ORIGINAL ARTICLE

The Pattern of Death Related to Trauma Cases Presented to The Emergency Department of A Tertiary University Hospital

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SUMMARY

Trauma is an ever increasing problem and it is the leading cause of morbidity and mortality in the under 40s age group. The main purpose of this study is to determine the pattern of death related to trauma cases presenting to the emergency department (ED) of a university hospital. This was a retrospective analysis of 75 consecutive trauma case records at a university hospital for a one year period. The most common cause of deaths is motor vehicle crashes. The mean score for the injury severity score (ISS) and revised trauma score (RTS) on arrival to the ED among the succumbed patients were 27.8 (s.d 8.6) and 5.7 (s.d 1.1) respectively. 58.7% of deaths occurred within 48 hours after the admission. Less than 50% of studied patients were still alive beyond 45 hours post admission and less than 10% still alive beyond 11 days. Our analysis also showed that 28% (n=21) and 56% (n=41) of the studied sample had a probability of survival between 50% to 75% and more than 75% respectively upon arrival based on the initial vital signs in the ED and the trauma and injury severity score (TRISS) methodology. Overall, we observed similar injury mechanisms, demographics and causes of death compare to other studies. The figures from this study, mandate further exploration of preventive issues and management improvements that should be applied not only to the current trauma system, but also to the health care system in general.

KEY WORDS:
Trauma, injuries, deaths, injury scores

INTRODUCTION

Traumatic injury and trauma deaths are considered a major health problem all over the world. The World Health Organization (WHO) estimates that 16 000 people die every day from trauma injuries, and for every person who dies, several thousands more are injured, many of them with permanent sequelae[1]. Injury accounts for 16% of the global burden of disease. According to WHO, road traffic injury is ranked ninth among the leading causes of loss of disability-adjusted life years (DALYs) worldwide, and is anticipated to rise to become the third leading cause by 2020[2, 3]. In Malaysia, trauma is an ever increasing problem and it is the leading cause of morbidity and mortality in the under 40s age group. Trauma is the third most common cause of admission to the Ministry of Health hospitals following normal delivery and complications of pregnancy and childbirth, and is the fifth principal cause of death[4]. Thus, the main challenge for public health in this century is to decrease the burden of injuries. The main purpose of this study is to determine the pattern of death related to trauma cases presented to the emergency department (ED) of a university hospital.

OBJECTIVES

General objective is to examine the pattern of injury in victims of trauma death presented to the ED of a university hospital. Specifically we would like:

1. to analyze the demographic data of the involved victims
2. to document the time distribution from injury to death after trauma

METHODOLOGY

This is a retrospective study of all trauma deaths occurring in a university hospital during a one-year period. All trauma related deaths data were retrieved from medical case notes from the unit of medical record. Demographic and in-hospital data were collected. Patients were analyzed for injury severity by standard scoring systems (Revised Trauma Score [RTS], Injury Severity Score [ISS], and the Trauma and Injury Severity Score [TRISS] methodology). Patients who fulfil the inclusion criteria were selected for this study (Figure 1). Selection criteria include:

Inclusion Criteria

- All trauma deaths in the university hospital during a 1-year period.
- All patient with direct admission to the hospital
- All trauma deaths with associated anatomical injury

Exclusion Criteria

- Intentional/ self inflicted injury
- Patients transferred from other hospital

No sampling method was applicable since all cases of trauma death that fulfilled the inclusion and exclusion criteria within the study period were included in this study. All data entry and analysis were done using Statistical Packages for Social Science [SPSS] version 18.0 software.

As all the variables are categorical variables, descriptive data are expressed as percentages and frequencies and presented as bar chart, pie chart, etc. Comparison between continuous

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variables is performed by using independent or paired t-test, or by analysis of variance (ANOVA). The chi-square test or fisher's exact test is used for categorical data. Correlations (i.e between age, ISS, and time from injury to death) are assessed by using Spearman's rank correlation. All statistical tests were two tailed, and the significance level was set at $p< 0.05$.

