ORIGINAL ARTICLE

Risk factors for mortality and morbidity in Syrian refugee children with penetrating abdominal firearm injuries: an 1-year experience

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ABSTRACT

BACKGROUND: Despite improvements in technology and surgical techniques, abdominal injuries caused by firearms in children are traumatic with high complication rates and mortality. In this study, factors affecting mortality and complications in penetrating abdominal firearm injuries caused by high-velocity bullets and shrapnel in children as a result of the civil war in Syria were evaluated.

METHODS: This study was conducted as a case series with 53 patients admitted to Kilis State Hospital with penetrating abdominal firearm injuries between January 2016 and February 2017. Patients aged between 6 months and 17 years who suffered penetrating abdominal firearm injuries (PAFI) as a result of the civil war in Syria in the state hospital in Kilis Türkiye border province with Syria and were transferred to our hospital and operated on were included in the evaluation. Patients' sociodemographic information, time to surgery, number of abdominal organs injured, type of firearm causing injury, presence of large vessel injury and extremity injury, presence of thoracic injury requiring thoracotomy in addition to laparotomy, colostomy, penetrating abdominal trauma index, pediatric trauma score (PTS), and shock status were evaluated.

RESULTS: In our study, it was found that a high penetrating abdominal trauma index significantly increased complication rates and mortality (P<0.001 and P=0.002, respectively). In addition, it was found that lower PTSs significantly increased the development of complications and mortality (P=0.001 and P<0.001, respectively). Mortality was not observed in any of the patients with a PTS>8, whereas mortality was observed in 27.3% of patients with a PTS≤8, and this result was statistically significant (P=0.003). Shock significantly increased mortality, and no patient who was not in shock died (P<0.001). In our study, it was determined that the increase in the number of injured intra-abdominal organs had a significant effect on both complications and mortality (P<0.001 and P=0.002, respectively).

CONCLUSION: The penetrating abdominal trauma index and PTS were found to be effective in predicting mortality and morbidity in pediatric patients with PAFI. It is crucial in this patient group to provide appropriate transport after the first intervention is done rapidly and effectively in conflict zones.

Keywords: Child; firearm injury; morbidity; mortality; penetrating abdominal injury.

Cite this article as: Tuşat M, Özmen İ, Demirtaş MS, Ateş C, Öztürk AB, Kankılıç NA, et al. Risk factors for mortality and morbidity in Syrian refugee children with penetrating abdominal firearm injuries: An 1-year experience. Ulus Travma Acil Cerrahi Derg 2023;29:1051-1060.

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Ulus Travma Acil Cerrahi Derg 2023;29(9):1051-1060 DOI: 10.14744/tjtes.2023.70658 Submitted: 29.09.2022 Revised: 16.03.2023 Accepted: 01.05.2023

INTRODUCTION

As a result of the civil war in Syria, children have been exposed to both deteriorating living conditions and psychological effects, as well as physical damage that has caused morbidity and mortality.[1,2] The World Health Organization (WHO) reports that many children are treated in neighboring countries due to the devastating effects of war on hospitals as well. During this process, Türkiye has become one of the prominent neighboring countries for treating Syrian children.[3]

The effect of high-energy bullets or shrapnel during the war can inflict damage not only to organs, it penetrates but also to nearby tissues due to the blasting effect and the change in direction within the body.[4] Injuries to children are of higher severity than those to adults because the size of the area covering vital organs is smaller in children.[1,5] Despite advances in diagnosis and treatment, there is still a high mortality and morbidity rate associated with intra-abdominal firearm injuries in the childhood age group in conflict zones.[6,7]

To the best of our knowledge, this is the first study in the literature that examines pediatric patients with penetrating abdominal firearm injuries (PAFI) caused by the Syrian civil war.

MATERIALS AND METHODS

Study Design

This study was conducted as a case series study involving pediatric cases with PAFI between the ages of 6 months and 17 years between January 2016 and February 2017 at the state hospital in Kilis a border province of Türkiye, 16 km away from Azaz, Syria.

Study Population

A total of 53 children aged 6 months-17 years who were brought to Kilis State Hospital with PAFI and operated on during the civil war in Syria were included in the study. Patients who were admitted to our hospital due to PAFI between the specified dates and who additionally had severe burns and/or head and neck injuries, patients with head trauma, patients who were operated on in Syria after injury, and patients who underwent negative laparotomy, and conservative treatment were excluded from the study.

