Considerations and Evaluations on Abdominal Trauma in Pediatric Age.

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Abstract

Background: Trauma is the leading cause of morbidity and mortality in pediatric age.
Abdominal trauma is the third most frequent cause of trauma injuries in children.
The purpose of our study is to discuss BATp epidemiology and its relationship with polytrauma, , to recognize and describe the mechanisms of blunt abdominal trauma in pediatric age and to identify the signs and symptoms that associate it.
Material and methods: In this retrospective study we reviewed all patients with blunt abdominal trauma in pediatric age who presented in Emergency Department at the University Hospital of Trauma in Tirana, Albania in the period between December 1-st 2017 and June 24-th 2018. The sample in the study was taken randomly. The Injury Severity Score, Revised Trauma Score were used as important points to evaluate gravity of injuries, and method of treatment.
The data was introduced in absolute and percentage values and Kendal's tau b correlation coefficient and the regression analysis was used to analyze and to find out any association among the dependent versus independent variable. The type of study is case control with two components; descriptive and analytical.
Results: In the time period that we studied, about 25200 patients were presented in Emergency department and 6.68% of these cases were hospitalized. Most frequent causes were motor vehicle accidents (35.4%) and abdominal trauma comprised 25.8% of cases, whereas in children it comprised 13.7% of total pediatric trauma. We have found correlation between the injury severity score and complications rate ($r = 0.254$, $n = 49$, $p <0.001$), and injury severity score with length of hospital stay ($r = 0279$, $n = 49$, $p <0.001$).
Conclusions: Blunt Abdominal Trauma in pediatric age is a serious threat to the health of the children. Their treatment should be carried out not only in tertiary trauma centers but in every regional hospital. The trauma score is very valuable to determine the gravity of the injury, method of treatment and is a predictive tool in trauma outcomes.
Keywords: Blunt Abdominal Trauma, pediatric, abdominal injuries, trauma score, trauma assessment.

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Full Text

Introduction

Traumatic injuries are the most frequent cause of mortality and morbidity in children worldwide and are considered the major cause of deaths in developed countries [1, 3].

Trauma is the leading cause of mortality and morbidity in pediatric age, where the mortality rate reaches 8.5% [4]. Pediatric Trauma causes about 40% of deaths in children aged 1-4 years old and 70% of deaths for children 5-9 years old [2].

The most common injuries in children are the result of craniocerebral trauma (CCT), followed by locomotor trauma (LMT) and abdominal trauma (AT) [7]. The mechanism of injury is almost the same as in adult trauma, but it has its own specifications for each age group. The main causes of death in children by age group are: ***a - Minors*** - child abuse, asphyxia, motor vehicle accidents (MVA), fires; ***b - Preschool*** - fires, drowning in water, MVA; ***c - School age*** - bicycle accidents, pedestrian accidents; ***d - Teens*** - MVA, murders, suicides [9].

The cause of death comes as a result of respiratory compromise, hypovolemic shock, traumatic brain injury (TBI), all injuries that give metabolic hypoxia progressive and acidosis [11]. Distribution of injuries by age showed that greater damages were under the age of 6-7 years old [11].

Evaluation of causes of pediatric Blunt Abdominal Trauma (***BATp***) is a major point of discussion for activation of the trauma system. ***MVA*** are more favored in relation to pedestrian accidents, fall from heights (***FfH***) and being hit by solid objects (***HsO***) to cause intraabdominal injuries. [13, 14]

In some studies, it is concluded that the trauma from bicycle handlebars is responsible for and has a risk for intraabdominal injuries, especially pancreatic injuries. [17, 18]

Aim

Our aim is to achieve a comprehensive study on BATp cases in our hospital, to discuss BATp epidemiology and its relationship with polytrauma, to recognize and to describe the mechanisms that cause BATp, and to identify the assessment criteria for TP in the primary, secondary and tertiary evaluations. Our intention is to impart our clinical experience regarding primary, secondary and tertiary assessments, and our assessment of NOM or OM for traumatic injuries.

Objectives

The objective is to evaluate the pre-hospital management elements associated with the time of the accident, the mode of transport (ambulance, private car, or air transport), and the time of arrival at the ED, and their impact on the success of treatment.