RESULTS

During the one year period, seventy five trauma deaths were identified which satisfied the inclusion criteria. The general demographic distribution of all deaths related to trauma within the stipulated study period is as shown in Table I & Table II. The most common mechanism of death is motor vehicle crashes. (Figure 2) The majority of patients presented initially with systolic blood pressure of more than 90 mmHg however death occurred most among patients with GCS less than nine. The mean score for ISS and RTS on arrival to the ED among the patients who succembed were 27.8 (±8.6) and 5.7 (±1.1) respectively. 58.7% of deaths occurred within 48 hours after the admission. (Figure 3) A more detailed analysis according to temporal pattern of deaths namely acute (within 48 hours), delayed (within 3 – 7 days) and late (more than 7 days) is as shown in Table 3. The mean time of death after the admission took place was 119 hours (±221). Less than 50% of studied patients were still alive beyond 45 hours post admission and less than 10% were still alive beyond 11 days. (Figure 4) Our analysis also showed that 28% (n=21) and 56% (n=41) of the studied sample had probability of survival between 50% to 75% and more than 75% respectively upon arrival to the ED.

DISCUSSION

Knowledge of the spectrum of trauma in particular related to fatal outcome is the backbone for trauma system planning and injury prevention. Several recent studies have identified areas in which improvements have led to lower mortality [5,6]. In modern trauma systems, fatalities still do occur but, compared to historical studies, it is improving and somewhat changing "face and pace" now [7,8,9,10]. According to ATLS Student Course Manual (Eight edition), injury-related deaths are expected to rise dramatically by 2020, with deaths due to motor vehicle crashes projected to increase by 80% from current rate in low- and middle-income countries. By 2020 it is estimated that more than 1 in 10 people will die from injuries. Thus, the development of standardized trauma training for doctors, better prehospital care, and development of trauma centers with dedicated trauma teams and established protocols to care for injured patients may alter the current trauma burden.

Very little information pertaining to the deaths related to trauma is available in Malaysia. This is partly due to lack of data collection by the health care providers. The most comprehensive data related to injuries and deaths are commonly available for road traffic crashes only. Royal Police Force Malaysia (PDRM) regularly updated the data into their website but however this does not reflect the overall trauma cases and even does not represent the all deaths cases[11]. Only cases reported to them are included. In our study, the majority of cases who succumbed due to any cause of trauma were males gender and were younger than 50 years. This general demographic pattern is very similar to death cases related to trauma in other countries especially the developing countries [12,13]. The young age group predominates the death pattern for a variety of reasons such as involvement in high risk activities such as illegal road racing and due to employment related injuries which are uncommon activities among the elderly population [14]. Blunt injuries were the dominant mechanism in fatal trauma. This result is very similar to a study done in Canadian Trauma Center in 2007 which found that blunt trauma represented 87% of all cases and penetrating injuries were only 13% of all trauma cases [15]. As reported in series of studies, head injury remains a frequent killer, which is related mainly to the road traffic crashes [16,17,18]. Similarly in this study, the predominant cause of death was traumatic brain injury followed by multi organ failure and other related complications such as sepsis and dessiminated intravscular coagulation (DIC). The impact of fatal traumatic brain injury in this region remains significant, and further in-depth analysis to define potential protective and preventive factors appears as the key to reducing mortality [19]. Multiorgan failure (MOF) continues to be a late fatal sequel at a much lower rate in recent years [20]. The reported rate is in line with other studies [21,22]. Although treatment and prevention of MOF in the general trauma population may have been improved since early report by Trunkey in 1983, the elderly trauma population appears to be more fragile and have complex co-morbid patterns that make them prone to complication, including single organ or multiorgan failure [23].

