

Penetrating stab wounds to the abdominal wall: Retrospective analysis of 131 cases: Can the number of unnecessary laparotomies be reduced?

Batına nazif kesici delici alet yaralanmaları: Yüz otuz bir olgunun retrospektif analizi: Gereksiz laparatomiler azaltılabilir mi?

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ABSTRACT

Objective: Penetrating stab wounds (PSW) are among the most frequent causes of admissions to the emergency services. The current study attempted to answer the question of whether unnecessary laparotomies could be reduced by preoperative tests and physical examinations.

Methods: The electronic records of patients admitted to the Emergency Service of the Ministry of İzmir Bozyaka Education and Research Hospital between 2008 and 2013 with penetrating stab wounds were retrospectively examined.

Results: 29367 (96.7%) of total 30.356 patients were ambulatory patients. Of these patients, 274 (27.7%) were hospitalized in general surgery clinics. 131 (47.8%) of these patients had abdominal injuries. Hundred and twenty patients who were operated on were divided into two groups as Group A (necessary laparotomy: therapeutic group) which consisted of 30 patients (25%) and Group B (unnecessary laparotomy: nontherapeutic+ negative laparotomy group) consisted of 90 patients (75%). Chest tubes were inserted to eight patients (26.7%) in Group A, and five (5.6%) patients in Group B. Accidental mesenteric ischemia was observed in two patients in which negative laparotomy was conducted, and while in one of them segmental small intestinal resection and terminal ileostomy were performed, and an inflamed appendix was observed and appendectomy was performed. The histopathology of appendix was consistent with carcinoid tumor.

Conclusion: Conservative treatment should be a strong option in young patients who have stable hemodynamic conditions whose US and CT was unremarkable without alcohol abuse, anemia and thoracic trauma.

Key words: Stab wound, laparotomy, abdominal wall

ÖZET

Amaç: Kesici delici alet yaralanmaları (KDAY) acil servise sık başvuru nedenlerinden biridir. Biz bu çalışmamızda gereksiz laparotomi oranları pre-operatif tetkik ve muayenelerle azaltılabilir mi sorusuna yanıt aradık.

Yöntemler: İzmir Bozyaka Eđitim ve Arařtırma Hastanesi Acil Servis Kliniđine 2008-2013 yılları arasında kesici delici alet yaralanması ile başvuran hastaların elektronik kayıtları retrospektif olarak incelendi.

Bulgular: Toplam 30 356 hastanın 29 367 (%96,7)'si ayaktan tedavi edildi. Bunların 274 (%27,7)'ü Genel Cerrahi Kliniđine yatırıldı. Bu hastaların 131 (%47,8)'i batına nazif yaralanmaydı. Opere edilen 120 hasta gerekli laparotomi (terapötik) 30 hasta (%25) Grup A ve gereksiz laparotomi (non terapötik+negatif laparotomi) 90 hasta (%75) Grup B olarak ikiye ayrıldı. A grubunda 8 (%26,7) hastaya torax tüpü takılırken, B grubunda 5 (%5,6) hastaya torax tüpü takıldı. Negatif laparotomi yapılan 2 hastadan birinde rastlantısal mezenter iskemi görülüp segmental ince bağırsak rezeksiyonu+uç ileostomi uygulanırken, diđerinde enflame apendiks görülerek apendektomi yapıldı. Apendiksin histopatolojisi karinsinoid tümör olarak geldi.

Sonuç: USG ve BT'nin negatif olduđu, alkollü, vitalleri stabil, anemisi ve torax travması olmayan genç hastalarda konservatif tedavi güçlü bir seçenek olmalıdır.

