Original Article

Incidence, Patterns, and Factors Predicting Mortality of Abdominal Injuries in Trauma Patients

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Abstract

Background: Abdominal trauma is a major public health problem for all nations and all socioeconomic strata. **Aim:** This study was designed to determine the incidence and patterns of abdominal injuries in trauma patients. **Materials and Methods:** We classified and identified the incidence and subtype of abdominal injuries and associated trauma, and identified variables related to morbidity and mortality. **Results:** Abdominal trauma was present in 248 of 300 cases; 172 patients with blunt abdominal trauma and 76 with penetrating. The most frequent type of abdominal trauma was blunt trauma; its most common cause was motor vehicle accident. Among patients with penetrating abdominal trauma, the most common cause was stabbing. Most abdominal trauma patients presented with other injuries, especially patients with blunt abdominal trauma. Mortality was higher among penetrating abdominal trauma patients. **Conclusions:** Type of abdominal trauma, associated injuries, and Revised Trauma Score are independent risk factors for mortality in abdominal trauma patients.

Keywords: Abdominal injuries, Incidence, Mortality, Patterns, Trauma

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Introduction

Trauma is still the most frequent cause of death in the first four decades of life, and it remains a major public health problem in every country, regardless of the level of socioeconomic development.[1] The abdomen is the third most common injured region, with surgery required in about 25% of civilian cases.[2] Abdominal trauma is traditionally classified as either blunt or penetrating. Penetrating abdominal trauma can usually be diagnosed easily and reliably, whereas blunt abdominal trauma is often missed because clinical signs are less obvious.[1] Blunt abdominal injuries predominate in rural areas, while penetrating ones are more frequent in urban settings.[2] Penetrating abdominal trauma is often subdivided into stab wounds and gunshot wounds, which require different methods of treatment.[3]

In order to minimize mortality in cases of abdominal trauma, risk factors for mortality need to be systematically identified and studied. In recent years, studies have identified a number of such risk factors, including sex, the length of the interval between abdominal injury and surgery, shock at the time of admission, and cranial injury.[1] Our goals were to document the incidence of abdominal trauma among patients presenting serially to the emergency room of Suez Canal University Hospital, Ismailia-Egypt; determine the type of abdominal trauma; determine the injuries' associated features; and catalog a range of independent risk factors for mortality in our sample.

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Materials and Methods

This was a descriptive (prospective and retrospective) study of all trauma patients over the age of 18 years admitted to the emergency department (ED) of Suez Canal University Hospital, Ismailia-Egypt, between December 2005 and January 2011.

Data collection

The following clinical and demographic data were collected for each patient:

1. Sociodemographic data: Age, sex, residence, and arrival time.
2. Clinical data: Initial assessment of ABCDE (airway and cervical spine control; breathing; circulation; dysfunction of the central nervous system; and exposure),[4] followed by regional examination of head and neck; chest; abdomen; extremities; and back. An initial determination of abdominal trauma type was made by thorough physical examination. Patient condition was next classified as either stable or unstable. Finally, a plan was developed for additional evaluation and management.
   We defined stability and hemodynamic status with the revised trauma score (RTS), one of the most widely used physiological rating systems: The RTS, the glasgow coma scale (GCS), systolic blood pressure, and respiratory rate (RR). The degree of dysfunction in each parameter is scored from 0-4 and the RTS is determined by adding each of the coded values together; therefore, RTS scores range from 0 to 12.[4]
3. Investigations: Two types of investigative data were analyzed:
   a. Laboratory investigations: These included complete blood count, blood typing, and cross matching and coagulation profile.
   b. Radiographic investigations**:** Plain chest X-ray, pelviabdominal ultrasound, and, in some stable cases, computed tomography.
4. Trauma data: We documented the pattern of abdominal injury, time of injury, mechanism of trauma, and associated injuries. Cases of penetrating abdominal trauma are abbreviated in this report as penetration cases. Cases of blunt abdominal trauma are abbreviated as blunt cases.
5. Medical history: A medical history was attempted in each case, with an emphasis on documenting the existence of any comorbid chronic disease.
6. Emergency department outcome: Each patient's ED outcome was coded as one of the following: Surgical intervention; admitted for observation; admitted to the Intensive Care Unit; recovered while under observation; or died while in the ED.