Time has always been a crucial factor in detrmining the outcome of patients after trauma. Our study found that over 50% of victims died within 45 hours after injury, and less than 10% of deaths occur beyond 270 hours post-injury. A unique temporal death distribution was identified; 58.7% of deaths occurred within 48 hours of presentation, of the remaining 22.7% patients died within 3-7 days, 18.7% later than 7 days. This temporal pattern of deaths after trauma follows the typical and well known trimodal distribution of deaths after trauma incidence. Eventhough our study samples excluded the pre hospital data, but the general pattern is still very similar. The early deaths are mainly caused by the severe traumatic brain and other visceral injuries whereas the late deaths are caused by complications of the disease such as sepsis, acute renal failure and worst condition such as multiorgan failure. The temporal distribution of trauma deaths is poorly investigated in Asia. In fact, the validity of a trimodal distribution has been called into question from numerous studies from both the United States and Europe [24]. The frequently quoted paper by Trunkey described the trimodal distribution of trauma death, which has been taught as textbook knowledge and perceived as a standard in most regions worldwide [25]. As depicted in this study, the temporal distribution is an effect of the model used. When using the Trunkey classification of immediate, early and late deaths, we found that a trend of deaths, clustering in a bimodal –like fashion when stratified according to cause of death. This is because the prehospital death is not included in the study. This is different from a study done in United States in 1997 whereby the result showed trimodal

Table I: Demographic distribution of trauma death cases

Demographic & Clinical variables (n=75)	Characteristics	n(%)	Mean (s.d)
Gender	Male	63 (84.0%)	
	Female	12 (6.0%)	
Age (years)	<18 years	19 (25.3%)	43.0 (27.03)
	18 – 55 years	26 (34.7%)	
	>55 years	30 (40.0%)	
Mechanism of injury	Blunt	73 (97.3%)	
	Penetrating	2 (2.7%)	
Death distribution	CNS trauma	58 (72.3%)	
	Exsanguinations	2 (2.7%)	
	MOF/SIRS	14 (18.7%)	
	Other	1 (1.3%)	
Injury Severity	ISS ≤25	45 (60.0%)	27.6 (8.6)
	ISS >25	30 (40.0%)	27.6 (8.6)

Table II: Pattern of Vital Signs Upon Anival in The ED

Variables	Characteristisc	n (%)
Systolic Blood Pressure	≥ 90mmHg	73 (97.3)
	< 90mmHg	2 (2.7)
Respiratory Rate	< 10 breath / min	4 (5.3)
	10-29 breath / min	71 (94.7)
	>29 breath / min	0
GCS	≥ 9	18 (24)
	< 9	57 (76)

Table III: Distribution of demographic, injury mechanism, severity and outcome prediction according to time after injury.

	Acute, n=44	Early, n=17	Late, n=14	Total, n=75	P value
Gender					
• Female	9 (12.0%)	1 (1.3%)	2 (2.7%)	63(84%)	
• male	35 (46.7%)	16 (21.3%)	12 (16.0%)	12(16.0%)	
Mechanism of injury					
• Blunt	43 (57.3%)	17 (22.7%)	13 (17.3%)	73(97.3%)	
• penetrating	1 (1.3%)	0	0	1 (1.3%)	
Age	40.1±27.8	41.0±29.7	54.9±18.2	43.0±27.0	0.003b
ISS	27.1±7.3	33.1±11.8	23.8±5.6	27.6±8.6	0.068b
RTS	5.3±1.0	6.1±0.7	6.5±1.3	5.7±1.1	<0.001b

[b] analysis of variance one-way (ANOVA) (df=2) comparing acute, early and late deaths
ISS: Injury severity score
RTS: Revised trauma score

distribution of trauma deaths in urban environments [26]. However, we believe that temporal distribution serves merely as an educational tool, because any time interval is prone to distort the actual negatively inverse relationship between the number of remaining survivors and increasing time of injury, as showed in a Kaplan-Meier survival curve.

Structural and trauma systems changes are taking place in many parts of Malaysia. This study will serve as a baseline for evaluation of such efforts. The data from the study center will serve as a good proxy for the general trauma population in Malaysia and should be regarded as a baseline for discussing strategies for improvement and prevention in trauma in future.

