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ORIGINAL ARTICLE

Admission delays' magnitude of traumatized patients in the emergency department of a hospital in Egypt: a cross-sectional study

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Abstract
Background Injury is an escalating public health problem, representing about 9% of global mortality, which disproportionately impacts lower- and middle-income countries. There are approximately 12,000 annual fatalities from road traffic injuries in Egypt, but a little information about delays in seeking emergent care is available.
Objectives To measure the time interval between sustaining an injury and presentation to the emergency department of Ain Shams University Surgery Hospital and to identify possible causes of these delays.
Methods We conducted a cross-sectional, facilitated survey of a convenience sample of trauma patients presenting to the emergency department of Ain Shams University Surgery Hospital from 1 February to 31 May 2014. Data obtained included: demographic information, trauma incident details, and injury assessment.
Results The average reported transport time for patients from injury to hospital arrival was 3.8 h, while the mean ambulance response time was 45 min. Referral from other hospitals was revealed to be a significant cause of delay ($P=0.004$), while ignorance of the local ambulance phone number could not be confirmed as a cause ($P=0.2$).
Conclusion This study demonstrated that trauma patients at our hospital experience more than 3 h of delay until they reach the ED. It also identified the possible causes accounting for that delay. However, additional nationwide research is needed to establish the clear causation or association of these causes with the delay intervals.

Keywords Emergency care · Trauma · Delays · Ambulance · Referral

Introduction

Injury is an escalating public health problem, representing about 9% of global mortality, and is a leading cause of death and disability [1, 2]. Causes of injury include suicide, homicide, road traffic crashes, drowning, falls, and poisonings. Road traffic injuries are a leading cause of injury deaths which are predicted to become the 7th leading cause of death by 2030 [2]. According to the World Health Organization (WHO), Egypt is a middle-income country in the eastern Mediterranean region with an estimated rate of road traffic fatalities of 12.8 per 100,000 population. It was also reported in the WHO Eastern Mediterranean Region that injury death rates are nearly three times greater in low- and middle-income countries (LMICs) than in high-income countries [3, 4]. Tens of millions of people suffer injuries that lead to hospitalization, emergency department treatment, or treatment that does not involve formal medical care. This largely depends on the emergency medical system prevalent in each country.

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Pre-hospital care systems in high-income countries can be classified into two major categories: The Anglo-American model and the Franco-German model. The Anglo-American model (applied in the US, the UK, Australia, and Canada) is best described as a paramedic-based system, in which paramedics and emergency medical technicians (EMTs) are trained and formally certified to identify, manage, and transport trauma patients. In such a model, the role of physicians is restricted to providing support and consultation for complicated cases. The Franco-German model, on the other hand, is a physician-based model, where the ambulances are staffed by physicians in addition to EMTs and drivers [5]. In comparison, in low- and middle-income countries, emergency medical services are usually provided by bystanders, laypeople who happen to be present at the trauma scene [6]. Formal EMS systems are usually rudimentary and frequently inconsistent. Communication lies at the heart of the pre-hospital management of trauma patients. Yet, it is widely affected by a country's infrastructure and standards of living. While the availability of telephone lines and mobile phones is taken for granted in high-income countries, this is not the case in LMICs. A study performed in 1999 revealed the availability of only 9 telephone lines and 23 cell phones per 100 inhabitants in Azerbaijan. The condition was even worse in Cambodia with no available telephone lines and only 7 cell phones [7]. According to the International Telecommunication Union in 2011/2012, 1% of rural households in Egypt have fixed phones only, 61% have mobile phones only, and around 30% have both fixed and mobile phones. This leaves a 38% of rural households with no phones whatsoever [8]. In high-income countries using the Anglo-American model, patients are triaged to various levels of healthcare facilities according to assessment protocols of pre-hospital trauma patients. The lack of triage in some LMICs makes the destination of trauma cases to be the nearest health facility regardless of the healthcare facility's capabilities. This can cause significant loading of tertiary facilities by cases that merely require basic services, while sending complicated cases to non-specialized facilities [9].