Data Collection

The time of injury and the type of firearm that caused the injury were learned from the patient, the patient's parents, or the health personnel who were accompanying the patient during admission. Patients' sociodemographic data, type of firearm causing injury, time to operation, number of injured abdominal organs, accompanying extremity and great vessel injuries, need for thoracotomy in addition to laparotomy, intraoperative colostomy, penetrating abdominal trauma index (PATI), pediatric trauma score (PTS), total amount of blood transfusion delivered in the emergency department and intraoperatively, and shock status were evaluated.

Hemograms, blood groups, routine biochemistry, INR, PT, and aPTT were routinely performed at the first admission of all patients.

Evaluation and Stabilization of Patients in the Emergency Service

When the injured children came to the emergency room, their general condition was quickly evaluated with a multidisciplinary approach. Stabilization and resuscitation procedures were started in the emergency department in all cases. The measurements of the vital signs of the patients (pulse, blood pressure, respiratory rate, and heart rate) were performed by health-care personnel with at least 10 years of pediatric patient experience in the field.

Vital signs and accompanying injuries that can be seen in the comprehensive physical examination and their features were determined. PTS scores were then calculated in the emergency department.

Patients without respiratory failure were given 3–4 l/min oxygen through nasal cannula, while patients with signs of respiratory failure or developing respiratory failure were intubated in the emergency department. Blood pressure readings of injured children were determined by health personnel experienced in trauma by measuring the blood pressure twice in succession on the upper arm using an age-appropriate cuff. When evaluating patients for hypovolemic shock, systolic blood pressure, and pulse rate according to age were determined by considering the ranges specified in the pediatric advanced life support section of the American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care.[8] At the time of evaluation, patients who had hypotension, tachycardia, bradycardia, and capillary refill >2 s were considered to have shock.

Central venous catheters were routinely used in all patients for blood and fluid replacement as well as for other intravenous procedures. All patients underwent anal examination after insertion of the nasogastric catheter and urethral catheter if there was no contraindication. Prophylactic tetanus vaccine and 3rd generation cephalosporin were administered preoperatively. When necessary, an anaerobic antibiotic was included in the treatment depending on the findings of the procedure.

Patients with unstable vital signs, signs of peritoneal irritation, and evisceration were operated on urgently, while patients with stable conditions underwent radiological examinations (computed tomography, X-ray radiographs, intravenous pyelography, etc.) in the emergency department to determine the injured area, organs, and accompanying injuries. At the time of surgery, the organ injured in the abdomen and the degree of injury and concomitant injuries were determined, and necessary interventions were performed. In addition to laparotomy, the thoracic tube was inserted in cases of hemothorax and/or pneumothorax affecting or thought to affect respiration in penetrating injuries in the chest region, and thoracotomy was performed in thoracic injuries that did not stop bleeding. All procedures performed during the surgery and the calculated PATI were recorded in the operation note.

Evaluation of PATI and PTS

PATI is the most widely used scoring system to determine the severity of trauma and to predict the risk of morbidity and mortality in patients who underwent laparotomy for penetrating abdominal trauma.[9] In this scale developed by Moore et al., each organ has its risk score (duodenum=5, pancreas=5, liver=4, colon=4, major vessel=4, spleen=3, kidney=3, extrahepatic biliary system= 3, small intestine=2, stomach=2, ureter=2, bladder=2, bone=1, small vessel=1, etc.) and the degree of injury of the injured organ at the time of abdominal exploration is rated from 1 to 5 points. The injured organ score is calculated by multiplying the numerical values of the injured organ risk score and the degree of injury. The PATI value is calculated by summing the score of all injured organs.

PTS was defined by Tepas et al. to determine the severity of trauma in traumatized children.[10] In this scoring system, six clinical variables (airway and consciousness status, systolic blood pressure, open injury, and extremity fracture) are considered in the traumatized child. After the evaluation, +2, +1, and 0 points are given for each variable, and PTS is obtained by summing the scores of the variables. The patient's total score ranges from −6 to +12.