The assessment of the patient-based hemodynamic status (HdSt) in the ED was done using the Allgower formula.

The centre of attention is on estimating the gravity of the injury and the prognosis of injuries, by using available formulas such as: *Abbreviated Injury Score* (AIS), *Injury Severity Score* (ISS), *Revised Trauma Score* (RTS) and *Trauma Injury Severity Score* (TRISS).

We also plan to evaluate the definite criteria for non-operative management (NOM) or operative management (OM) in relation to the ISS and to to identify BATp treatment strategies in order to make implementation easier on the surgeon given the urgency of polytrauma.
We will describe the ratio of solid organ injuries (SOI) to hollow visceral organ injury (HVI) in BATp, the success of BATp treatment depending on the time of presentation to the ED, and the success of BATp treatment depending on the presence of extra-abdominal injury (EAI) in polytrauma.
Furthermore, the success of BATp treatment will be examined with regards to the time of surgery, complications, the mechanism of trauma, HdSt, the mode of transport, the time of presentation to the ED, the ISS value, M&M associated with BATp and the correlation between them with the mechanism of injury, the time of arrival at the ED, the diagnostic level, the ISS, RTS, and TRISS scores, and the treatment strategy.

Materials and methods

This is a retrospective study that includes all children with BAT who presented to ED at the UHT in Tirana, Albania by 01/12/2017 - 24/06/2018.
The sample in the study was taken randomly.

Exclusion criteria

In our study we did not included patients that had TBI with GCS < 8 points, who didn't have intraabdominal injuries and children with the extremities fractures without intraabdominal injuries.

Data collection

For each trauma patient (TP), a previously approved study tip card was completed.
Study variables obtained from the clinical records included ***sex*** (*M, F*), ***age*** (*0-16 years old*), ***mechanism of injury*** (*a - MVA, b - FfH, c - HsO*), ***mode of transport*** (*a - private car, b - ambulance, c - helicopter*); ***time of presentation to the ED*** (a - immediately, b - after 6 h, c - more than 24 h), and the assessment of the patient's situation in the ED using the Allgower formula (FC/TA) in determining ***HdSt*** *(a - HdSt normal [(FC/TA) = 0.5], b - possible HdSt [(FC/TA) = 1], c - HdInSt [(FC/TA) = 1.5])*. Data from the ***AIS, ISS, RTS and TRISS*** scores were analysed online at www.traumaorg.com. In our study, ***the ISS value*** was divided into three groups (*a - ISS < 15, b - ISS 15-25, c - ISS > 25).*
Laboratory examinations were classified as routine or as a trauma evaluation (*complete blood count, haematocrit, complete urinalysis, liver and pancreatic enzymes, uraemia and creatine*). [9]
Special examinations: *FAST, CT scan, diagnostic peritoneal lavage (DPL), abdominal X-ray, chest X-ray, pelvic X-ray, LPD, cystography*.
Type of BATp (*a - pure, b - combined*): BATp combined with polytrauma, chest trauma (ChT), CCT, fracture of the extremities, pelvic fracture and vertebral fracture.
Mode of management (*non-operative and operative*): ***Treatment of BATp according to the time of surgery*** (*a - within 2 h, b - 2-6 h, c - 6-24 h, d – more than 24 h).*

Injured organs: Solid organ injuries (*spleen, liver, pancreas, and kidney*), Hollow viscus injuries (*stomach, intestine, urinary bladder*), retroperitoneal haematoma (*RPH*), Extra abdominal injuries (*ribs, thoracic-abdominal wall contusion, extremities fractures, pelvic fractures, vertebral fractures, major vessel injury*).
Type of operation performed: *spleen removal (splenectomy), liver suture, perihepatic packing, intestinal resection and anastomosis; colostomy, nephrectomy/suture of the kidney, diaphragm suture, chest drain.*
Length of stay (LOS) in hospital: *a - 0-1 days, b - 1-7 days, c - more than 7 days*.
Complication rate: a - early *(bleeding),* b - late (*sepsis, late bleeding, abscesses, pleural effusion, haemopneumothorax, subcapsular hematoma of the liver, acute respiratory failure (ARF), abdominal eventration, ileus, biliary fistula, acute renal failure(ARF), multiple organ dysfunction syndrome (MODS)).*
Time of death: a - early (*preoperative and perioperative period*), b - late (*postoperative period within 24 h, 24-72h, or more than 72 h*).
Cause of death: *acute irreversible shock, fibrinolysis, disseminated intravascular coagulation (DIC), traumatic brain injury (TBI), acute pulmonary thromboembolism (APT), MODS.*
All data were coded and analyzed by a computer.

