PATTERN OF TRAUMATIC DEATHS IN PATIENTS ADMITTED TO SOAD KAFAFY HOSPITAL. MEDICOLEGAL STUDY

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Submit Date: 2023-11-21

Revise Date: 2023-12-20

Accept Date: 2023-12-30

ABSTRACT

Background: The fifth most frequent cause of reported impairment is trauma, and is thought to be responsible for 10% of all deaths globally. For the first four decades of life, it continues to be the biggest threat to public health and the main reason for death and disability. **Objectives:** The current study aims to evaluate cases of death due to traumatic injuries admitted to Soad Kafafy Hospital regarding the manner of exposure, causes of injury, mechanism of injury, and time between admission and death. **Methods:** This study was a cross-sectional retrospective study conducted on cases of traumatic injury admitted to Soad kafafy hospital from the first of January till the last day of December 2019. Data was collected from the patient's records regarding demographic data, department of admission, and other data on medico-legal aspects such as exposure, causes of injury, mechanism of injury and time between admission and death. **Results:** thirty-five deaths due to traumatic causes were included within the study period. The majority of cases were males (71.4%) and the majority of them were within the first (< 10 years) and the fourth (30-40 years) age groups. The majority of cases were exposed to motor vehicle accidents and died due to head trauma. There was a significant correlation between the cause of injury, cause and manner of death, and period of survival. **Conclusions and Recommendations:** Motor vehicle accidents were the most common cause of injury-related deaths, the majority of causes fall under category A (CNS causes) and the highest percentage of deaths occurred after more than seven days. however, homicidal physical attacks, with Class A (CNS) injuries, and acute or early mortality were anticipated. Therefore, Prompt identification and early treatment are critical when a patient meets those criteria.

Keywords: Trauma, Death, Medicolegal, motor vehicle

INTRODUCTION

The fifth most frequent cause of reported impairment is trauma and is thought to be responsible for 10% of all deaths globally. For the first four decades of life, it continues to be the biggest threat to public health and the main reason for death and disability (Fouad et al., 2019).

Trauma can have many different consequences, ranging from endangering life to seriously impairing mental and physical health and negatively affecting social and economic development (Mahran et al., 2016).

The World Health Organization (WHO) states that 2.37% of all yearly fatality cases are attributable to injuries sustained on the road. 14.46 deaths occur for every 100,000 people (Alhaizaey et al., 2015).

The standard trimodal distribution of trauma deaths was described by (Baker et al., 1980), in their 1977 study on trauma deaths over one year in the San Francisco area. Rapid

exsanguination and nonsurvivable central nervous system (CNS) injuries were the main causes of the first peak's instantaneous deaths. The early hospital deaths, which were primarily brought on by brain damage and exsanguination, were included in the second peak. Seventy-five percent of the late deaths were ascribed to multiple organ failure (MOF), constituting the third peak (Evans et al., 2010).

The most frequent traumatic injuries are bone fractures and traumatic head injuries, which account for a large percentage of injury cases requiring forensic analysis. Injuries to the head are thought to be among the leading causes of homicidal deaths globally (Ali et al., 2022).

Given that they occur in between 3% and 8% of all patients who experience trauma, pelvic ring fractures are regarded as rare fractures. Similar to several skeletal fractures, traumatic pelvic fractures have been linked to several medico-legal ramifications, including the need to pursue compensation, the possibility of long-term disability, and malpractice claims (Mohamed & Elzahed, 2019).

The aim of the current study is to assess cases of death due to traumatic injuries admitted to Soad Kafafy Hospital regarding the manner of exposure, causes of injury, mechanism of injury, and time between admission and death.

SUBJECTS AND METHODS

This study was a cross-sectional retrospective study conducted on cases of traumatic injury admitted to Soad Kafafy Hospital from the first of January till the last day of December 2019. Data were collected from the patient's records regarding demographic data, department of admission, and other data on medico-legal aspects such as the manner of exposure, causes of injury, mechanism of injury and time between admission and death.