Anahtar kelimeler: Kesici delici alet yaralanmaları, laparotomi, karın duvarı

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INTRODUCTION

The first article related to trauma was mentioned in the Edwin Smith Papyrus in 3000-1600 B.C. In a mass grave in Egypt, injuries caused by sharp objects and arrows were detected ⁽¹⁾. Penetrating stab wounds (PSW) are currently an important problem in Turkey, as is the case around the world. In the United States of America (USA), 25% of all deaths are related to trauma ⁽²⁾. Ten percent of all deaths related to trauma are due to abdominal traumas. Surgical intervention may be required in 20% of abdominal traumas ⁽³⁾. In our hospital, 92% of the patients who had abdominal injuries within the last 5 years received laparotomy, and in the present retrospective study, 75% of these laparotomies were considered as unnecessary laparotomies.

MATERIAL and METHODS

The electronic records of patients admitted to the Emergency Service of the Ministry of İzmir Bozyaka Education and Research Hospital between 2008 and 2013 with penetrating stab wounds were retrospectively examined. The patients who were operated on due to abdominal trauma were divided into two groups, as Group A (necessary laparotomy group: therapeutic group) and Group B (unnecessary laparotomy group; non-therapeutic + negative laparotomy).

Statistical Analysis

Statistical Package for the Social Sciences (SPSS) 21 program was used to analyze the data in Izmir, Turkey. The suitability of data to normal distribution was examined with the Shapiro-Wilk test and parametric methods were used in the analysis of data with normal distribution; nonparametric methods were used in the analysis of the data without normal distribution. The independent sample t-test and Mann-Whitney U(Exact)-test were used to compare the two independent groups. Pearson's chi-square test and Monte Carlo Simulation technique were used to

compare categorical variables. Quantitative data were expressed as mean±STD (standard deviation) and median±IQR (interquartile range); whereas, categorical data were expressed as n (number) and percentages (%). Data were examined within a confidence interval of 95%, and p values smaller than 0.05 was accepted as significant.

RESULTS

Twenty-nine thousand three hundred and sixty-seven (96.7%) of the 30356 patients were ambulatory patients. The remaining 987 (3.3%) were hospitalized in different clinics. Of these patients, 274 (27.7%) were hospitalized in general surgery clinics. One hundred thirty-one (47.8%) had abdominal injuries. In all patients, the extent of abdominal injury was determined by wound exploration.

While 120 patients were operated on at the time of admission to emergency service, ten patients were followed-up and discharged after conservative treatment. One patient who was a drug abuser ran away while under observation. Out of 120 patients, eight were female (6%) and 112 were male (94%). The median age of the patients was 33.6 years (range: 16-86). Sixty-five percent of the patients were among young group, aged between 16 and 35 years. The median duration of hospital stay was 6.6 (range: 0-35) days. The most frequently involved site of injury was around the umbilicus, middle quadrant (region numbered 5) in 30 patients (23%) (Table 1). One hundred and twenty patients who were operated on were divided into two groups as Group A (necessary laparotomy; therapeutic group) (n=30; 25%), and Group B (unnecessary laparotomy: non-therapeutic + negative laparotomy group (n=90; 75%) (Tables 2-3). The median PATI (Penetrating Abdominal Trauma Index) scores in Groups A, and B were 9.5, and 1.5 points, respectively. While a chest tube was inserted to eight patients (26.7%) in Group A, and these patients, and five (5.6%) patients in Group B (Table 4). While in Group A, positivity was detected in nine of 11 patients (81.8%) in which US was performed, in

Table 1. Comparison of site of injury in patients in which laparotomy was performed GROUP A: Necessary Laparotomy (Therapeutic Laparotomy) and GROUP B: Unnecessary Laparotomy (Negative Nontherapeutic Laparotomy).