Analysis

The discrete data (variables) are shown as absolute and percentage values.
Kendal's tau-b correlation coefficient was used to show connections between two variables.
Regression analysis was used to analyse the dependence of the dependent variable on the independent variables.
The magnitudes with central tendency are reported for numerical variables (arithmetic average, median and mode).
The respective frequencies and percentages are reported for categorical variables.
The data are presented in tables and graphs of different types.
Statistical significance was considered for p-values <0.05 (or 5%).
The statistical package SPSS (Statistical Package for Social Sciences, version 10.0) was used for all statistical analysis of the data.

Results

In the period under study, there were 25200 patients presented in ED and 1685 (6.68%) hospitalized patients, with the following causes of trauma: *a - MVA 598 (35.4%); b - FfH 452 (26.8%); c - HsO 593 (35.1%); d – (gunshot wounds) GSW 42 (2.4%).*
Regarding the sex distribution, 378 (22.4%) cases were female and 1307 (77.6%) of cases were male.
The distribution by age group for all hospitalized patients was: *a - 0-16 years old 231 (13.7%), b - 15-30 years old 547 (32.4%); c - over 30 years old 867 (51.4%).*
The mortality rate was 26 (3.7%), a satisfactory number under these conditions.
We had the following distribution regarding the hospitalized cases; *a- isolated or combined TBI with 583 (34.6%); b - LMT with 556 (33%); c – AT439 (25.8%); d - ENT with 107 (6.4%) of cases.*

Pediatric patients comprised 231 (13.7%) of total cases presenting in hospital. 70 pediatric patients were hospitalized and after the exclusion criteria only 49 patients were involved in the study.

The distribution of patients by age group is as following: *10-12 years old 8(16%) cases; 14 years old 6(12%) cases; 7 years old 4(8%) cases; 5, 6, 8, 12, 13, 15, 16 years old 3(6%); 11 years old 2(4%); 4 & 9 years old 1(2%) of cases.*

The mechanisms of BATp injury were: *a - MVA 27 (55%) cases, b - FfH 16 (33%) cases, c - HsO 6 (12%).*

Regarding the time of ED presentation: *a - immediately in 41 (82%), b - after 6 h in 5 (10%); c – greater than 24 h in 3 (8%) of cases.*

In our study, the mode of transport distribution was*: a – by private car in 26 (52%), b – by ambulance in 18 (36%); c - by helicopter in 5 (12%) cases.*

It was very important for us to evaluate the patient's situation in the ED using the Allgower formula (FC/TA) to determine the HdSt for this age group: *a - HdSt [(FC/TA) = 0.5] in 20 (40%); b – possible HdSt [(FC/TA) = 1] in 24(48%); c - HdInSt [(FC/TA) = 1.5] in 5 (10%) cases (see Table 1).*

The time of admission in ED	Nr of cases (%)	Mode of transport	Nr of cases (%)	HdCo ALLGÖWER Formula (HR/SBP)	Nr of cases (%)	Isolated BATp - 14(28%)		Combine BATp - 35(72%)	
						Mechanism of injury	Nr of cases (%)	Polytrauma	ChT
Directly	41 (82%)	private car	26 (52%)	0.5	20 (40%)	FfH	5 (10%)	6 (12%);	4 (10%);
after 6 h	5 (10%)	ambulance	18 (36%)	1.0	24(48%)	MVA +BA	3(6%) +4 (8%)	12 (26%);	6 (12%);
after 24 h	3 (8%)	helicopter	5 (12%)	1.5	5 (12%)	HsO	2 (4%)	5 (10%)	2 (4%)
Total	49(100%)		49(100%)		49(100%)		14(28%);	23(48%)	12 (24%)

MVA - Motor vehicle accident; FfH - Fall from Height; HsO - Hit with strong objects; HdCo - Hemodynamic Condition; BA – Bicycle accident; ED-Emergency Department; HR- Heart Rate; SBP - Systolic Blood Pressure; ChT- Chest trauma; BATp - Blunt Abdominal Trauma pediatrics age

Table 1: *Distribution of data for Trauma patient in ED*

Kendal's correlation coefficient showed that there was a statistically significant connection between the mode of transport and HdSt (r = 0.199, n = 49, p = 0.001), which means that appropriate transportation saves lives (see Table 2).