1. Demographic criteria:

a- **Age:** was categorized into 5 groups:

<10 yrs

10-20

20-30

30-40

>40

b- **Sex:** both sex.

c- **Residence:** either inside or outside greater Cairo

2-Medico legal aspects of the study:

a- Exposure manner: (suicidal, homicidal, or accidental).

b-Causes of injury: (Road traffic accident, fall, physical assault, …etc).

c-Mechanism of death: was classified into six categories (Sauaia et al., 1995):

(a) CNS (central nervous system) -- Fatal injuries related to the high cervical spine, brain, and brain stem;

(b) exsanguination—mostly caused by uncontrollable hemorrhage;

(c) The combination of categories (a) and (b).

(d) organ failure—Multiple organ failure or Acute respiratory distress syndrome;

(e) other—other fatal injuries, such as airway injuries, or subsequent complications, such as myocardial infarction, pulmonary embolism, etc.; and

(f) uncertain.

d- Time between admission and death Following admission, deaths were categorized as acute (before 48 hours), early (between 3 to 7 days after injury), and late (after 7 days) (Sauaia et al., 1995).

Statistical analysis of the data

Data were fed to the computer using IBM ***SPSS software package version 24.0.***

Shapiro–Wilk test was used to test of normality of data, the data Time between admission and death was nonparametric data, and

the Kolmogorov-Smirnov and Shapiro–Wilk had p value <0.05.

For normally distributed data, the mean and standard deviation were used to characterize quantitative data.

For normally distributed data, comparisons between two independent populations were done using the Whitney -test, while for comparisons between more than two groups we used the Kruskal-Wallis test

The chi-square test was used to compare between categorized data.

The results of significance tests are expressed as a two-tailed probability. The results were considered significant at the 5% level.

RESULTS

In the current study, thirty-five deaths due to traumatic causes were included within the study period. The majority of cases were males (71.4%) from greater Cairo with mean age 24 years and the majority of them were within the first (<10 years) and the fourth (30-40 years) age groups (table 1). Regarding the department of admission, 83 % of cases were admitted to the neurosurgery department and 17 % were admitted to the orthopedic department (table 1).

From the medico-legal aspect, when studying the cause of injury, motor vehicle accidents were the most common cause followed by physical assaults, so accidental incidents were the most prevalent at 71 %. Regarding the causes of death, the majority of the causes are included in category A (CNS causes) as skull fractures, brain edema, and extra, subdural, and subarachnoid hemorrhages. Also, other categories were organ failure (category D) as renal failure and ARDS and others (category E) as pulmonary embolism and shock. Regarding time between admission and death, 42.9 % of cases died late after more than 7 days, while 31 % died between 3 to 5 days and 25 % of cases died within two days of admission (table 2).

When discussing the relationship between demographic data and the time between admission and death, we can find a significant correlation regarding sex and residence where the majority of female cases died late (> 7 days) (table 3). Furthermore, there was a significant correlation between injury cause and period of survival where patients exposed to severe physical assault died earlier than those of motor vehicle accidents, also period of survival showed a significant correlation with cause and manner of death where direct CNS trauma and homicidal cases showed significant lower survival period after admission than others (table 4).

Table (5), shows the Multiple logistic regression analysis of different risk factors affecting the time between admission and death. This model was done using the significant variables which affect early mortality, from this significant item it was found that the most predictor factors for acute and early mortality were mechanisms of injury (assault), direct relation between trauma and death, class A (CNS) injuries, and homicidal death. If these factors were found in one patient, the mortality was acute or early.

Table (1): demographic data and admission department of the studied cases.

	Number "n=35"	**Percent**
Age group	10	28.6
<10 yrs	6	17.1
10-20	5	14.3
20-30	9	25.7
30-40	5	14.3
>40		
Range	0.42-67.0	
Mean±S.D.	24.51±17.31	
Median	25.00	
Sex		
Male	25	71.4
Female	10	28.8
Residence	27	77.1
Greater Cairo	8	22.9
Other		
Department	29	82.9
Neurosurgery	6	17.1
Orthopedic		

Table (2): Distribution of the studied group regarding the death conditions.