Ethics

Written informed consent was obtained from all parents after the procedures were fully explained to the families. Approval for this study was obtained from the Aksaray University Faculty of Medicine Clinical Research Ethics Committee with decision number 2022/04-10 dated February 24, 2022.

Statistical Analysis

Statistical analysis was conducted using the Statistical Package for the Social Sciences, version 26 (SPSS Inc., Chicago, IL, USA). The data used here were tested for violations of assumptions of parametric tests, such as using the Levene test for homogeneity of variances and Shapiro–Wilk's test with QQ plots for normality. Therefore, to identify differences between the independent two groups, the Mann–Whitney U test was used. The chi-square and/or Fisher's exact test were used to compare groups among the categories of variables. Data are presented as the mean±standard deviation and median-range values and as frequencies and percentages. A P<0.05 was considered statistically significant for all statistical processes.

RESULTS

The mean age of the patients in this study was 9.55±3.99 years, while it was 9.98±3.95 years in males and 7.44±3.74 years in females. Of the patients, 44 (83%) were male, and 9 (17%) were female. Shrapnel injuries were detected in 38 patients (71.6%), and bullet injuries were detected in 15 patients (28.3%). In our study, it was found that age, gender, and type of firearm causing injury had no significant impact on the development of complications and mortality (Tables 1 and 2).

The most commonly injured intra-abdominal organs in our series were the small intestine (62.3%), colon (49.1%), liver (30.2%), stomach (13.2%), and spleen (9.4%) (Table 3).

In our study, it was determined that the increase in the number of injured intra-abdominal organs had a significant effect on both complications and mortality (P<0.001 and P=0.002, respectively). Only one abdominal organ injury was detected in 35.8% (n=19), and ≥3 organ injuries were detected in 30.2% (n=16) of the patients. While 21.6% of patients with <3 injured abdominal organs developed complications, 68.8% of patients with ≥3 abdominal organs developed complications, and this difference was significant (P=0.001). Moreover, mortality was 2.7% in patients with <3 abdominal organs injured and 31.3% in patients with ≥3 abdominal organs injured, and this difference was significant (P=0.007) (Tables 1 and 2).

The mean duration from injury to surgery was 293.33±152.5 min in patients who died and 110.32±29.5 min in patients who survived, and this difference was significant (P<0.001) (Table 2). No significant difference was found in terms of other parameters (Table 1).

PATI was found to be ≤15 points in 47.2% (n=25) of the patients, between 16 and 24 points in 30.2% (n=16), and 25–50 points in 20.8% (n=11). It was determined that a high PATI significantly increased the complication rates and mortality (P<0.001, P=0.002, respectively) (Tables 1 and 2). While 22% of 41 patients with PATI<25 developed complications, 83.3% of 12 patients with PATI≥25 developed complications, and this difference was significant (P<0.001) (Table 1). Furthermore, mortality in patients with PATI scores <25 and ≥25 was 4.9% and 33.3%, respectively, and this difference was significant (P=0.019) (Table 2).

In our study, the PTS was <6 in 28.3% (n=15), 6–8 in 13.2% (n=7), and >8 in 58.5% (n=31) of the patients. Low PTS was found to significantly increase the development of complications and mortality (P=0.001, P<0.001) (Tables 1 and 2). Mortality was not observed in any of the patients with a PTS>8, whereas mortality was 27.3% in 22 patients with a PTS≤8,

Table 1. Comparison of the parameters between patients with and without complication development