Transport mode	Koefficient of Correlation of Kendal's tau b	P value	Nr. of cases
HdCo in ED	0,199	0,001	49

HdSt - Hemodynamic Condition; ED-Emergency Department

Table 2: *Connections between the mode of transport and HdCo.*

In these pediatric patients, *a - pure BATp* was found in 14 (28%) cases while *b - combined BATp* was found in 35 (72%) cases.

The combined BATp distribution was: *a - combined with polytrauma in 24 (48%) cases and b - combined with TT in 11 (24%) cases.*
The mechanism of trauma in *pure BATp*, comprising 14 (28%) cases, was *FfH in 5 (10%) cases, bike accident (BA) in 4 (8%) cases, and MVA in 3 (6%) cases (each patient showed evidence of wearing a safety belt) and 4 - HsO in 2 (4%) cases.*
The mechanism of trauma in *combined BATp*, comprising 35 (72%) cases with polytrauma ***(1)*** *was MVA in 12 (26%) cases, FfH in 6 (12%) cases, and HsO with 5 (10%) cases.*
The mechanism of trauma in *pure BATp* cases with TT ***(2)*** have this distribution according to the damage mechanism was *MVA in 6 (12%) cases, FfH in 4 (10%) cases, and HsO in 2 (4%) cases.*

In our study, one important element was the use of laboratory examinations in NOM/OM cases including complete blood analysis (CBA) in 100% of all cases of our study and complete urine analysis in 85% of cases, particularly those with urinary tract trauma (UTT).
Skull x-ray (S-xr) was performed in 26 (15%) cases with polytrauma, particularly those with CCT. Chest x-ray (Ch-xr) was performed in 95 (74%) cases with TT.
Abdominal x-ray (A-xr) was performed in 78 (70%) cases with pure or combined BATp with a mechanism of injury suggesting the possibility of damaging cavitary organs (CO) or the possibility of fracture of the spinal column.
Pelvic x-ray (P-xr) was conducted in 22 (29%) cases where the clinical data or the damage mechanism supported it.
FAST was performed in 100 (96%) cases as it is an easy and rapid diagnostic method that has a high degree of sensitivity to trauma.
DPL (0/16%) was performed only in cases where it was impossible to perform other examinations. CT scans (70/50%) were performed depending on the HdSt and clinical and laboratory data.

Regarding the treatment strategy for this age group, *non-operative management (NOM)* was used in the same proportion as *operative management* (OM) ***(48% : 52%).***
A very important element in our study was the use of formulas such as *AIS, ISS, RTS and TRISS* in the assessment of the gravity of injury and the prognosis of injuries depending on the treatment strategy used, which we observed following OM and NOM.
In cases with NOM, when the ISS was over 15, the RTS score was proportional, while the TRISS score was inversely proportional.