INJURY SITE	Operation		P Value
	GROUP A : Necessary Laparotomy (Therapeutic Laparotomy) n (%)	GROUP B: Unnecessary Laparotomy (Negative Nontherapeutic Laparotomy) n (%)	
Anterior	20 (66.7)	72 (80)	0.239
Posterior	1 (3.3)	0 (0)	
Lateral	4 (13.3)	8 (8.9)	
Multiple	5 (16.7)	10 (11.1)	
Right upper quadrant: 1	3 (10)	14 (15.7)	
Middle upper quadrant: 2	2 (6.7)	11 (12.4)	
INJURY SITE			
Left upper quadrant: 3	2 (6.7)	11 (12.4)	
Middle right quadrant: 4	1 (3.3)	4 (4.5)	
Around umbilicus :5	7 (23.3)	23 (25.8)	
Middle left quadrant: 6	3 (10)	6 (6.7)	
Lower right quadrant:7	1 (3.3)	3 (3.4)	
Lower middle quadrant: 8	2 (6.7)	1 (1.1)	
Lower left quadrant : 9	3 (10)	4 (4.5)	
	6 (20)	12 (13.5)	

Pearson's Chi Square Test (Monte Carlo)

Table 2. GROUP A : Necessary Laparotomy (Therapeutic Laparotomy).

Operation	N (%)
Splenectomy	5 (4.1)
Primary repair in full thickness injury of the small intestine	5 (4.1)
Primary repair in full thickness injury of the large intestine	3 (2.5)
Primary repair of diaphragm	1 (0.8)
(Primary repair in full thickness injury of the small intestine)+(Primary repair in full thickness injury of the large intestine)+(hepatoraphy)	1 (0.8)
(Primary repair in full thickness injury of the small intestine)+(Primary repair in full thickness injury of the large intestine)	1 (0.8)
(Primary repair in full thickness injury of the large intestine)+(Primary repair in full thickness injury of the stomach)	1 (0.8)
Primary repair in full thickness injury of stomach	1 (0.8)
Major vascular repair	1 (0.8)
(Primary repair in full thickness injury of large intestine)+(hepatoraphy)	1 (0.8)
(Hepatoraphy)+(primary repair of the diaphragm)	1 (0.8)
(Primary repair in full thickness injury of the stomach)+(primary repair of the aorta)+(primary repair of the pancreas)	1 (0.8)
(Hepatoraphy)+(splenoraphy)+(colostomy)	1 (0.8)
(Primary repair in full thickness injury of the stomach)+(primary repair of the pancreas)	1 (0.8)
(hepatoraphy)+(Primary repair in full thickness injury of stomach)+(primary repair of the heart)	1 (0.8)
(Primary repair in full thickness injury of the small intestine)+(ileostomy)	1 (0.8)
(Primary repair of the inferior vena cava)+(segmentary ileum resection-anastomosis)	1 (0.8)
(Primary repair in full thickness injury of small intestine)+(primary repair of serosa of the large intestine)	1 (0.8)
(Primary repair of duodenum)+(t-tube placement to choledoc)	1 (0.8)
(Primary repair of renal serosa)+(major vascular repair)	1 (0.8)

Group B, positivity was detected in four (12.1%) out of 33 patients in which US was performed. Whereas positivity was detected in 3 (37.5%) out of 8 patients in which CT was performed in Group A, positive CT findings were detected in one (4.5%) out of 22 patients in Group B.

In Group A, hypotension (n=7; 23.7%), tachycardia (n=6; 20%), and tachypnea (n=7; 6.7%) were observed. While in Group B, hypotension, tachycardia,

and tachypnea were seen in 10 (11.1%), 6 (6.7%), and 4 (4.4%) patients, respectively. Anemia was detected in eight (26.7%) patients in Group A, and ten (11.1%) patients in Group B.

Intraoperative blood transfusion was required in 11 patients (36.7%) in Group A, and in eight patients (8.9%) in Group B. Level of ethanol was higher than 10 mg/dL in three (37.5%) out of eight patients in Group A, and in 16 (51.6%) out of 31 patients in

Table 3. GROUP B: Unnecessary Laparotomy (Negative Nontherapeutic Laparotomy).