Complication	No		Yes		P-value
	M±SD	MD - R	M±SD	MD - R	
Age (years)	9.41±4.34	10-14	9.79±3.39	10-12	0.802*
Elapsed Time Until Surgery (minute)	127.79±76.69	110-450	136.84±88.03	95-390	0.823*
Blood Transfusions (unit)	2±1.70	1.5-8	2.74±2.13	2-8	0.168*
Number of Injured Abdominal Organs	1.68±0.91	1-4	2.84±1.11	3-5	**<0,001***
PTS	8.59±2.48	9-9	6.05±2.52	5-7	**0.001***
PATI Score	13.29±8.61	12-48	24.68±10.03	25-37	**<0.001***
	No n (%)		Yes n (%)		
Gender					
Male	28 (63.6)		16 (36.4)		1.00**
Female	6 (66.7)		3 (33.3)		
Type of Weapon Injuries					
Bullet	11 (73.3)		4 (26.7)		0,381***
Shrapnel	23 (60.5)		15 (39.5)		
Presence of Shock					
No	29 (69.0)		13 (31.0)		0.173**
Yes	5 (45.5)		6 (54.5)		
Extremity Injury					
No	22 (61.1)		14 (38.9)		0.502***
Yes	12 (70.6)		5 (29.4)		
Great Vessel Injury					
No	34 (66.7)		17 (33.3)		0.124**
Yes	0 (100)		2 (100)		
Thoracotomy(+)					
No	33 (68.8)		15 (31.3)		0.05**
Yes	1 (20)		4 (80)		
Colostomy					
No	29 (72.5)		11(27.5)		**0.044****
Yes	5 (38.5)		8(61.5)		
PATI					
<25	32 (78.0)		9 (22.0)		**<0.001****
≥25	2 (16.7)		10 (83.3)		
PTS					
≤8	10 (45.5)		12(54.5)		**0.017*****
>8	24 (77.4)		7(22.6)		
Number of Injured Abdominal Organs					
<3	29 (78.4)		8 (21.6)		**0.001*****
≥3	5 (31.3)		11 (68.8)		

*Mann Whitney U test; **Fisher's exact test; ***Pearson Chi-square; M: Mean; SD: Standard deviation; MD: Median; R: Range; PATI: Penetrating abdominal trauma index; PTS: Pediatric trauma score.

Table 2. Comparison between patients who survived and died

	Dead		Survive		P-value
	M±SD	MD - R	M±SD	MD - R	
Age (years)	9.67±2.58	10.5-6	9.53±4.16	10-14	0.955*
Elapsed Time Until Surgery (minute)	293.33±152.5	255-360	110.32±29.5	100-120	**<0,001***
Blood Transfusions (unit)	6,17±1,47	5,5-3	1,77±1,24	2-5	**<0,001***
Number of Injured Abdominal Organs	3,5±1,05	3,5-3	1,91±1,02	2-5	**0,002***
PTS	3±1,26	2.5-3	8,28±2,29	9-8	**<0,001***
PATI Score	33,6±12,6	35-36	15,3±8,39	14-32	**0,002***
	Dead n (%)		Survive n (%)		
Gender					
Male	4 (9.1)		40 (90.9)		0.267**
Female	2 (22.2)		7 (77.8)		
Type of Weapon Injuries					
Bullet	1 (6.7)		14 (93.3)		0,662**
Shrapnel	5 (13.2)		33 (86.8)		
Presence of Shock					
No	0 (0)		42 (100)		**<0,001****
Yes	6 (54.5)		5 (45.5)		
Extremity Injury					
No	2 (5.6)		34 (94.4)		0,076**
Yes	4 (23.5)		13 (76.5)		
Great Vessel Injury					
No	4 (7.8)		47 (92.2)		**0,011****
Yes	2 (100)		0 (0)		
Thoracotomy(+)					
No	3 (6.2)		45 (93.8)		**0,008****
Yes	3 (60)		2 (40)		
Colostomy					
No	5 (12.5)		35 (87.5)		1.000**
Yes	1 (7.7)		12 (92.3)		
Blood Transfusions (unit)					
<3	0 (0)		36 (100)		**0.001****
≥3	6 (35.3)		11 (64.7)		
PATI					
<25	2 (4,9)		39 (95.1)		**0.019****
≥25	4 (33.3)		8 (66.7)		
PTS					
≤8	6 (27.3)		16 (72.7)		**0.003****
>8	0 (0)		31 (100)		
Number of Injured Abdominal Organs					
<3	1 (2.7)		36 (97.3)		**0.007****
≥3	5 (31.3)		11 (68.8)		

*Mann Whitney U test; **Fisher's exact test; M: Mean; SD: Standard deviation; MD: Median; R: Range; PATI: Penetrating abdominal trauma index; PTS: Pediatric trauma score.