	Number "n=35"	Percent
Cause of injury	2	5.7
Fall from height	23	65.7
MVA*	10	28.6
Physical assault		
Manner of death	25	71.4
Accidental	10	28.6
Homicidal		
Cause of death category	22	62.9
A= central nervous system	7	20.0
causes	6	17.1
D= organ failure		
E= others		
Cause in details#		
Subdural hemorrhage	3	3.4
Brain edema	4	4.5
Multiple fractures	19	21.3
Skull fracture	11	12.4
Fracture base	12	13.5
Extradural hemorrhage	10	11.2
Hypovolemic shock	3	3.4
Septic Shock	5	5.6
Fracture pelvis	5	5.6
Subarachinoid hemorrage	3	3.4
Renal failure	4	4.5
ARDS	5	5.6
Pulmonary embolism	5	5.6
Relation between trauma and	22	62.9
death	13	37.1
Directly related		
Indirectly related		
Time between admission and	9	25.7
death (days)	11	31.4
Acute	15	42.9
Early		
Late		
Range	0.50-35.0	
Mean±S.D	11.39±11.89	
Median	4	

*# More than cause or mechanism in the same subject. * motor vehicle accidents.*

Table (3): Relation between time between admission and death regarding basic demographic data.

	Time between admission and death						X^2
	Acute		EARLY		LATE		P value
	No	%	No	%	No	%	
Age group (years)							7.589
<10 yrs	2	22.2	3	27.3	5	33.3	0.475 N.S.
10-2	2	22.2	1	9.1	3	20.0	
20-30	0	0.0	4	36.4	1	6.7	
30-40	3	33.3	2	18.2	4	26.7	
>40	2	22.2	1	9.1	2	13.3	
SEX							6.016
Female	0	0.0	3	27.3	7	46.7	0.049*
Male	9	100.0	8	72.7	8	53.3	
RESIDENCE							5.761
Greater Cairo	7	77.8	11	100.0	9	60.0	0.046*
Other	2	22.2	0	0.0	6	40.0	
DEPARTEMENT							4.251
Neurosurgery	8	88.9	7	63.6	14	93.3	0.119 N.S.
Orthopedic	1	11.1	4	36.4	1	6.7	
Total	9	100.0	11	100.0	15	100.0	

** Significant at level 0.05*
N.S. = Not significant

Table (4): Relation between death conditions and time between admission and death.

	Time between admission and death						X^2
	Acute		EARLY		LATE		P value
	No	%	No	%	No	%	
cause of injury							8.948
Fall from height	0	0.0	1	9.1	1	6.7	0.042*
MVA	3	33.3	8	72.7	12	80.0	
Physical assault	6	66.7	2	18.2	2	13.3	
Relation between trauma and death							6.428 0.040*
Directly related	8	88.9	8	72.7	6	40.0	
Indirectly related	1	11.1	3	27.3	9	60.0	
Cause of death category							7.331
A= central nervous system causes	7	77.8	4	36.4	11	73.3	0.039*
D= organ failure	1	11.1	5	45.5	1	6.7	
E= others	1	11.1	2	18.2	3	20.0	
Manner of death							16.687
Accidental	2	22.2	8	72.7	15	100.0	0.001*
Homicidal	7	77.8	3	27.3	0	0.0	
Total	9	100.0	11	100.0	15	100.0	

Table (5): Multiple logistic regression analysis of different risk factors affecting the time between admission and death.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	13.232	3.551		3.726	.001
Sex (male	-.075-	.119	-.109-	-.630-	.533
Residence (Cairo)	-.103	.211	-.144	-.561-	.211
Mechanisms of injury (assault)	.365	.411	.261	2.31	0.044*
Relation between trauma and death (Direct)	.711	.271	.063	2.45	0.041*
Cause class (A)	.611	.108	.039	2.51	0.040*
Manner of death (homocida)	.89	.277	.206	5.11	0.002*

Dependent Variable: time between admission and death.

