diagnosis. It is thought that these patients most likely suffered a major duct disruption at the time of the original injury, which had either been unsuspected or missed on the original diagnostic images. The treatment is conservative with gut rest, parenteral nutrition, and observation by serial ultrasound. Some resolve spontaneously, while the rest usually respond to external or internal drainage after a period of four to six weeks [18-20].

Injury Severity Scoring is a process by which complex and variable patient data is reduced to a single number. This value is intended to accurately represent the patient's degree of critical illness. In truth, achieving this degree of accuracy is unrealistic and information is often lost in the process of such scoring. As a result, despite the proposal of many score systems, all have both advantages and disadvantages. Some of the main inaccuracy reasons are the inherent anatomic and physiologic differences existing among patients. As a result, in order to accurately estimate patient outcome, we need an accurate and personalized quantification of patients' anatomic injury, physiologic injury, taking into account the possible pre-existing medical problems which negatively impact on the patient's physiologic reserve and ability to respond to the stress of the injuries sustained.

The results of this study are consistent with other literature data. Matusno and colleagues [21] suggested that a delayed (N2 hours) serum amylase and lipase level was predictive of pancreatic injury and correlated with the severity of the injury. Nadler et al reported that high (peak) amylase (N200 U/L) and lipase levels (N1800 U/L) were more consistent with major duct disruptions [7].

In our study, we found that initial values of serum amylase higher than 1194 mg/dl, and lipase higher than 5900 mg/dl, combined with urine amylase concentration higher than 5954 mg/dl and a I.S.S. score grade more than 9, are correlated to post traumatic pancreatic pseudocyst presentation.

The limitations of this study are inherent based on its limited patient number. We argue/advocate that these initial blood laboratory tests may be proved to be very useful to the prediction of posttraumatic pancreatic cyst complication/formation. However multicenter analyses are still needed, in order to confirm the utility of these tests for other pancreatic injuries in childhood as well.

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