Table 3. Distribution of injured abdominal organs and other associated injuries

	n (%)	Surgical Interventions (n)
Small bowel	33 (62.3)	Primary Repair (19)
		Resection Anastomosis (12)
		Ileostomy (2)
Colon	26 (49.1)	Primary Repair (8)
		Resection Anastomosis (5)
		Colostomy (13)
Rectum	1 (1.9)	Primary Repair + Diverting Colostomy (1)
Stomach	7 (13.2)	Primary Repair (7)
Duodenum	1 (1.9)	Primary Repair (1)
Pylor	2 (3.8)	Primary Repair (1)
Gall bladder	1 (1.9)	Cholecystectomy (1)
Liver	16 (30.2)	Primary Repair + Hemostasis (16)
Spleen	5 (9.4)	Splenorrhaphy (3)
		Partial Splenectomy (1)
		Total Splenectomy (1)
Diaphragm	3 (5.7)	Primary Repair (3)
Ureter	4 (7.5)	Ureteroureterostomy + Double J stent (4)
Kidney	3 (5.7)	Total Nephrectomy (3)
Bladder	3 (5.7)	Primary Repair + Urethral Catheter (3)
Pancreas	1 (1.9)	Distal Pancreatectomy (1)
Major vessels	2 (3.8)	Synthetic Vascular Graft Implantation (2)
Urethra	2 (3.8)	Primary Open Realignment + Cystostomy + Urethral Catheter (2)
Pubic Ramus Fracture	2 (3.8)	External Fixation (2)
Complete Urethrovaginal Complex Avulsion	1 (1.9)	Primary Open Realignment + Cystostomy + Urethral Catheter + Vaginal Repair (1)
Spinal Cord	1 (1.9)	Conservative Management (1)
Abdominal Wall Avülsion	3 (5.7)	Primary Repair + VAC (Vacuum-assisted closure) (3)
Heart	1 (1.9)	Anterior thoracotomy (1) + Primer repair
Thorax	11 (20.8)	Thoracotomy (4)
		Tube Thoracostomy (6)
Extremity	17 (32.1)	Orthopedic Intervention(22)

and this difference was found to be significant (P=0.003) (Table 2). In addition, while 22.6% of 31 patients with a PTS>8 developed complications, 54.5% of 22 patients with a PTS≤8 developed complications, and the difference was significant (P=0.017) (Table 1).

Moreover, 43.4% (n=23) of the patients had isolated abdominal injuries, while 56.6% (n=30) had other system injuries in addition to abdominal injuries. In 32.1% (n=17) of the patients, extremity injury was the most common concomitant injury, while thoracic injury was the second most common concomitant injury in 20.8% (n=11). Other accompanying injuries and procedures performed are shown in Table 3. In addition to abdominal organ injury, thoracic injury requiring thoracotomy and accompanying large vessel injury increased mortality, and this difference was significant (P=0.008 and P=0.011, respectively), whereas there was no significant effect on the development of complications (P=0.05 and P=0.124, respectively) (Tables 1 and 2). Accompanying extremity injury did not have a significant effect on mortality or the development of complications (P=0.076 and P=0.502, respectively) (Tables 1 and 2).

While an average of 6.17±1.47 units of blood was transfused to patients who died, this amount was 1.77±1.24 units in patients who survived, and this difference was significant (P<0.001) (Table 2). Seventeen of the patients received ≥3 units of blood transfusion, and the mortality was 35.3% (n=6), whereas no patient who received <3 units of blood transfusion died, which was statistically significant (P=0.001) (Table 2). The amount of blood transfusion performed had no significant effect on the development of complications (P=0.168) (Table 1).

Shock was observed in 11 patients at the time of admission, and 6 (54.5%) of these patients died, whereas none of the patients without shock died, and this difference was significant (P<0.001) (Table 2). The fact that the patient was in shock at the time of admission had no significant effect on the development of complications (P=0.173) (Table 1).

In our study, a colostomy procedure was performed in 13 patients, and complications developed in 8 (61.5%) of these patients; this rate was significant (P=0.044) (Table 1). The colostomy procedure was found to have no significant effect on mortality (P=1.000) (Table 2).

While 47 (88.7%) of the patients were discharged, 6 (11.3%) died. Complications developed in 19 (35.8%) patients, including wound infection (31.6%, n=6), intra-abdominal abscess (15.8%, n=3), intra-abdominal adhesion (10.5%, n=2), lung infection and ARDS (10.5%, n=2), sepsis and septic shock (5.3% n=1), incisional hernia (15.8% n=3), and DIC (10.5% n=2) were the complications observed in our series.

