Original Article

Determinants of Outcome of Abdominal Trauma in an Urban Tertiary Center

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Abstract

Background: Abdominal trauma constitutes a significant cause of potentially preventable mortality. Therefore, knowledge of the determinants of outcome facilitates the development of rational treatment protocols for improving outcome. **Objective:** To identify the determinants of outcome in patients with abdominal trauma managed in a tertiary health center. **Patients and Methods:** This is a prospective study of consecutive patients presenting with abdominal trauma to our tertiary health center over a 12-month period. Data regarding patient demographics, injury mechanisms, type of organ injuries, treatment modalities, injury-to-intervention time, and outcomes were documented. The Injury Severity Scores and Revised Trauma Scores were determined. The data were analyzed using the Statistical Package for the Social Sciences version 20. **Results:** There were 76 patients, 66 males and 10 females, whose ages ranged from 15 to 66 years (mean of 32.9 ± 10 years). Thirty-one (40.2%) patients had blunt abdominal trauma whereas 45 (59.8%) patients had penetrating trauma. There was a mortality rate of 8% predominantly from blunt trauma as compared to penetrating abdominal trauma (12.9% *vs.* 4.4%). There was a statistically significant difference between survivors and nonsurvivors as regards the means of injury-to-intervention time (25.4 ± 36.4 *vs.* 67.5 ± 58.2, $P = 0.007$), the means of Injury Severity Scores (15.1 ± 27.9 *vs.* 23.7 ± 9.8, $P = 0.008$), and the presence of brain injury (50.0% *vs.* 5.6%, $P = 0.029$). **Conclusion:** This study has shown that delayed intervention, high Injury Severity Score, and associated significant brain injury were determinants of poor outcomes. Prompt intervention and postoperative management in intensive care definitely improve outcome.

Keywords: *Abdominal trauma, blunt abdominal trauma, management outcome in abdominal trauma, penetrating abdominal trauma*

Introduction

The abdomen is the third most commonly injured part of the body in civilian trauma, and in about 25% of cases, surgery is required.[1] Abdominal injuries could be blunt or penetrating, and many patients with abdominal trauma suffer polytrauma. In civilian practice, there is often a predominance of blunt trauma whereas in war, there is a greater incidence of penetrating abdominal trauma.[2] The use of modern means of transport, leading to motor vehicle, motorcycle, and pedestrian-vehicle accidents contributes to blunt abdominal trauma cases.[3] However, sectarian violence, intertribal wars, and criminal acts account for a significant proportion of the penetrating abdominal injury cases.[2]

The clinical outcome for either penetrating or blunt abdominal trauma is dependent on the anatomical extent of injuries and the presence of extra-abdominal injuries. In particular, head injuries have a disproportionate influence on trauma outcomes and the presence of associated

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craniocerebral injuries has been known to contribute to adverse outcome.[4] Another significant outcome determinant is the degree of physiologic insult, which can be measured by the Revised Trauma Score (RTS).[5]

Age is a significant clinical outcome determinant, as geriatric patients due to decreased physiological reserve, frailty, and preinjury comorbidities have a higher morbidity and mortality on an injury-for-injury basis than their younger counterparts.[6] The presence of preexisting medical comorbidities plays a modulating role in not just physiologic response to injury but the overall outcomes[7] It has been noted uniformly, however, that the vast majority of trauma victims are young.[2,8]

In addition to the foregoing, the existence or nonexistence of functional and highly organized trauma management systems can significantly affect outcome in trauma patients. The dearth of organized trauma management systems in resource-poor settings constitutes a significant challenge to the management of trauma patients.

In general, to study the outcomes of trauma, accurate and reliable methodological tools are required for appropriate scoring of severity and outcome prediction.[9-13] Statistical scores for predicting outcomes can be divided into three categories: anatomical scores, physiological scores, or a combination of the two.[13] Trauma and Injury Severity Score (TRISS), Revised Trauma Score (RTS), and ISS are scoring systems used to assist in clinical decision-making and to aid physicians in initial evaluation of trauma. ISS is an anatomical score and independent predictor of death that is mostly used for patients with multiple injuries.[14] RTS is a physiological score for predicting in-hospital mortality and outcome of trauma patients.[5] TRISS uses a combination of both physiological and anatomical ISS (RTS and ISS) as well as age to predict posttrauma survival. Studies to identify determinants of outcome in abdominal trauma have not been undertaken in our center. It is, therefore, necessary to identify these determinants of outcome and recommend changes for the modifiable determinants in this environment.