Pre-hospital transport delay leads to delays in receiving definitive trauma care and can be one of the most important factors affecting outcome in many types of injuries [1, 10–12]. In a study by McCoy et al., odds of mortality increased in patients with penetrating trauma when out of hospital time was greater than 20 min [10]. Another study by Rouleau et al. showed that delays in seeking orthopedic consultation markedly affected patients' outcome [13]. It has long been stated that the first hour after sustaining an injury is the golden hour as early proper intervention can save traumatized patients from significant morbidity and mortality.

In Egypt, we are missing data about emergency admission delays and pre-hospital time interval measurement due to lack of trauma registry in which all trauma patients are documented. Another possible cause for missing data is the lack of efficient communication means between the organizations in charge, namely, the ambulance authority and emergency departments in various hospitals. The availability of data about emergency admission delays is an indispensable first step in the evaluation and improvement of emergency medical services in Egypt.

In this study, we intend to interview patients about their perceived time from sustaining an injury till presentation to the emergency department at Ain Shams University Surgery Hospital and to identify potential causes of delay.

Methods

This is a cross-sectional study conducted in Ain Shams University Surgery Hospital (located in the center of Cairo) on a convenience sample of patients presented to the emergency department (ED) in the period between 1 February and 31 May 2014. Approximately 15% of patients admitted to the ED during the study period were enrolled. Those were interviewed on randomly selected days of the week. The ED is staffed by general surgery and orthopedics residents. Residents of other specialties are full time on-call upon the request of the examining residents.

Ain Shams University Surgery Hospital is a tertiary care hospital serving Cairo downtown. Health services in Egypt are currently managed, financed, and provided by agencies in all three sectors of the economy—government, parastatal, and private. The parastatal organizations are governmental organizations operated through the Ministry of Health and Population (MOHP) or other ministries. They include the Teaching Hospitals and Institutes Organization (THO), the Health Insurance Organization (HIO), and the Curative Care Organization (CCO). THO are under the supervision of the ministry of higher education. They include nine hospitals distributed over Egypt as follows: four hospitals in Cairo (including our hospital), two hospitals in Upper Egypt governorates, and three hospitals in Lower Egypt governorates. The MOHP delivery system lacks a formal referral system.

The study was pilot-tested over the course of 1 month (November 2013) using open-ended questions in Arabic language. Ten cases (not included in the study sample) were enrolled and interviewed, and then, the questionnaire was modified into closed ended questions divided into three sections (demographic information, trauma incident details, and injury assessment). Data collectors

enrolled patients presenting to the ED from 1 February to 31 May 2014 and filled in the previously mentioned questionnaire through face-to-face interview in average time of 4.82 min. Data collected were patients' age, educational status, cause of injury, time of the accident, time of arrival of help, time of admission to the ED in addition to the treatment he received, and ambulance phone number inquiry. The data on method of transport of patients to hospital, en-route care, and transfers from other hospitals were also collected. In certain cases, data were collected from the escorting personnel. That was resorted to for patients with a disturbed level of consciousness, those who could not remember the accident details or for cases where data collection would hinder critical diagnostic or therapeutic measures.

The institutional review board governing research in medical school of Ain Shams University has determined that the study protocol adheres to ethical principles.

Inclusion criteria were any patient presented to the ED with isolated or polytrauma in the previously mentioned period and was willing to participate in the study. Patients were excluded if they had active psychosis, suicidal, or homicidal ideation; were unwilling to consent, presented with eye or ear or nose injuries; or had no available 'injury to ER time'.

Three time points were defined, time of the incident (T1), time of arrival of help (T2) (ambulance, relative ….etc.), and time of presentation to our ED (T3). These time points were obtained from the individual completing the questionnaire. Response time interval (Tr) is the time between the incident and arrival on-scene (T1–T2). Transport time interval (Tt) is the time between arrival on-scene until reaching the ED (T2–T3). Pre-hospital time (Th) is the time between the incident and the presentation to the ED (T1–T3) These time points were defined by the meta-analysis of pre-hospital care times for trauma conducted by Carr et al. [14]. Injuries were categorized based on the ICD-10 classification system.