DISCUSSION

To the best of our knowledge, this study is the first in the pediatric literature on PAFI in the patient population of the civil war in Syria. We found that having ≥3 abdominal injuries was a significant finding affecting mortality (P=0.007). One of the most striking results we found in our study was that a PATI score ≥25 not only increased the mortality but also the complication rate (P=0.0019, P<0.001, respectively). Furthermore, another important result of our study was the finding that low PTS significantly increased the development of complications and mortality (P=0.001, P<0.001, respectively).

At present, due to the evolution of wars and the shift of conflict zones from hot zones to residential areas, civilians and children have become the target of weaponry. Bullets and fragments account for 80–90% of abdominal injuries on battlefields.[4,11] The majority of adult injuries in war zones are caused by bullets, but fragments have been reported to cause injuries more frequently in children.[2,4,12] The reason for this is that adults are more frequently in an active combat environment. In our study, we found that most children, especially boys, were injured by shrapnel fragments (71.6%), but we could not determine a significant difference in complication and mortality rates in children injured by bullets or shrapnel. In our study, we thought that the higher prevalence of boys in our study might be because boys spend more time outside the home than girls or are located closer to the battlefield. In a study conducted with children with PAFI in a civilian living area, the mortality was 2.8%, and the morbidity was 17%.[7,13] Meanwhile, in our study, mortality was 11.3%, and morbidity was 35.8%. We think that the reason for the high mortality and morbidity is the lack of experienced personnel to perform the first intervention on the battlefield, stabilization due to inappropriate transport conditions, and the long time until surgery.

The presence of shock is a common clinical symptom in patients with PAFI, significantly affecting outcomes in the early post-injury period, and studies have reported that the cause of death is usually shock due to hemorrhage.[13,14] The depth of the shock that develops after the injury and the duration of the patient's stay in shock directly affect morbidity and mortality, and studies have reported that shock plays a role in patients who die due to trauma at rates ranging from 5.5% to 100%.[15] Similarly, in our study, the mortality was 54.5% in 11 patients who presented with clinical signs of shock, whereas no death occurred in any patient without signs of shock, and this difference was significant (P<0.001). It has been well documented that the time from injury to surgery is an effective factor in the development or increase in the depth of shock.[16] In our study, it was observed that the time from injury to surgery had a significant effect on mortality (P<0.001) but had no significant effect on the development of complications.

It is well known that excessive blood transfusion increases both mortality and morbidity due to metabolic disorders, hemostasis and coagulation disorders, and disruption of the antibacterial defense mechanism.[17] In a study of 521 adult patients with penetrating abdominal injuries, mortality was reported to be 7.2% in patients with 2 units of blood transfusion, 13.3% in patients with 3–5 units of blood transfusion, and 26.3% in patients with 6 or more units of blood transfusion.[18] Likewise, in our study, a mean of 6.17±1.47 units of blood transfusion was administered to patients who died, whereas this amount was 1.77±1.24 units in patients who survived, and this difference was found to be significant (P<0.001). In injured children who received ≥ units of blood transfusion, the mortality was 35.3% (n=6), whereas no patient who received <3 units of blood transfusion died, and this difference was significant (P=0.001). The low mortality in patients with <3 units of blood transfusion is because these patients are not in shock and are stabilized in the earlier period. The amount of blood transfusion was not found to have a significant effect on the development of complications (P=0.168).

Increasing the number of injured intra-abdominal organs means more bleeding, more blood transfusions, more intra-abdominal contamination, longer surgery duration, higher trauma score, and ultimately increased morbidity and mortality.[4,19,20] In his study, Larson reported that there is a significant increase in the rate of complications that may develop with the increase in the number of injured organs in penetrating trauma.[21] In addition, in a study conducted on pediatric patients with penetrating abdominal injuries, it was reported that two or more intra-abdominal organ injuries significantly increased the post-operative complication rate by 3-fold.[22] In another retrospective study of 2962 adult patients with PAFI, a significant increase in mortality was observed in patients with ≥3 organ injuries.[12] Consistent with the literature, in our study, both mortality and morbidity increased in injured children with ≥3 intra-abdominal organ injuries (P=0.007, P=0.001, respectively).