Patients and Methods

This was a prospective hospital-based study carried out over 12 months from November 2014 to October 2015. Ethics committee approval was obtained for the study with reference number: ADM/DCST/HREC/1614. The hospital is a tertiary center in Lagos metropolis and attends to referrals from other hospitals in the city. Consecutive adult patients with clinical and imaging finding suggestive of abdominal trauma during the period of the study were included. It included patients with either penetrating or blunt abdominal trauma. Patients who sustained abdominal trauma but died before arrival or whose injuries could not be evaluated before death were excluded.

Information collected included demographic data: vital signs at presentation, injury mechanisms, types of injuries sustained, surgery performed, complications, and outcome. These were documented in a pro forma. The degree of physiologic injury and anatomical extent of injuries were computed using the known instruments of stratification such as the Revised Trauma Score (RTS)[5] and the ISS,[14] respectively. The Revised Trauma Score (RTS) is a physiologic scoring system based on the initial vital signs of a patient. The score consists of three continuous measurements, Glasgow Coma Scale, systolic blood pressure, and respiratory rate. On the other hand, the ISS is an anatomically based scoring system to assess trauma severity. It is based on the Abbreviated Injury Scale that classifies each injury in everybody region on a six-point ordinal scale.[15] The TRISS scores were computed from the physiologic and anatomic scores as referred to above. A web-based software was employed for this calculation.[16]

The management policy for the patients included resuscitation according to Advanced Trauma Life Support protocols and emergency laparotomy for patients with shock and generalized peritonitis. Hemodynamically stable patients with minimal, equivocal, or no abdominal sign were selected for nonoperative management. The nonoperative management protocol involved serial observation of vital signs and abdominal examination and determination of the anatomical grade of injury using a computerized tomography scan of the abdomen. Diagnostic laparoscopy was done for hemodynamically stable patients with penetrating abdominal trauma.

Data collected were collated using Statistical Package for Social Sciences (SPSS) Version 20, IBM, Armonk, NY, United States of America. Level of significance was set at $P < 0.05$.

Results

There were a total of 96 consecutive patients with suspected abdominal injuries during the period of the

Table 1: Age distribution of abdominal trauma (*n*=76; 100%)

Age distribution	*n* (%)
11-20	9 (11.8)
21-30	27 (35.5)
31-40	23 (30.3)
41-50	11 (14.5)
51-60	4 (5.3)
61-70	2 (2.6)

Table 2: Injury-to-intervention time

Variable (h)	Injury-to-intervention time		
	Penetrating (*n*=45), *n* (%)	Blunt (*n*=31), *n* (%)	Total (*n*=76; 100%), *n* (%)
0-6	3 (6.7)	0 (0.0)	3 (3.9)
7-12	16 (35.6)	0 (0.0)	16 (21.1)
13-24	20 (44.4)	8 (36.4)	28 (36.8)
25-48	4 (8.9)	8 (36.4)	12 (15.8)
>48	2 (4.4)	6 (27.3)	8 (10.5)
No surgical intervention	0	9	9 (11.8)
Mean±SD	17.2±13.4	53.7±61.1	

SD: Standard deviation

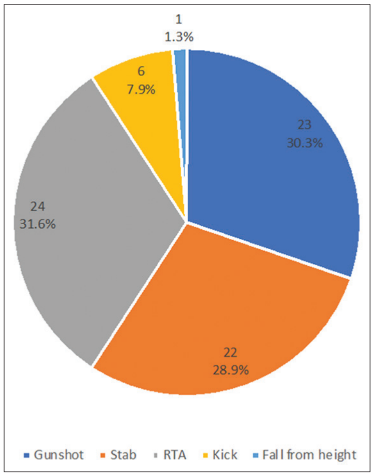

Figure 1: Etiology of abdominal trauma

Table 3: Injury severity score

Variables	Penetrating, *n* (%)	Blunt, *n* (%)	Statistics
ISS			
0-10	5 (11.1)	6 (19.4)	χ^2: 12.475 df=4 *P*=0.014
11-20	35 (77.8)	15 (48.4)	
21-30	3 (6.7)	10 (32.3)	
31-40	1 (2.2)	0	
>40	1 (2.2)	0	
Mean	15.4±7.6	16.4±7.9	