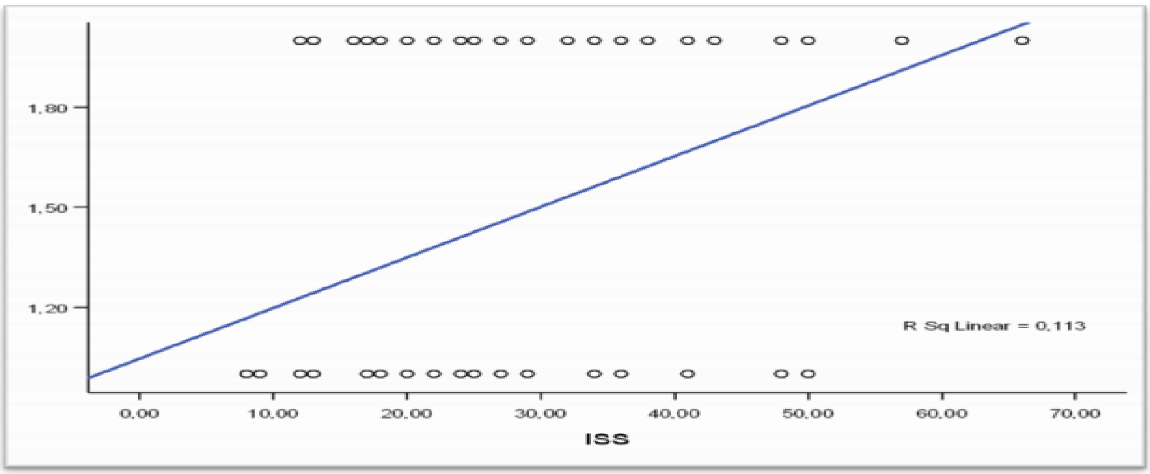
As seen in the table below; when ISS <15, NOM was favored whereas when ISS >25, OM was favored. The high value of ISS is in some cases associated with polytrauma and extra abdominal injury (EAI), which add value to the ISS and its derivatives.
Even though the intraabdominal injuries may be low ranked, the same logic follows when ISS< 15 and OM is indicated, since although the damages are unique the extent of their degree is high.

ISS	NOM	OM	TOTALE
<15	11(22%)	3(6%)	14(28%)
15-25	9(18%)	13(26%)	22(44%)
>25	3(8%)	10(20%)	13(28%)
TOTALE	23(48%)	26(52%)	49(100%)

ISS - Injury Severity Score; OM – Operative management; NOM – Non Operative management

Table 3: *Presentations of cases by ISS and a final treatment*

Children who had a higher ISS score were treated with OM more than NOM; a significant connection was found between ISS and the form of treatment (coefficient of Kendal's correlation: r = 0318, n = 49, p <0.001) (see Graph 1).



Graph 1: *Relationship between ISS and mode of treatment*

Damage to the following organs was treated by OM in 26 (52%) cases: spleen 11 (22%); Liver 6 (12%), diaphragm 3 (6%), intestine 2 (4%), kidney 2 (4%), duodenum 1 (2%), colon 2 (4%), pancreas 1 (2%), urethra 1 (2%), and urinary bladder 1 (2%). In the majority of cases, combined damage was observed.

Damage to solid organs was observed in 20 (40%) cases and damage to cavitary organs was observed in 7 (14%) cases that underwent OM.

In patients with splenic injuries (SI) treated with OM, 9 (18%) cases were pure BATp due to direct trauma to the abdominal wall and 3 (6%) cases were combined BATp with other intraabdominal injuries.

Rib fractures were not always present in SI as a result of the elasticity of the rib cage.

In all cases with OM in this age group, the average ISS score was 24.7 with

maximum and minimum values of 50 and 12, respectively.
In both cases ending in death, the ISS scores were 43 and 50; one patient had LI and retroperitoneal hematoma (RPH) due to vena cava rupture who died in the operation theatre (OT), while the other case had SI, CCT and acute irreversible shock.

Regarding the time of performing OM in this age group: *A within 0-2 h in 13 (26%), B within 2-6 h in 8 (16%), C within 6-24 h in 6 (12%), and D over 24 h in 2 (4%) cases.*

The time of intervention in interval A in this age group occurred in cases with HdInSt after MVA (66%) and FfH (34%), determined during the primary
In this interval, no rib fractures were presented. Of all cases treated with OM, rib fractures in this age group were present in only 5 (20%) cases and a contusion of the thoracoabdominal wall was seen in 6 (24%) cases.

The time of intervention in interval C occurred in 6 (12%) cases with damage to the spleen, liver, and kidney, in the period that coincides with the secondary assessment as a result of failure in the procedures for NOM. In this interval, damage to the duodenum and pancreas was observed in 1 case caused by BA. With the delay in OM, stabilization and resuscitation procedures were required as HdInSt was present.

The time of intervention in interval D occurred in 2 (4%) cases with damage to the liver and kidney (20%), in the period that coincides with the tertiary assessment. These injuries, coupled with

assessment and in cases with damaged organs such as the liver, spleen, kidney, and large vessels, as well as those associated with diaphragm injury, rib injury, and cranial and extremities fractures. In the two cases that ended in death, the children were passengers in a motor vehicle.