Statistical analysis

All data were entered and coded using Microsoft Excel and analyzed with Statistical Package for Social Sciences (SPSS) version 10.0 Chi-square, nonparametric and multiple logistic regressions tests were used to compare categorical variables; all other analyses relied on the independent *t*-test or one way analysis of variance (ANOVA). In all cases, we relied on a *P* value of <0.05.

Results

Abdominal trauma was present in 248 of 300 cases (82.7%); 172 patients presented with blunt abdominal trauma (69.4%) and 76 (30.6%) patients with penetrating abdominal trauma. There were no significant differences in the demographic characteristics of abdominal trauma cases *vs* non-abdominal trauma cases, except for a positive association between abdominal trauma and rural residence (P=0.03). The majority of abdominal trauma cases were male (87.1%). Motor car accidents were the immediate cause of 62.8% of the abdominal traumas; falls and/or violence accounted together for all of the remaining cases. Among the penetration cases, 47.4% were stab injuries, 36.8% were blast injuries, and 15.8% were gunshot wounds.

Overall, abdominal trauma was associated with additional comorbid injuries in 66.1% of cases, and more so for blunt cases (76.7%) than for penetration cases 42.1%, P<0.05. The most common associated injuries in blunt cases were injury of extremities (51.2%), chest injuries (34.1%), and head and neck injury (14.6%). Cases most commonly had injuries of the chest (54.5%), and 45.5% presented with injury of extremities.

Overall, few (19.4%) abdominal trauma patients reported history of chronic disease. Among those who reported chronic illness, the most common illness was hypertension (50%).

Clinical features

Table 1 presents the clinical evaluation of abdominal trauma patients on arrival. Several features stand out: Patients who survived were more hemodynamically and neurologically stable upon arrival [Tables 2 and 3], and most abdominal trauma patients were initially stable (69.4%). There was much higher mortality among penetration cases (57.9%) than among blunt cases (11.6%), which was consistent with the lower RTS scores for penetration cases. The relatively few blunt cases who died in the ED had more comorbid injuries than did surviving cases; for example, fully 80% of the fatal blunt cases were suffering from injuries to their extremities (P≤0.01). Mean hemoglobin was significantly lower among fatal abdominal trauma cases. This was true both for the blunt cases (Hb was 6.4±0.9 for fatal blunt cases and 10.6±1.3 for nonfatal blunt cases, P≤0.01) and for penetration cases (Haemoglobin was 8.2±0.8 for fatal cases and 11.1±0.8 for nonfatal cases, P≤0.01.

Surgical intervention vs observation

Overall, 28.3% of the abdominal trauma cases received surgical intervention. Surgical intervention was far more

Table 1: Clinical evaluation results both blunt and penetrating of abdominal trauma patients

	Blunt trauma (*n*=172)		Penetrating trauma (*n*=76)		*P* value
	Number	Percent	Number	Percent	
Breathing					0.01*
Self breathing	152	88.4	40	52.6	
Assisted breathing	20	11.6	36	47.4	
Pulse					0.1 (NS)
<100/min	128	74.4	40	52.6	
>100/min	44	25.6	36	47.4	
Systolic blood pressure					0.02*
>80 mmHg	144	83.7	40	52.6	
<80 mmHg	28	16.3	36	47.4	
Respiratory rate					1 (NS)
<20/min	156	90.7	72	94.7	
>20/min	16	9.2	4	5.3	
External bleeding					0.05 (NS)
Not present	84	48.8	12	15.8	
Mild	52	30.2	36	47.4	
Moderate	36	20.9	24	31.5	
Severe	0	0	4	5.3	
Glasgow coma scale					0.001*
13–15	140	81.4	24	31.5	
9–12	8	4.7	8	10.6	
6–8	16	9.3	12	15.8	
4–5	4	2.3	20	26.3	
3	4	2.3	12	15.8	