Type of Operation	N (%)
Negative laparotomy	51 (42.5)
Hepatoraphy	15 (12,5)
Primary repair of serosa of the small intestine	8 (6,6)
Primary repair of serosa of the large intestine	4 (3,3)
Primary repair of the omentum	3 (2,5)
Primary repair of the serosa of the stomach	3 (2,5)
Omentum resection, partial	2 (1,6)
Splenoraphy	1 (0,8)
Hematoma drainage from the jejunum meso	1 (0,8)
Minor vascular repair	1 (0,8)
(Primary repair of serosa of the small intestine)+(primary repair of serosa of the stomach)	1 (0,8)

Table 4. Preoperative comparison of GROUP A (Necessary Laparotomy (Therapeutic Laparotomy)) and GROUP B (Unnecessary Laparotomy (Negative Nontherapeutic Laparotomy)).

THORAX TUBE		Operation		P Value
		GROUP A : Necessary Laparotomy (Therapeutic Laparotomy) n (%)	GROUP B: Unnecessary Laparotomy (Negative Nontherapeutic Laparotomy) n (%)	
THORAX TUBE	Absent	19 (63.3)	73 (81.1)	0.079
	Present	11 (36.7)	17 (18.9)	
Ultrasonography	Absent	22 (73.3)	85 (94.4)	0.003
	Present	8 (26.7)	5 (5.6)	
Computed Tomography	(-)	2 (18.2)	29 (87.9)	<0.001
	(+)	9 (81.8)	4 (12.1)	
ANEMIA	(-)	5 (62.5)	21 (95.5)	0.048
	(+)	3 (37.5)	1 (4.5)	
HYPONATREMIA	Absent	22 (73.3)	80 (88.9)	0.072
	Present	8 (26.7)	10 (11.1)	
TACHYCARDIA	Absent	23 (76.7)	80 (88.9)	0.129
	Present	7 (23.3)	10 (11.1)	
TACHYPNEA	Absent	24 (80)	84 (93.3)	0.071
	Present	6 (20)	6 (6.7)	
BLOOD	Absent	24 (80)	86 (95.6)	0.015
	Present	6 (20)	4 (4.4)	
MORBIDITY	Absent	19 (63.3)	82 (91.1)	0.001
	Present	11 (36.7)	8 (8.9)	
ETHANOL	Absent	27 (90)	89 (98.9)	0.048
	Present	3 (10)	1 (1.1)	
Pearson's Chi Square Test (Exact)	(-)	5 (62.5)	15 (48.4)	0.695
	(+)	3 (37.5)	16 (51.6)	

Group B The injuries were mostly observed in summer (33%) and most frequently in May (14%). The admissions to hospital were most frequently observed between 24:00-04:00 hours (47.5%). While 51 (42.5%) patients had negative laparotomies, nontherapeutic laparotomy was performed on 39 (32.5%) patients. The most common operation for patients in which nontherapeutic laparotomy was performed was hepatoraphy in 15 patients (11.5%). Any mortality was not observed. In Group A, wound infection was observed in three patients, whereas in Group B, reexploration was performed in one patient

due to postoperative ileus. Accidental mesenteric ischemia was observed in two patients in which negative laparotomy was performed, while in one patient, segmental small intestinal resection and terminal ileostomy was performed. The other patient had an inflamed appendix and an appendectomy was performed. The histopathology of the appendix was consistent with a carcinoid tumor.

DISCUSSION

Penetrating stab wounds (PSW) are as old as

human history, and can be traced to when Habil, the grandson of the Holy Prophet Adam, killed his younger brother Kabil with a piece of sharp stone. Since then until the present day, both sharp objects and the treatment methods have changed. Although routine laparotomy was accepted in PSW's during the First and Second World Wars, this treatment method was questioned in 1960s and selective conservative treatment became popular⁽⁴⁻⁷⁾. In the study of Jansen et al.⁽⁸⁾, 84.3% of the surgeons in England and Ireland and 94.4% of the surgeons in the USA preferred selective conservative treatment. As the rate of intraabdominal organ injury is higher than 90% in firearm injuries, direct laparotomy is performed, whereas in PSW, the selective conservative approach has recently become popular⁽⁹⁾. As the duration of hospital stay decreases in this approach, the patients' cost decreases approximately \$2800 US Dollars⁽¹⁰⁾. In the present study, 7% of the surgeons preferred selective conservative treatment.