Analysis

Data were analyzed using SPSS version 14.0 software. As the distribution of the mean time intervals was not normal, we used non-parametric tests of significance (Wilcoxon rank sum test) to assess the statistical significance for the difference between the delay time interval means between the groups (the group who knew the accurate ambulance phone number versus the group who did not and the group who were referred versus the group who were transferred directly to our ED). Statistical significance was set at P value < 0.05.

Results

Of 149 patients, 119 (79.9%) were males and 30 (20.1%) were females. 130 patients (87.2%) came from Cairo within 50 km of the hospital, while 19 patients (12.8%) came from nearby rural areas more than 50 km from the hospital. The causes of injury varied from road traffic accidents for 37 patients (24.8%), work-related accidents for 27 patients (18.1%), violence-related accidents for 16 patients (10.7%), and injuries caused by exposure to inanimate mechanical forces for 69 patients (46.3%). Examples of the latter include contact with sharp glass or knives, explosion of gas cylinders, and others.

Only 8 patients (5.5%) reported the arrival of police to the scene of injury. Thirty-one (22%) patients knew the correct universal phone number for the ambulance in Egypt (i.e., 123), while 109 (78%) did not know it or reported it wrongly.

Two patients (1.3%) drove their own cars to reach the ED, while 86 patients (57.7%) were driven by someone else, 48 patients (32.2%) used the public transportation, while the ambulance transferred only 13 patients (8.7%).

Sixty patients (40.2%) were transferred directly to our hospital ED, while 89 patients (59.7%) were referred from other non-trauma centers and hospitals. Sixty-three percent of referred patients reported that the cause of referral was the availability of better diagnostic and therapeutic modalities that were lacking at the initial centers. Thirty-seven percent were referred due to the presence of highly specialized and well-trained physicians at our hospital (i.e., higher level of care). The relative low cost of health services at our hospital was the cause of referral of 18%, whilst 11% were referred for the lack of vacancy at the initial centers.

Out of 149 patients, only 72 (48%) had an initial thorough assessment of their vital signs (pulse rate, respiratory rate, and blood pressure). Most of the patients (98%) underwent imaging studies to reach their diagnosis.

The mean overall time of delay or the pre-hospital time (Th) (T3–T1) was 226 min (3.8 h) where it was 238 min for those transported by the ambulance, 209.5 min for those who were driven by someone else, and 377.8 min for those who used the public transportation.

The mean time needed for the transportation method to arrive at the scene or response time interval (Tr) (T2–T1) was 26 min where mean ambulance response time was 45 min, 22 min for those who were driven by someone else, and 46 min for those who used the public transportation.

The mean time from the minute of arrival of transportation method until it reaches the ED or transport time interval (Tt) (T3–T2) was 189.7 min (3.2 h) where the mean ambulance transport time was 193 min, 186.6 min for those who were driven by someone else, and 299 min for those who used the public transportation.

The relation between response time interval (Tr) and knowledge of ambulance phone number is given in Table 1.

(P value = 0.20) by the conventional criteria; this difference is considered to be statistically insignificant.

If the patients were referred from another hospital, the mean overall time of delay (T3–T1) was 239 min, while it was 205 min if they were transferred directly to our ED (P value = 0.004) by the conventional criteria; a difference that is considered to be statistically significant.

The relation between overall time of delay (Th) and ICD10 diagnosis of injuries is given in Table 2.

For 8 patients, a definitive diagnosis for the type of injury could not be obtained.

Discussion

This hospital-based study showed that trauma patients are seen at our ED within 3.8 h of the incident, violating the golden hour concept, a parameter that has been shown to be a good measure of the effectiveness of the trauma protocols in patient transport and its impact on clinical improvement [11, 12, 15].

In correlating the mean overall delay interval in this study with other countries with variable degrees of trauma care system maturity and availability of specialized trauma centers, we found that the average time to hospital arrival typically did not exceed 60 min in studies conducted in the United States [10, 12], Australia [15], and Iran (Mashhad) [16],while it reached up to 4.7 h in a study conducted by Khan et al. on trauma registries of 979 patients in Karachi, Pakistan [11], a result that is similar to ours.

In our study, only 8.72% of the patients were admitted via the ambulance service which is extremely low when compared to other studies conducted in relatively similar developing countries like Jamaica [17] and South Africa [18]. However, in a study conducted by Haghparast-Bidgoli et al. in Iran, only 13% of the patients were transferred by the ambulance service with an average time of transport of 2.46 h [19].