Another factor affecting mortality and morbidity is the presence of extra-abdominal organ injuries.[4,23] In a study by Cardi et al. on 953 children and adults with penetrating abdominal combat injuries, it was shown that mortality was higher in injuries to vital organs such as the inferior vena cava, large vessels such as the iliac artery and pancreas in addition to abdominal injuries.[24] In another study, it was reported that the highest mortality rate among associated extra-abdominal injuries in victims with penetrating abdominal trauma was due to head injury.[18] In addition, thoracic injury requiring thoracotomy and concomitant large vessel injury increased mortality (P=0.008 and P=0.011, respectively) but had no significant effect on the development of complications (P=0.05 and P=0.124, respectively).

In firearm injuries, the rate of thoracic injury accompanied by abdominal injury is 6–42%.[25] In these patients, rapid deterioration of hemodynamic balance, as well as respiratory function, aggravates the clinical picture. In general, many thoracic injuries can be monitored and treated non-surgically with chest tube application.[26] In our study, 20.7% (n=11) of the patients had thoracic injuries accompanied by an abdominal injury. Thoracotomy was performed in four of these patients due to active bleeding, and anterior thoracotomy was performed in one patient due to heart and lung injury. The remaining six injured children underwent tube thoracostomy.

PTS was developed to evaluate traumas in the pediatric age group. It has been reported that morbidity and mortality are higher in patients with a PTS≤8 than in patients with a PTS>8 due to the increased severity of injury.[27] In a study in which PTS was analyzed in high kinetic energy fragment impact injuries and no death occurred, the complication rate was 29.4% in patients with PTS≤8, while this rate was significantly lower at 5.9% in patients with PTS>8%, and it was concluded that PTS is effective and time-saving in the evaluation of trauma in fragmentation injuries.[28] Likewise, in our series, low PTS was found to significantly increase the development of complications and mortality (P=0.001, P<0.001, respectively). PTS is considered a good marker for predicting mortality and morbidity in patients with PAFI and for predicting the need for intervention at the time of transport by scoring at the scene and guiding patient triage.

In a study conducted to determine the severity of trauma as well as to predict the risk of morbidity in patients who underwent laparotomy for penetrating abdominal trauma, complication rates were reported to be 46% in patients with PATI≥25 and 7% in those with <25 in firearm injuries.[9] In a study conducted in Syria with penetrating firearm injuries, it was reported that the PATI was ≥25 in 76.4% of the deaths, and the mortality was 35.6% in patients with a PATI≥25.[6] In a study involving adults with PAFI, it was reported that a high PATI significantly increased mortality and morbidity.[4] One of the most striking results we found in our study was that a PATI score ≥25 not only increased the mortality but also the complication rate (P=0.0019, P<0.001, respectively).

The non-operative treatment model has recently been introduced to the treatment agenda for patients with PAFI in selected civilian settings who have stable hemodynamic status without signs of peritonitis.[29] Although many studies have demonstrated the effectiveness of this treatment model in adults, few studies have been conducted in pediatric populations.[30] In contrast, firearms used in warfare have high kinetic energy and unique projectile structures. The level and range of damage to internal organs caused by these weapons are therefore different from those observed with civilian firearms. Hence, we consider mandatory laparotomy as an integral part of the diagnosis and treatment of penetrating abdominal injuries due to high kinetic energy bullets and explosive weapon fragments.

CONCLUSION

In children with PAFI, PATI and PTS may help clinicians and surgeons to predict injury severity, mortality, and morbidity. To reduce mortality and morbidity in these patients, we think that it would be appropriate to take emergency measures at the scene, perform blood replacement according to age, transport quickly and accurately, and perform scoring. It is of great importance to have experienced health personnel with high levels of intervention and knowledge and equipment available in border hospitals of countries treating war wounds. Our study may be a pioneering study for surgeons to achieve effective results in the management and treatment of PAFI in children.

Ethics Committee Approval: This study was approved by the Aksaray University Faculty of Medicine Clinical Research Ethics Committee (Date: 24.02.2022, Decision No: 2022/04-10).

Peer-review: Externally peer-reviewed.