When the literature before 1990s was examined, the rate of negative laparotomy was reported as 5-14.3%⁽¹¹⁻¹³⁾. After 1990s, studies were published that demonstrate that routine laparotomy had negative results at a rate of 50%⁽¹⁴⁻¹⁶⁾. In the present study, the rate of negative laparotomy was 42.5%. In patients in which negative laparotomy was performed, morbidity was reported as 0-19% and mortality as 1.1-6.3%⁽¹⁰⁻¹⁷⁾. In the present study, while no mortality was seen in patients who had negative laparotomy, morbidity was found as 2%. However, the cases that died in the ambulance or upon first admission to emergency service were not included in the study. In the study of Leydand et al. that was performed on patients admitted to the hospital with PSW in Scotland between 1981-2003, they reported that 66.6% of the patients were aged between 15-34 years, and 53.7% of these were male⁽¹⁸⁾.

In another study, only abdominal PSWs were included and it was reported that 90.3% of these cases were male and the mean age was 30.3 years⁽¹⁹⁾.

Similar to the literature, the current study revealed that 63% of the patients in Group A + Group B were

among young population, aged between 16-35 years, and the percentage of the males was 92%. The patients were most frequently admitted in the summer, in May and between the hours of 24:00-4:00. The authors believe that this might be due to the increased alcohol consumption in the summer and in the evening. Duration of hospital stay was 7.5 days in Group A, and 5 days in Group B. The mean PATI score was 9.5 and 1.5 in Groups A and B, respectively. This index, which was found by MOORE, is the most common test used to predict the mortality and morbidity of the patient⁽²⁰⁾. In the study of Navsaria et al.⁽²¹⁾, anterior abdominal wall was reported to be the most (55%) frequent site of injury

In the present study, the anterior abdominal wall injuries were seen in 76% of the cases. In a prospective study by Demetriades et al.⁽²²⁾ the most frequently injured solid organ was the liver (73%), kidneys (30.3%), and spleen (30.3%) in decreasing frequencies. In the current study, the most commonly injured solid organ was the liver (70%), followed by the spleen (22%), kidneys (4%), and pancreas (4%) in decreasing frequencies. An abdominal injury is detected by wound exploration, diagnostic peritoneal lavage, radiological methods, clinical outcomes (shock, hypotension), peritoneal irritation signs, hematuria, organ evisceration, and laboratory findings (complete urine analysis and hemogram)⁽²³⁾.

Many centers detect abdominal injuries by wound exploration⁽²⁴⁻²⁶⁾.

However, anterior -by some authors- posterior abdominal fascia was accepted as the margin of the abdominal wounds⁽²⁷⁾. In the current study, the authors evaluated the injuries extending to the posterior abdominal fascia as abdominal wounds. Abdominal injury alone is not sufficient criteria for laparotomy⁽²⁴⁾. Moreover, even the determination of organ evisceration is an absolute indication for laparotomy is controversial⁽²⁸⁻³⁰⁾. While in some publications, evisceration alone without signs of shock and peritoneal irritation are not accepted as indication for emergent laparotomy^(28,31,32); in some publications, emergent laparotomy is recommended

as the rate of organ injury is very high ^(10,29,30,33). The presence of signs of peritoneal irritation and shock detected during physical examination suggests the presence of a severe pathology. However, these findings are present in only 28% of these injuries ⁽³⁴⁾. In the current study, while the signs of shock (hypotension, tachycardia, and tachypnea) were observed at a rate of 21% in Group A (Necessary Laparotomy (Therapeutic Laparotomy Group)), these signs were observed in 7% of the patients in Group B (Unnecessary (Negative + Nontherapeutic Group)) Laparotomy. In Group A, there was accompanying thorax trauma in 36.7% of the patients, and a thorax tube was inserted in 26.7% of these patients. In Group B, thorax trauma accompanied in 18.9% of the patients, and a thorax tube was inserted in 5.6% of the cases. This demonstrates that the signs of shock alone could misguide the surgeon in PSW with multiple traumas. Some studies have indicated that initial physical examination is not reliable and could give false negative or false positive results ^(35,36).