LIMITATIONS

This study has several limitations. The study needs to be extended further with a longer study period. It also involved only one study centre. Thus the result cannot be extrapolated to other institutions. The time period also was identified as another limiting factor. The next limitation is concerning data sampling and collection. This study was carried out retrospectively, thus there were some clinical data missing or poorly registered. There was also lack of similar study done in Malaysia; comparison made is based on studies from overseas. Published reports from Malaysia regarding trauma is limited. Another limitation in this study is the inclusion criteria which only captured cases with direct admission to the study center. This study excluded referral case and patient transferred from other hospitals.

CONCLUSION

In conclusion, this study supports the stereotypical view of the typical trauma victim. We observed similar injury mechanisms, demographics and causes of death compare to other studies. The figures from this study, mandate further exploration of preventability issues, management improvements, and areas of clinical management that should be applied not only to the current trauma system, but also to the health care system in general.

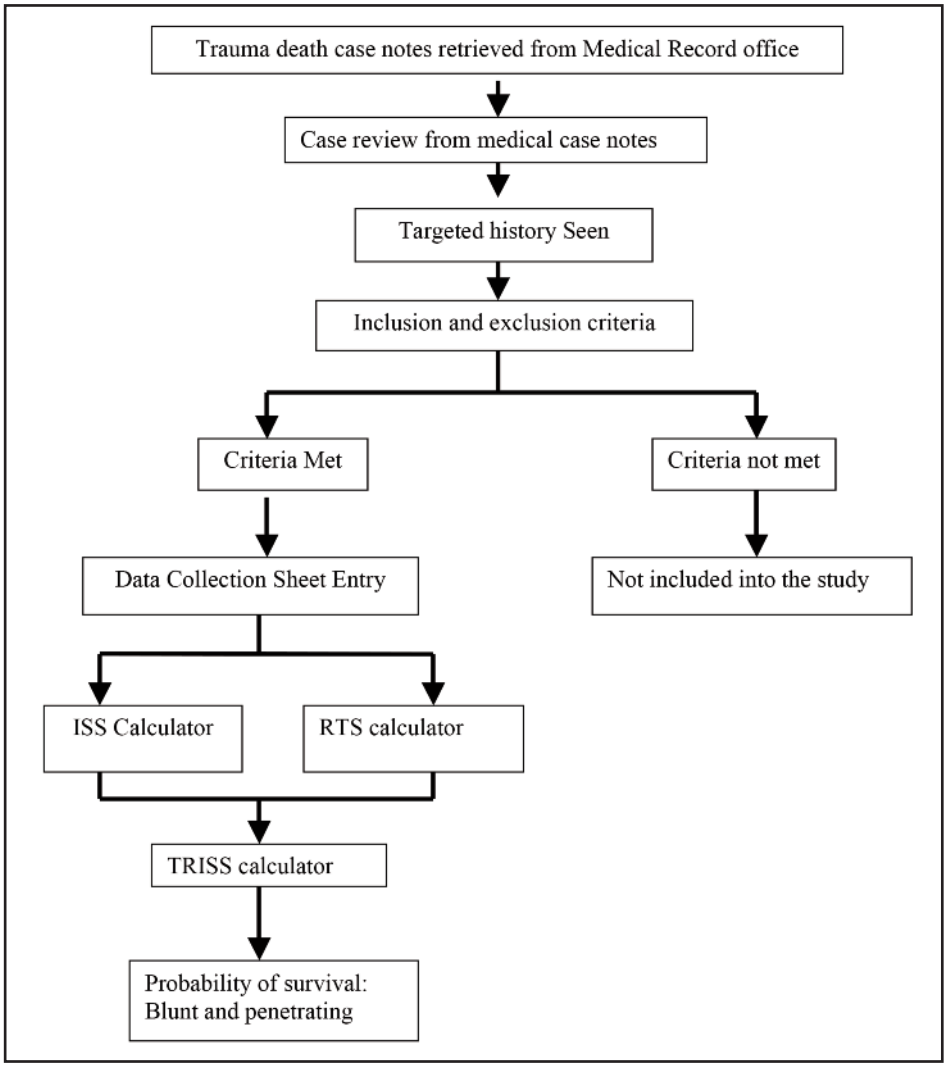

Fig. 1 : Flow chart of study.