DISCUSSION

Trauma is considered one of the most common causes of death worldwide. The current study was conducted on dead cases due to traumatic causes in Soad Kafafy Hospital. As regards the age of cases, most cases (85.7 %) were below 40 years, whereas the lowest number were more than 40 years (14.3 %) of all cases, this was in line with research from India (Sivakumar et al., 2018) and studies from England, Belgium and South Africa, that revealed that young individuals in active age groups had the highest risk of traumatic injuries (Jasper, 2014). The study's findings may be the consequence of young adults as young adults often engage in riskier activities compared to other age groups, such as extreme sports, reckless driving, or participating in dangerous stunts, which increases their chances of experiencing traumatic injuries (El-Farouny, 2021).

Males were around three times more likely than females in our study to die from traumatic injuries; other studies conducted in Iran, Bangladesh, and Taiwan also revealed comparable results (Akber et al., 2016; Hsu et al., 2018; Roshanaei et al., 2022), these studies all revealed a majority of men. It is expected that men are more prone to trauma due to the nature of their occupational standing in comparison to women. (Beigzadeh et al., 2015; Kanwar et al., 2019) Men are more likely to be in stressful situations, which increases their vulnerability to becoming involved in violent acts, and they are also more likely to work outside, which makes them more likely to be involved in traffic accidents, attacks, and injuries. This reflects the gender's susceptibility to trauma and the detrimental effects it has on their life productivity (Habib, 2019).

Our results showed that the most common cause of injury was motor vehicle accidents, the high prevalence of RTA (71%), was consistent with 96%, 62.3 from Nigeria (Solagberu et al., 2002; Thanni & Kehinde, 2006). According to reports, this rate is higher than that of the Netherlands (19%) (Oskam et al., 1994), Kenya (18% to 31%), the West Indies (20%), and Kenya (19%) (Crandon et al., 1994).

The study center's proximity to a major highway is likely the source of this high rate. RTAs can be caused by dangerous vehicles and roads, inadequate safety measures, or human mistakes; of these, human error is the most frequent cause. A few examples of human error include driving while intoxicated, speeding and passing illegally, using a phone while operating a vehicle, and poor driving skills (Bahadorimonfared et al., 2013; Soori et al., 2011).

Regarding the causes of death, the majority of the causes are included in category A (CNS causes) as skull fractures, brain edema, extra, subdural and subarachnoid hemorrhages (62.9 %). According to other publications, CNS injuries account for the majority of deaths, with rates ranging from 21% to 71%. (Carrasco et al., 2012; Kauvar et al., 2006; Pfeifer et al., 2009). This may be owing to a Lack of Protective Mechanisms; unlike other parts of the body, the CNS has limited natural protective mechanisms. For instance, the brain lacks thick layers of muscle or fat to absorb impact, and the spinal cord is surrounded by bony vertebrae, which can be damaged in traumatic events.

Regarding time between admission and death, 42.9 % of cases died late after more than 7 days, while 31 % died between 3 to 5 days and 25 % of cases died within two days of admission.

This was in accordance with the first case series in 1972, permanent brain injury, such as brain, brain stem, or spinal cord lacerations, was the cause of death for 45% of the patients in the immediate death category (Carrasco et al., 2012).

The reason why most trauma deaths occur after the first two days could be attributed to fewer severe injuries, improved prehospital care, and quicker transportation to trauma centers.

In addition, our study revealed that direct CNS trauma and homicidal cases showed significantly lower survival periods after admission than others while late deaths were mostly due to organ failure. According to research by Baker and colleagues (Baker et al., 1980), the majority of head injury deaths occurred within the first two days following the accident. Cowley stated that irreparable head injuries were the most common causes of death in his studied group. (Cowley, 1976) . Meislin et al. also demonstrated that more than 80% of early deaths were caused by brain damage and circulatory collapse or bleeding (Meislin et al., 1997). According to Trunkey's research, infections or multiple organ failure accounted for 80% of hospitalized patients' late deaths (Trunkey, 1983). Similarly, Baker discovered that sepsis and multiple organ failure accounted for 78% of deaths that occurred after 7 days (Baker et al., 1980). According to Sauaia et al, organ failure accounted for (61%) of patient deaths that occurred more than one week after the initial injury (Sauaia et al., 1995). Likewise, among those who died between two and three weeks following their accident, 48% suffered from neurological damage, 35% from hemorrhage or circulatory collapse, and 16% from multiple organ failure. According to this research, multiple organ failure becomes increasingly common with time, even in patients who survive the first twenty-four hours, bleeding and head traumas continue to be major causes of death. (Sobrino & Shafi, 2013).