*Statistically significant difference (*P* value <0.05). NS: No statistically significant difference (*P* value >0.05)

Table 2: Comparison of clinical evaluation data among blunt abdominal trauma patients

	Blunt trauma (*n*=172)				*P* value
	Alive group (*n*=152)		Dead group (*n*=20)		
	Number	Percent	Number	Percent	
Breathing					0.09 (NS)
Self breathing	140	92.1	12	60	
Assisted breathing	12	7.9	8	40	
Pulse					0.01*
<100/min	124	81.6	4	20	
>100/min	28	18.4	16	80	
Systolic blood pressure					0.001*
>80 mmHg	140	92.1	4	20	
<80 mmHg	12	7.9	16	80	
Respiratory rate					0.4 (NS)
<20/min	140	92.1	16	80	
>20/min	12	7.9	4	20	
External bleeding					0.07 (NS)
Not present	80	52.6	4	20	
Mild	48	31.6	4	20	
Moderate	24	15.8	12	60	
Glasgow coma scale					0.001*
13–15	140	92.1	0	0	
9–12	8	5.3	0	0	
6–8	4	2.6	12	60	
4–5	0	0	4	20	
3	0	0	4	20	

*Statistically significant difference (*P* value <0.05). NS: No statistically significant difference (*P* value >0.05)

Table 3: Comparison of clinical evaluation data among penetrating abdominal trauma patients

	Penetrating trauma (*n*=76)				*P* value
	Alive group (*n*=32)		Dead group (*n*=44)		
	Number	Percent	Number	Percent	
Breathing					0.001*
Self breathing	32	100	8	18.2	
Assisted breathing	0	0	36	81.8	
Pulse					0.001*
<100/min	32	100	8	18.2	
>100/min	0	0	36	81.8	
Systolic blood pressure					0.001*
>80 mmHg	32	100	8	18.2	
<80 mmHg	0	0	36	81.8	
Respiratory rate					1 (NS)
<20/min	32	100	40	90.9	
>20/min	0	0	4	9.1	
External bleeding					0.6 (NS)
Not present	4	12.5	8	18.1	
Mild	20	62.5	16	36.4	
Moderate	8	25	16	36.4	
Severe	0	0	4	9.1	
Glasgow coma scale					0.001*
13–15	24	75	0	0	
9–12	8	25	0	0	
6–8	0	0	12	27.3	
4–5	0	0	20	45.4	
3	0	0	12	27.3	

*Statistically significant difference (*P* value <0.05). NS: No statistically significant difference (*P* value >0.05)

common for penetration cases (100%) than for blunt cases (13.2%). Overall, more than half of the patients who survived (63.1%) were admitted for observation, and admission for observation was more common for blunt cases (76.2%) ($P \leq 0.001$).

Delay to treatment

The interval between injury and care in the ED may also be an important risk factor for fatalities. For example, 80% of blunt cases who experienced a delay of 60 to 90 minutes died at the ED, whereas nearly as many blunt cases who waited less than 60 minutes survived (76.3%). Similarly, 81.8% of fatal penetration cases waited 60 to 90 minutes for emergency care, whereas 75% of surviving penetration cases waited less than 60 minutes ($P \leq 0.001$).

Independent significant risk factors

Table 4 summarizes the strength of association between fatal outcomes and a number of independent risk factors, including type of abdominal trauma (blunt *vs* penetrating), comorbid injuries, comorbid chronic illness, low RTS, Haemoglobin level, interval between injury and intervention; and abnormal pelviabdominal ultrasound.