The time of intervention in interval B occurred in 8 (16%) cases with damage to the spleen in 6 (60%), the liver in 2 (20%), and the kidney in 2 (20%) cases, in the period that coincides with the secondary assessment. These cases were caused by MVA in 5 (50%), FfH in 5 (20%), HsO in 2 (20%) and in one case bicycle accident (10%).

colon and intestine injuries, were observed in cases lacking clinical signs and diagnostic tools, making early diagnosis very difficult.

We performed splenectomy in 7 (28%) cases in interval B; 86% of these cases required resuscitation and assessment for TP with HdSt and had positive diagnostic and clinical data. In only one case, in interval A, OM was performed because the patient had HdInSt and positive clinical data which required emergency OM.
We performed a liver suture in 3 (12%) cases in intervals B, C, and D; 86% of these cases required resuscitation and assessment for TP with HdSt and had positive diagnostic and clinical data.
We performed perihepatic packing in 2 (8%) cases in interval A. In one patient, OM was performed because the patient had HdInSt and positive clinical data which required emergency OM. The

other patient, in interval D, i.e. during the tertiary assessment, in this time was had HsC of the liver which had ruptured a second time and required emergency OM.

We performed a diaphragm suture in 3 (11%) cases in interval A; in these patients, OM was performed because the patient had HdInSt and positive clinical data which required emergency OM because of SO injury. Those cases in interval D had a delay in diagnosis.

We inserted a chest tube in 5 (18.5%) cases in interval A. This procedure was performed because the patient had HdInSt and positive clinical data which required an emergency chest drain.

We performed a suture and intestinal resection in 5 (18.5%) cases in interval A, in which OM was performed because the patients had HdInSt and positive clinical data which required emergency OM. In interval C, i.e. during the secondary assessment, cases required resuscitation and assessment for TP with HdSt and had positive diagnostic and clinical data.

We performed nephrectomy and kidney suture in 2 (8%) cases in intervals A and B because the patients had HdInSt and positive clinical data which required emergency OM.

We performed a colostomy in 1 (4%) case in interval D because of a delay in diagnosis.

Regarding combined BATp, most were cases of polytrauma (51%) followed by combined BATp with TT (48.4%) and finally combined BATp with fractures of the extremities (0.6%). In some cases, they were signs or symptoms suggesting of IAI.

It is known that rib fractures generally occur in the lower part of the rib cage, and in a significant number of cases in our study, a statistically significant correlation was found between thoracic contusion (with or without fracture of the ribs) and spleen or liver injury.

In our study, most patients underwent OM (52%), with the most commonly damaged organ being the spleen (33%), followed by the liver (18%) (see Table 12). Regarding the distribution of NOM cases (48%), damaged organs that were treated by NOM in 23(48%) cases were the liver in 11 (22%), spleen in 11 (22%), kidney in 2 (4%), and pancreas in 1 (2%). The majority of cases were caused by combined damage.

Type of intervent	*Nr of cases*	*%*	*Time of operation*			
			0-2 h	*After 2-6 h*	*After 6-24 h*	*Over 24 h*
Spleenectomy	*9*	*33,0*	*1*	*6*	*-*	*-*
Liver Suture	*2*	*7.0*	*1*	*1*	*1*	*-*
Perihepatic packing	*3*	*11.0*	*1*	*-*	*-*	*1*
Suture et intestinal resection	*3*	*11.0*	*2*	*-*	*3*	*-*
Colostomy	*1*	*4.0*	*-*	*-*	*-*	*1*
Nefrectomy / kidney suture	*1*	*4.0*	*1*	*1*	*-*	*-*
Diaphragm Suture	*3*	*11.0*	*1*		*1*	*-*
Primary suture D_1 & drain	*1*	*4.0*	*-*	*-*	*1*	*-*
Vassal suture	*2*	*7.0*	*1*	*-*	*-*	*-*
Chest Drain	*5*	*18.0*	*5*	*-*	*-*	*-*

Table 4: *Distribution of the type of operations and the time of their performance.*

In all cases treated by NOM in this age group, the average ISS score was 31.5 with maximum and minimum scores of 41 and 8, respectively.