In contrast to our study, Sauaia et al., 1995 concluded that trauma deaths that occurred within 48 hours of the injury were most frequently caused by exsanguination (51%) as a result of damage to the heart, liver, or major blood vessels.

Our results showed that class A (CNS) injuries, homicidal death, and injuries caused by physical assaults were predictive factors. when the patient is fulfilling this criterion, the mortality is expected to be acute or early, therefore prompt diagnosis and treatment are essential. Further researches are needed to confirm our results and prove them with more strong pieces of evidence.

CONCLUSION AND RECOMMENDATIONS

In conclusion, motor vehicle accidents were the most common cause of injury-related deaths, and the highest percentage of deaths occurred after more than seven days. The most common causes of injuries related deaths fall under category A (CNS causes), which include brain edema, intracranial hemorrhages, and skull fractures. Traumatic deaths also tended to occur

at a higher percentage in Males and people under 40 years of age. Predictive indicators of mortality were Class A (CNS) injuries, homicidal attacks, and injuries from physical assaults. Prompt identification and treatment are critical because when a patient meets those criteria, acute or early mortality is anticipated. We recommend conducting additional research over a longer period and utilizing established medical scores to assess the severity of injuries. Additionally, the establishment of trauma centers that are easily accessible to children and adolescents who are experiencing trauma, as these populations deserve more attention and study.

Funding: NA

Ethical approval: the study is approved by the ethical committee of Misr University for science and Technology, approval number 2022/0039

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الخلفية: تعتبر الإصابات من خامس أكثر الأسباب شيوعًا للإعاقات، ويُعتقد أنها مسؤولة عن حوالي 10% من جميع الوفيات عالميًا. كما تشكل الاصابات أكبر تهديد للصحة العامة والسبب الرئيسي للوفاة والإعاقة في الأربعة عقود الأولى من العمر. تهدف الدراسة الحالية إلى تقييم حالات الوفاة الناتجة عن الإصابات التي أدخلت إلى مستشفى سعاد كفافي بالنسبة لطريقة التعرض وأسباب الإصابات وآليتها والوقت بين الدخول والوفاة.

الطرق: تستند هذه دراسة مستعرضة بأثر رجعيّ عن حالات الوفاة الناتجة عن الإصابات التي أدخلت إلى مستشفى سعاد كفافي خلال عام 2019. تم جمع البيانات من سجلات المرضى بخصوص البيانات الديموغرافية وقسم الدخول وغيرها من بيانات الجوانب الطبية القانونية الشرعية مثل أسباب الإصابات وآليتها والوقت بين الدخول والوفاة وأسباب الوفاة.

النتائج: تم ادراج خمسة وثلاثون حالة وفاة ناتجة عن اصابات خلال فترة الدراسة. كانت غالبية الحالات من الذكور (71.4%) وكانت غالبيتهم في الفئات العمرية الأولى (< 10 سنوات) والرابعة (30-40 سنة). كانت معظم حالات الإصابات معرضة لحوادث المركبات وتوفوا بسبب إصابات الرأس. كان هناك علاقة ذات دلالة بين سبب الإصابة وسبب وطريقة الوفاة وفترة البقاء على قيد الحياة.

الاستنتاج: حوادث المركبات هي السبب الأكثر شيوعًا للوفيات المرتبطة بالإصابات، وغالبية الأسباب تندرج تحت الفئة أ (أسباب الجهاز العصبي المركزي) وحدثت أعلى نسبة من الوفيات بعد مرور أكثر من سبعة أيام. ومع ذلك، كان من المتوقع حدوث الوفاة مبكرا خلال أقل من أسبوع في حالات الإصابات الناتجة عن الاعتداء البدني المباشر، خصوصا مع إصابات من الفئة أ (أسباب الجهاز العصبي المركزي). لذلك، فإن التعرف السريع والعلاج المبكر ضروريان في هذه الحالات.

الكلمات الدالة: الصدمة، الوفاة، الطب الشرعي، حوادث المركبات.