Authorship Contributions: Concept: M.T., İ.Ö., C.A., A.B.Ö., M.S.D., D.B., and N.A.K.; Design: M.T., İ.Ö., C.A.,

A.B.Ö., M.S.D., D.B., and N.A.K.; Supervision; M.T., İ.Ö., C.A., A.B.Ö., M.S.D., D.B., and N.A.K.; Data collection and/or processing: M.T. and İ.Ö.; Analysis and/or interpretation: M.T. and C.A.; Literature search: M.T.; Writing: M.T.; and Critical reviews: M.T., İ.Ö., C.A., A.B.Ö., M.S.D., D.B., N.A.K.

Conflict of Interest: None declared.

Financial Disclosure: The author declared that this study has received no financial support.

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ORİJİNAL ÇALIŞMA - *ÖZ*

Penetran abdominal ateşli silah yaralanması olan Suriyeli mülteci çocuklarda mortalite ve morbidite için risk faktörleri: Bir yıllık deneyim

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AMAÇ: Çocuklarda ateşli silahlar nedeniyle meydana gelen batın yaralanmaları, gelişen teknoloji ve ameliyat tekniklerine rağmen yüksek komplikasyon ve mortaliteye sahip travmalardır. Bu çalışmada, Suriye'deki sivil savaş sonucu çocuklarda meydana gelen yüksek hızlı mermi ve şarapnel kaynaklı meydana gelen penetran abdominal ateşli silah yaralanmalarında mortalite ve komplikasyona etki eden faktörler değerlendirilmiştir.
GEREÇ VE YÖNTEM: Bu çalışma Kilis Devlet hastanesinde Ocak 2016-Şubat 2017 tarihleri arasında penetran abdominal ateşli silah yaralanması sonucu başvuran 53 hasta ile vaka serisi olarak yapılmıştır. Türkiye'nin Suriye ile sınır ili olan Kilis'deki devlet hastanesine Suriye'deki iç savaş sonucu penetran abdominal ateşli silah yaralanmasına uğrayan ve hastanemize transvers edilip ameliyat edilen 6 ay-17 yaş arası hastalar değerlendirmeye alındı. Hastaların sosyodemografik bilgileri, cerrahiye kadar geçen süre, yaralanan abdominal organ sayısı, yaralanmaya neden olan ateşli silah tipi, büyük damar yaralanması ve ekstremite yaralanması eşlik etmesi, laparatomiye ek olarak torakotomi gerektiren toraks yaralanması varlığı, kolostomi uygulanması, penetran abdominal travma indeksi, pediatrik travma skoru ve şok durumu değerlendirildi.
BULGULAR: Çalışmamızda penetran abdominal travma indeksi'nin yüksek olmasının istatistiksel olarak komplikasyon ve mortalite oranlarını arttırdığı bulunmuştur ($p<0.001$, $p=0.002$). Ayrıca pediatrik travma skoru'nun düşük olmasının komplikasyon gelişimini ve mortaliteyi istatistiksel olarak arttırdığı tespit edilmiştir ($p=0.001$, $p<0.00$). PTS>8 olan hastaların hiçbirinde mortalite gözlenmemiş olup, PTS≤8 olan hastalarda %27.3 oranında mortalite gözlenmiş ve bu sonucun istatistiksel olarak anlamlı olduğu tespit edilmiştir ($p=0.003$). Şok tablosunun mortaliteyi anlamlı olarak arttırdığı ve şok tablosunda olmayan hiçbir hastanın hayatını kaybetmediği tespit edilmiştir ($p<0.001$). Çalışmamızda yaralanan intraabdominal organ sayısının artmasının hem komplikasyon hem de mortalite üzerinde istatistiksel olarak anlamlı şekilde etkili olduğu belirlendi ($p<0.001$, $p=0.002$).
SONUÇ: Penetran abdominal ateşli silah yaralanması olan çocuk hastalarda penetran abdominal travma indeksi ve pediatrik travma skorunun mortalite ve morbiditeyi öngörmede etkin olduğu tespit edilmiştir. Çatışma alanlarında hızlı ve etkin şekilde ilk müdahalenin yapıldıktan sonra uygun transportun sağlanması bu hasta grubunda oldukça önemlidir.
Anahtar sözcükler: Çocuk; penetran abdominal yaralanma; ateşli silah yaralanma; mortalite; morbidite.

Ulus Travma Acil Cerrahi Derg 2023;29(9):1051-1060 DOI: 10.14744/tjtes.2023.70658