ISS: Injury severity score

Table 4: Presenting vital signs of survivors and nonsurvivors

Variables	Outcome		*P*
	Survivors, *n* (%)	Nonsurvivors, *n* (%)	
Pulse rate			
<100	31 (100.0)	0 (0.0)	0.092
≥100	39 (86.7)	6 (13.3)	
Systolic blood pressure			
<90	3 (75.0)	1 (25.0)	0.285
≥90	67 (93.1)	5 (6.9)	
Respiratory rate			
<20	5 (100.0)	0 (0.0)	1.00**
≥20	65 (91.5)	6 (8.5)	
Glasgow Coma Scale			
13-15	68 (94.4)	4 (5.6)	0.029*
9-12	2 (50.0)	2 (50.0)	

*Significant, **Fisher Exact Test after Chi-square

study, but data from only 76 (79.2%) patients were analyzed based on the inclusion criteria. Of these, there were 66 (86.8%) males and 10 (13.2%) females; age range was from 15 to 66 years and a mean age of 32.1 ± 10.1 years. The majority (77.6%) of the patients were between the 2nd and 4th decades of life [Table 1]. Penetrating injuries occurred in 45 (59.2%) patients, while 31 (40.8%) patients had blunt injuries [Figure 1]. Penetrating injuries were due to gunshot in 23 (30.3%) patients and abdominal stab wounds in 22 (28.9%) patients, while blunt abdominal injuries were due to road traffic accidents, kicks, and fall from height [Figure 1]. Seventy-two (94.7%) patients were conscious at presentation while four patients were unconscious as a result of head injury. As regards mode of treatment, 66 (86.8%) patients had trauma laparotomy, 9 (11.8%) patients (blunt abdominal trauma) had nonoperative treatment, and 1 (1.3%) patient with penetrating trauma underwent diagnostic laparoscopy. There were 6 (7.8%) deaths in this study and all were males. Four of the mortalities were due to blunt abdominal trauma while the remaining two suffered penetrating abdominal injuries.

Table 2 shows the injury-to-intervention time. The injury-to-intervention time was almost uniformly delayed, with only 3 (6.7%) patients getting operative intervention within 6 hours (h). The mean injury-to-intervention time for penetrating and blunt injuries was 17.2 ± 13.4 h and 53.7 ± 61.1 h, respectively. Nine patients with blunt abdominal trauma had successful nonsurgical intervention.

Table 3 depicts the ISS of the patients. The ISS ranged from 6 to 50 in penetrating injuries and from 9 to 30 in patients with blunt abdominal trauma. The overall mean ISS was 15.8 ± 7.7. The mean ISS was 15.4 ± 7.6 in penetrating abdominal trauma and 16.4 ± 7.9 in blunt abdominal trauma (*P* = 0.014).

Table 5: Presentation and intervention parameters and outcome (survival/death)

	Survivors	Nonsurvivors	Test statistics	P
Time of presentation (h), mean±SD	13.1±27.9	43.2±51.3	U=128.500	0.115
Mode of presentation, n (%)				
Conscious	68 (94.4)	4 (5.6)	Fisher's exact**	0.029
Unconscious	2 (50.0)	2 (50.0)		
Revised trauma score, mean±SD	7.7±0.4	7.3±0.5	t=2.367	0.021*
Surgical intervention time (h), mean±SD	16.6±28.2	24.3±16.3	U=93.500	0.049*
Injury-to-intervention time (h), mean±SD	25.4±36.4	67.5±58.2	U=59.500	0.007*
Mode of care, n (%)				
Operative	60 (90.9)	6 (9.1)	Fisher's exact**	<0.001*
Nonoperative	10 (100.0)	0 (0.0)		
Injury severity score, mean±SD	15.1±27.9	23.7±9.8	t=−2.715	0.008*
TRISS, mean±SD	97.2±6.9	95±3.9	t=0.949	0.917
ICU admission (days)	5 (50.0)	5 (50.0)	Fisher's exact**	<0.001*
ICU length of stay (days), mean±SD	0.4±1.8	4.2 (4.1)	U=81.500	<0.001*
Length of hospital stay (days)	13.4±14.3	5.2±3.3	U=89.000	0.019*

*Statistically significant; *U*: Mann-Whitney U-test; *t*: Independent Sample *t*-test, **Fisher's exact test Chi-square performed.
TRISS: Trauma Injury Severity Score, SD: Standard deviation, ICU: Intensive care unit

Table 4 shows the comparison of Revised Trauma Scores of survivors and nonsurvivors and it reveals a statistically significant greater frequency of severe head injury in nonsurvivors, $P = 0.029$. Other vital signs (pulse rate, respiratory rate, and systolic blood pressure) were comparable between the two groups. Accordingly, the mean Revised Trauma Score was higher in patients who survived (7.7 ± 0.4) than in nonsurvivors (7.3 ± 0.5), and the difference was statistically significant, $P = 0.021$.