Table 4: Assessment of risk factors of mortality among abdominal trauma patients

Factor	Odds ratio	95% CI	*P* value
Age	1.1	0.3–1.6	0.3 (NS)
Sex	0.9	0.6–1.9	0.4 (NS)
Type of abdominal trauma	6.2	3.6–4.9	0.001*
Associated injuries	1.9	1.3–2.8	0.03*
Associated chronic illness	1.6	0.9–3.1	0.04*
Low RTS	5.3	4.9–6.1	0.001*
Hb level	2.8	2.1–3.9	0.02*
Interval between arrival and resuscitation	8.1	7.5–9.2	0.001*
Abnormal pelviabdominal US	1.3	1.1–1.9	0.04*

CI: Confidence interval; RTS: Revised trauma score; Hb: Haemoglobin; US: Ultrasound; NS: No statistically significant difference

Discussion

The earliest known medical text, the Edwin Smith Papyrus, classified injuries into the following three grades: Treatable, uncertain, and untreatable.[5] Modern trauma scoring methodology uses a combination of an assessment of the severity of anatomical injury with a quantification of the degree of physiological dysfunction to arrive at scores that correlate with clinical outcomes.[6]

In the present study, significantly more males than females presented with abdominal trauma (87.1% *vs* 12.9%), which is consistent with Lone *et al.*'s report of a male to female ratio of 4.4: 1 among abdominal trauma patients.[6] Young males, most of all those aged 20 to 30 years, have been reported to be the most frequent victims. [7] 69.4% of the cases were blunt abdominal trauma. Consistent with our results, previous studies found that most abdominal injuries were caused by blunt trauma.[1,8] Blunt abdominal trauma is more likely to be missed because clinical signs are less obvious.[9] Blunt injuries have been reported to predominate in rural areas,[3,10] but in our study no such demographic pattern was detected.

Vehicle accidents are a common cause of blunt abdominal trauma.[10] In our study, they were the most common cause (62.8%); the second most common was falling from a height and the third was interpersonal violence. Others have found that the main causes of blunt abdominal trauma were road accidents, interpersonal violence, and falls.[8] The most common cause of penetrating abdominal trauma in our sample was stabbing (47.4%). Gunshot wounds were the most common (77.65%) reported cause in other studies.[6,7] Blunt trauma in the present study was strongly associated with other comorbid injuries (76.7%), whereas penetration trauma was less strongly associated with such injuries (57.9%). The most common comorbid injury was to an extremity. Blunt abdominal trauma patients were more stable than penetrating abdominal trauma patients with RTSs, a combined index of blood pressure, GCS, and RR that predicts fatalities.[11]

The overall mortality rate among abdominal trauma patients in our series was 25.8%, which is relatively high. Mortality was significantly higher with penetrating trauma patients than with blunt trauma (57.9% *vs* 11.6% respectively, *P* value <0.05). Other investigators[6] have reported much lower mortality rates of 9.2% and 8.2% in penetrating and non-penetrating injuries, respectively. But, hemodynamically unstable patients with abdominal or suspected abdominal injuries undergoing emergency laparotomy have a much higher reported mortality, up to 56%, especially those with BP ≤60 mmHg.[12]

In our study, multiple logistic regressions were done to estimate the significance of prognostic factors of mortality among abdominal trauma patients as a whole and among patients with different types of abdominal trauma (penetrating or blunt).

We explored risk factors for fatalities in this sample of penetrating and blunt abdominal injuries. The strongest risk factor for all abdominal cases was delay before treatment. In all cases, the type of abdominal trauma, RTS, and comorbid injuries predicted higher mortality. [13] Increasing age was an additional risk factor among those with blunt injuries. Penetrating trauma had a much higher rate of fatality overall, and the type and site of penetration injury mattered a great deal. Gunshot wounds were associated with about eight times higher fatality rate than stab wounds, a pattern that is consistent with others' findings.[6,7,14] Other investigators have reported that conditions such as female sex, length of interval between injury and medical intervention, presence of shock at admission, presence of cranial injury, and high penetrating abdominal trauma index were all predictors of mortality in penetrating abdominal trauma cases.[1]

Conclusion

A number of independent risk factors for fatality were identified in this sequential sample of 248 abdominal trauma cases presenting to our ED. These included type of abdominal trauma (whether blunt or penetrating), presence of comorbid injuries, presence of chronic disease, RTS, haemoglobin level, delay before treatment, and abnormal pelviabdominal ultrasound. Improved motor vehicle safety; rapid emergency transport; and rapid intervention should help to reduce the mortality and morbidity associated with this public health problem.

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