In patients with SI treated by NOM, 2 (8%) cases of SI were pure BATp due to direct trauma to the abdominal wall; 9 (36%) cases were combined BATp with other IAI.
Rib fractures were seen in 11 (44%) cases, and were not always present with SI as a result of the elasticity of the rib cage.

Regarding combined BATp treated with NOM, 40% were polytrauma and 40% were combined BATp with TT. In 5 (20%) pure BATp cases treated with NOM, 4 (16%) cases were caused by FfH and 1 (4%) was caused by MVA.
In 20 (80%) cases of combined BATp, the 10 (40%) cases with polytrauma were caused by MVA in 4 (20%) cases, FfH in 4 (16%) cases, and HsO in 1 (4%) case.
The 10 (40%) cases of combined BATp with TT were caused by MVA in 6 (24%) cases, FfH in 3 (18%) cases, and HsO in 2 (12%) cases.

The patient's situation in the ED was evaluated using the Allgower formula (FC/TA) to determine the HdSt for this age group with NOM: a - HdSt [(FC/TA) = 0.5] in 15 (65%) cases and b - possible HdSt [(FC/TA) = 1] in 8 (35%) cases.

The evaluation of the data shows that there was a significant correlation between the ISS and TRISS scores, with values of 14 and 2.14 for patients treated by NOM.
Length of stay (LOS) in hospital is a very important element.
In paediatric patients with BATp, the LOS in hospital was *A - 0-1 days in 2 (4%)*

cases, B - 1-7 days in 26 (52%) cases, and C - more than 7 days in 21 (44%) cases.
In paediatric patients with BATp treated by NOM, the LOS in hospital was *B - 1-7 days in 18 (36%) cases and C - more than 7 days in 5 (10%) cases.*
In paediatric patients with BATp treated by OM, the LOS in hospital was *A - 0-1 days in 2 (4%) cases, B - 1-7 days in 11 (22%) cases, and C - more than 7 days in 13 (28%) cases.*

The complication rate was low; in children with BATp treated by NOM.

We observed sepsis in 2 (4%) cases and pleural effusion in 1 (2%) case.
In children with BATp treated by OM, we observed sepsis in 5 (10%) cases, haemopneumothorax in 3 (6%) cases, wound infection in 3 (6%) cases, ARF in 2 (4%) cases, and HsC of the liver 1 (2%) case.

The mortality rate was 4 (8%); in 2 (4%) cases, death occurred during surgery in the OT due to acute irreversible shock and in 2 (4%) cases death occurred after 72 h due to TBI.

ISS	Koefficient of Correlation of Kendal's tau b	Nr of cases	p value
Complication rate	0,254	49	<0.001
LOS	0,279	49	<0.001

ISS - Injury Severity Score; *LOS - Length of stay*

Table 5: *Comparative data between the ISS and the complications rate and LOS*

Kendal's tau-b correlation coefficient showed a statistically significant correlation between the ISS score and complications (r = 0.254, n = 49, p <0.001) and between the ISS score and LOS (r = 0279, n = 49, p <0.001) (see Table 5).

Discussion

In this study, it was found that 13% of cases who presented at our hospital were in the pediatric age range, which constitutes a number comparable to results in the literature where about 8-10% of all cases presenting to hospital are in the pediatric age range [9]. This relates to a number of factors such as social-economic class and demographic changes.

Abdominal injuries were found in 25% of cases with polytrauma in the pediatric age range. The leading cause of BATp, according to the mechanism of injury, was MVA with 28 (56%) cases, followed by FfH with 16 (32%) cases and HsO with 6 (12%) cases. This suggests that children are careless pedestrians and are unaware of traffic rules, which requires the extension of learning these rules in pre-school. These values are similar to the literature data, where most abdominal injuries are due to MVA (41%) and FfH (8%).
We have a relatively big difference in our country since the technical safety of dangerous toys and security measures in the workplace are not respected (Cooper 2004) [6].

The distribution of injuries by age is given graphically above, where the greatest number of injuries occurred in 6-7 year olds, almost fully agreeing with the literature data. Regarding the distribution of examinations in children with traumatic injuries conducted at the time of arrival, we obtained complete blood counts in all cases (100%) of children with suspected IAI13. In a study on children with traumatic injuries, it was estimated that an initial hematocrit value of less than 30 indicates that IAI is likely (Holmes and others) [13].