Table 5 compares the surgical intervention time, injury-to-intervention time, and intensive care unit (ICU) length of stay between survivors and nonsurvivors, and the values were significantly lower in patients who survived ($P < 0.05$). Similarly, the mean ISS was significantly lower in patients who survived (15.1 ± 7.2) compared to those that died (23.7 ± 9.8), $P = 0.008$.

Discussion

Seventy-six patients analyzed in this study showed a male-to-female ratio of 6.6: 1. Dongo *et al.*[17] in Ibadan found a similar sex distribution. Approximately 65.8% of our patients were between the ages of 21 and 40 years while those older than 45 years constituted an outlying group that made up only 15.8% of our patient population. This finding is consistent with a large number of prior studies that have shown the disproportionate involvement of young males in trauma.[4,18,19] There is no doubt because young males are known to be more adventurous than others in any population.

Of particular relevance to this study is the mean time to presentation in the hospital that was 15.5 ± 3.10 h, representing a very long delay. This is most probably because all the patients were referred to our hospital after having received initial treatment in other hospitals in the metropolis. The initial peripheral hospitals are usually staffed by junior doctors who may not appreciate the severity of the injuries and the need for surgical intervention. Consequently, the mean injury-to-intervention time, which was 29.2 ± 40.1 h, was also prolonged. However, these mean values are positively skewed as a result of a few patients with, particularly delayed presentations. A subgroup analysis of patients with blunt trauma showed a longer time to presentation (30.4 ± 44.4 h) compared to patients with penetrating trauma (5.3 ± 4.9 h), $P < 0.001$. This delay is often due to a failure of the patient to recognize the gravity of abdominal injury or a failure by the medical team to recognize the presence of associated abdominal injuries in polytraumatized patients. Fakhry *et al.*[20] reported that delays of as little as 8 h could adversely affect outcomes in patients who have suffered abdominal trauma with concomitant hollow viscus perforation. Olasehinde *et al.*[21] in Ile-Ife reached a similar conclusion as regards bowel injuries. The average intervention time was 25.4 ± 36.4 for survivors and 67.5 ± 58.2 for nonsurvivors ($P = 0.007$). Afolabi *et al.*[22] also previously reported this rather prevalent delay in intervention from our center.

In this study, the Revised Trauma Score (RTS) of survivors was significantly higher than that of nonsurvivors (7.7 ± 0.4 *vs*. 7.3 ± 0.5, $P = 0.021$). Further analysis of the variables in the RTS revealed that nonsurvivors had a significantly lower Glasgow coma score than survivors ($P = 0.029$). The presence of head injury as manifested by a reduced Glasgow Coma Scale scores ($P = 0.029$), an increased ISS ($P = 0.008$), and the presence of significant physiologic injury as evidenced by a low revised trauma score ($P = 0.021$) were all predictive of mortality. These findings are consistent with the findings by Nicolau *et al*.[23] The other variables of the RTS score were not significantly different. Furthermore, there was a significant difference in the ISS of survivors and nonsurvivors. The results indicated the mean ISS value for survivors was significantly lower than that for nonsurvivors ($P = 0.008$).

The timing of intervention was a major determinant of outcomes as surgical intervention time ($P = 0.049$), injury-to-intervention time ($P = 0.007$), and the requirements for intensive unit care ($P = 0.001$) were significant predictors of mortality. Furthermore, prolonged durations of ICU and hospital admission were also predictors of mortality.

There were a higher proportion of deaths in blunt trauma patients as compared to patients with penetrating abdominal trauma (12.9% *vs*. 4.4%) as a result of delayed presentation of patients with hollow viscus perforation. Although blunt trauma accounted for 40.8% of the patients, it accounted for 66.6% of the mortalities in this study. The calculated ISS for these patients with blunt injuries were not suggestive of a serious structural or anatomic insult, but they had evidence of significant physiologic stress (as evidenced by low RTS) at the time of presentation. A systemic inflammatory response state related to the peritoneal soilage was clearly well established at the time they received medical attention.

Conclusion

In this study, the most readily modifiable outcome determinant, the injury intervention time, was unduly prolonged, and it impacted negatively on the outcome. This is particularly worrisome as the majority of our victims were young males and their involvement in trauma is a cause of potential years of life lost when it leads to mortality and a significant source of wastage considering the economics of lost work time and hospital costs.

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Conflicts of interest

There are no conflicts of interest.

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