The authors investigated alcohol intake as the causative agent affecting the initial physical examination. Of course, even if the numbers were not sufficient, the level of ethanol was above 10 mg/dl in 37.5% of the patients in Group A and in 51.6% of the patients in Group B. More than 50% of the patients had consumed alcohol in cases in which unnecessary laparotomy was performed and the level of ethanol was controlled which is quite an important factor in decision making. The study of Demetriades et al. ⁽¹²⁾ found the rate of negative laparotomy as 40.38% when surgery was performed in all abdominal traumas; as 28.46% when surgery was performed in penetrating stab wounds; as 20.17% when surgery was performed in the presence of findings such as positive paracentesis, subdiaphragmatic gas, and evisceration; and as 7% when surgery was performed by taking clinical examination as the major criteria.

The question as to whether a delay in the treatment increases mortality and morbidity in selective conservative approach maintains its importance. Ekiz et al. ⁽³⁷⁾ investigated the primary repair in delayed

small intestine and colon perforations and they reported that the time to surgery is not a severe risk factor. Butt et al. ⁽³⁸⁾ recommended follow-up in penetrating abdominal injuries if the patient is stable, the tomography results are negative, and if there is no left thoracoabdominal injury. In the current study, in addition to physical examination, US and tomography were performed in suitable patients whose vital signs were stable. While ultrasonography is sufficient to detect the intraabdominal free fluid, it is usually insufficient to demonstrate solid organ damage ^(39,40). The use of tomography is progressively increasing and it has even begun to replace DPL in some centers ⁽⁴¹⁾. At the present time, the number of centers in which contrast-enhanced CT is obtained by three routes such as oral, IV, and rectal is increasing.

In ultrasonography while there were positive findings in 81.8% of the patients in Group A, positive findings were found in 12.1% of the patients in Group B, which was statistically significant. The rate of positivity was 37.5% in Group A and as 4.5% in Group B in patients in which abdominal tomography was performed. The ratio of patients in which anemia was detected was 26.7% in Group A and 11.1% in Group B; however it was not statistically significant.

Although the rate of unnecessary laparotomy was reported to be 14.8-19.1% in some publications, it was 75% in the current study ^(42,43). Interestingly, in one of two patients in which negative laparotomy was performed, accidental mesenteric ischemia was observed and segmental small intestinal resection and terminal ileostomy were performed. In the other patient, an inflamed appendix was observed and an appendectomy was performed. The histopathology of appendix was consistent with a carcinoid tumor.

The low rate of negative laparotomy in the decision for surgery, which was made in consideration of the physical examination, but at the same time the initial physical examination being unreliable due to causes such as alcohol, is contradictory. All cases in the present study were the subject of forensic investigation, and the fact that the relatives of the cases being prone to violence might have produced a

pressure on the surgeon in decision making. In the present study, although the resulting negative laparotomy rate (42.5%) and unnecessary laparotomy rate (75%) were higher than the rates in the literature, no significant difference was observed in terms of mortality and morbidity.

CONCLUSION

The authors believe that the patients in which by wound exploration injury was demonstrated to be a penetrating abdominal stab wound should be treated conservatively if the patient had alcohol abuse, with stable vital signs without any evidence of anemia, chest trauma or any pathology requiring a thorax tube, and hollow organ perforation on abdominal tomography and left thoraco-abdominal trauma.

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