The data about special examinations was pelvic x-ray (25%), FAST (92.4%), PDL (5%), and CT scan (60%). The use of CT scans in TP with HdSt has increased the number of cases with NOM (Morse, Garcia 1994)[19].

Regarding the treatment strategy, OM was realized in (58.8%), cases. Our results show an apparent difference with today's trend of treating the majority of BATp cases by NOM; 90% of cases are treated with NOM with complete recovery in 90-98% of traumatized cases [20, 21, 22]. However, this depends on a number of factors such as age, the mechanism of injury, the time hospital presentation, the mode of transportation and any associated injuries.

Regarding the damaged organs, we found damage to the liver (10%), spleen (40%), kidney (20%), intestine (10%), and colon (20%). In the literature, the spleen is the most commonly damaged organ in BATp, followed by the liver as the second damaged organ 24; this discordance regarding the liver is linked to the poor quality of the available apparatus. However, in some studies, damage to the liver is more common than damage to the spleen [13].

The diagnosis and management of LI in children is very important because liver trauma is the leading cause of death in BATp [25]. In the last two decades, the treatment trend for LI in most cases in which the bleeding stopped spontaneously has been to follow the treatment algorithm for LI upon ED admission [23]. The use of CT scans in the diagnosis and grading of LI (Mirvis classification) [20] is very useful and has consequently reduced the operability of grade III LI which was previously treated with OM in up to 7% of cases. The basic criterion is HdSt, i.e. if even after energetic resuscitation HdInSt occurs again, then the solution is OM [23]. The success rate for treating LI by NOM ranges from 85-90% [26, 27].

In the OM of LI, techniques such as perihepatic packing, suturing the liver, liver resection, lobectomy, and atypical resection of the liver are used (Chuang and others 2006) 28. NOM of children with LI or SI depends on HdSt, TP in patients who require less than half of the estimated blood volume (i.e. <40 ml/kg), and the presence of EAI that requires OM [29].

Splenectomy was performed in >90% of children (usually only 13-50% of adults). Regarding of the sort of BATp, in most of cases BATp was combined with polytrauma (51%) followed by TT (48.4%). We also observed a strong correlation between rib fractures and damage to the liver and spleen.

Using mathematical formulas has contributed to the predictive success of trauma and improved the quality of modern trauma management.

Kendal's tau-b correlation coefficient showed a statistically significant correlation between the ISS score and the type of treatment (r = 0318, n = 49, p <0.001), between the ISS score and the mode of transport (r = 0190, n = 49, p = 0.001), and between the ISS score and HdSt in the ED (r = 0.338, n = 49, p <0.001). A statistically significant link was not found between the ISS score and the type of trauma (r = 0.012, n = 49, p = 0.836) (see Table 7).

ISS	Koefficient of Correlation of Kendal's tau b	Nr of cases	P value
Type of trauma	0,012	49	0,836
Sort of treatment	0,318	49	<0.001
Mode of Transport	0,190	49	0,001
HdCo in ED	0,338	49	<0.001

HdCo - Hemodynamic Condition; ISS - Injury Severity Score; ED-Emergency Department

Table 6: *Relationship between ISS and Type of trauma, Sort of treatment, Mode of Transport, HdCo in ED.*

Conclusions

BATp is a serious threat to the health of children. Treatment should be carried out not only at national trauma centres but in every regional hospital or even in smaller hospitals where the protocols for trauma are rigorously applied in general and in particular for children. The use of AIS, ISS, RTS and TRISS scores contributes in this regard in predicting the evolution of trauma.

The management IAI has undergone a significant evolution in recent years. NOM of BATp is successful in more than 90% of cases, although this depends on a variety of factors and conditions that are in accordance with the anatomical and pathophysiological conditions of the patient.

The mortality of BATp was calculated depending on the organs affected:

• With damage to organs such as the liver, spleen, kidneys or pancreas, the mortality rate is less than 20%.
• If the damage includes some CO, the mortality rate increases to over 20%.
• If the damage includes large vessels, the mortality rate is over 50%.

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