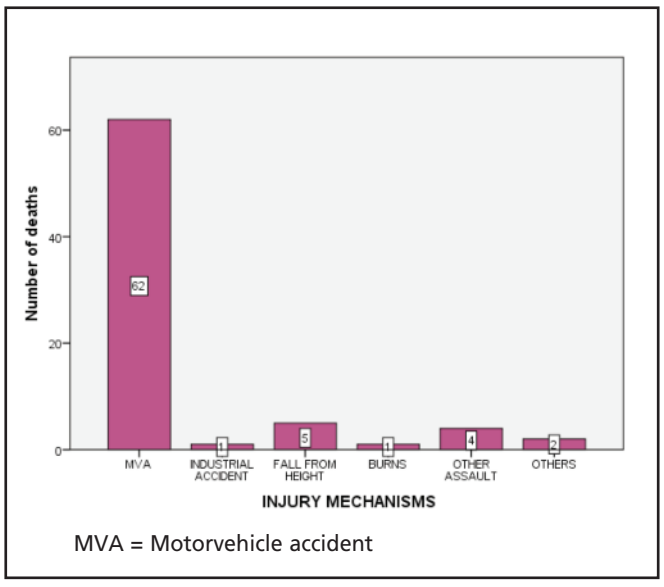

Fig. 2 : Mechanism of deaths.

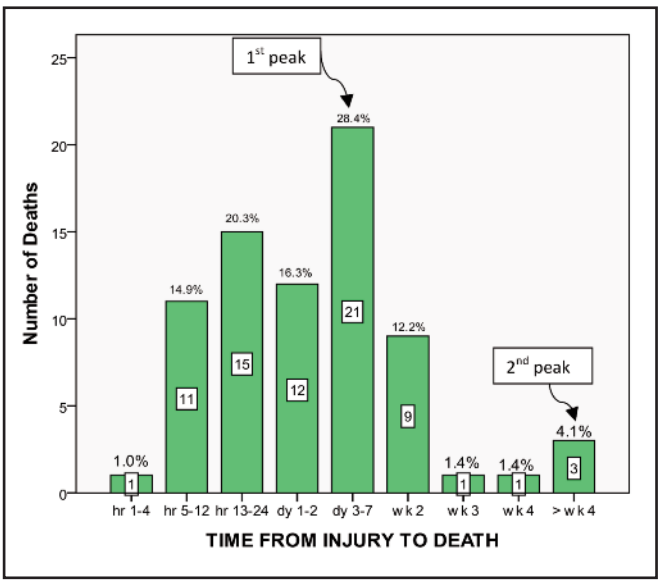

Fig. 3 : Temporal trending of Trauma Deaths.

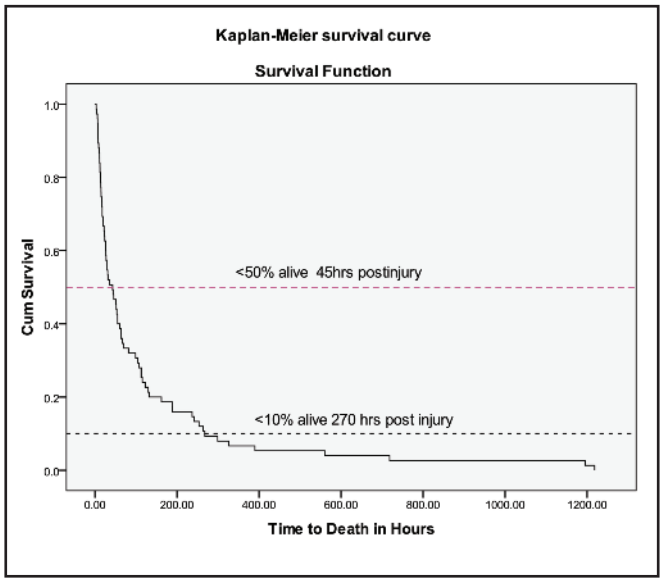

Fig. 4 : Kaplan-Meier survival curve, deaths occur on a consecutive time-scale with an inverse, cumulative relationship to time (Survival Trend of Trauma Death).

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