An important finding in our study, which could explain the paucity of patients using the ambulance service, is the degree of awareness of the local ambulance emergency phone number where about 78% of the enrolled patients did not know the ambulance phone number or confused it with other local services phone numbers causing a prolonged mean response time interval. The lack of a statistically significant difference in delay time between the group who knew the correct ambulance phone number and those who did not (P value = 0.2) is, however, not enough to reject the hypothesis that knowing the ambulance phone number reduces delay time or improves outcome. Further studies that address that entity are highly recommended, putting larger sample sizes as a priority.

Raising awareness of the local emergency ambulance service through media could minimize the response time delay, as rapid response of emergency calls in less than 5 min is associated with higher incidence of survival [20]. Availability of well-trained ambulance crews with proper clinical documentation of pre-hospital events should be taken in consideration in further studies to achieve precise

Table 1 .

(Tr) Time needed for transportation to arrive at the scene T2–T1			
Knowing ambulance phone number	*N*	Mean delay (min)	Standard deviation
Yes	31	12.6	29.5
No	109	30.4	79.9

Table 2 Determination of predictors and risk factors patients

(TH) Overall time of delay (in min) T3–T1			
Diagnosis of injury "ICD 10"	*N*	Mean delay (min)	Standard deviation
S00–S09 Injuries to the head	25	216.2	219.1
S10–S19 Injuries to the neck	1	30	
S20–S29 Injuries to the thorax	1	90	
S30–S39 Injuries to the abdomen, lower back, lumbar spine and pelvis	1	75	
S40–S49 Injuries to the shoulder and upper arm	3	290	398.4
S50–S59 Injuries to the elbow and forearm	6	444	510.3
S60–S69 Injuries to the wrist and hand	30	191	199.6
S70–S79 Injuries to the hip and thigh	4	307.5	61.8
S80–S89 Injuries to the knee and lower leg	20	230	237.5
S90–S99 Injuries to the ankle and foot	19	230	191.9
T00–T07 Injuries involving multiple body regions	31	202.9	214.8

assessment of the handover process of ambulance service and its clinical outcome [12, 17, 21]. Patient referral process is a major determinant of efficient trauma care system as it directly impacts the period of hospitalization and rehabilitation [11, 12, 17, 18]. As a tertiary medical center, Ain Shams University Surgery Hospital has a high flow of patients seeking better diagnostic and therapeutic medical services that other nearby public hospitals lack. This leads to a rush of patients with even minor injuries that could be handled in primary or secondary public medical centers. Our study shows that 59.7% of patients admitted to our hospital ED were referred from other hospitals with overall mean delay (Th) rounding 4 h reflecting the impact of improper referral process on the magnitude of delay. The difference in overall delay between the referred and unreferred groups was found to be statistically significant (*P* value = 0.004).

The percentage of referred patients in our study was greater than that in Iran [16] and Pakistan [11] which was 23% and 57.9%, respectively. The average time spent in the referring hospitals in the study conducted by Harrington et al. on trauma registry of Rhode Island Hospital in the United States of America was 162 min in 280 transferred patients with less time spent among the most severely injured patients [12]. We could not measure the exact time spent in the referring hospitals in our study as there is no available clear documentation of the pre-hospital events done in these institutions concerning the time of arrival or relevant clinical data like vital signs records, injury severity determinants, and first aid interventions.

We also observed that cardiothoracic, head, and neck injuries showed relatively lower delay intervals than injuries of extremities, a finding that needs further research to clinically correlate the severity of the injury with the delay time intervals.

Limitations

The major limitation we faced was the lack of a trauma registry with reliable documentation of pre-hospital and inter-hospital events concerning definitive management of trauma patients in the emergency department. As a result, we counted on interviewing the patients or their escorting personnel to get information about the pre-hospital events which may make the responses subjected to recall bias and inaccuracy in some cases. Moreover, the clinical records of the vital signs as blood pressure, pulse, and Glasgow Coma Scale during the transporting phase were not available, a factor that hindered our evaluation of the injury severity.

Other obstacles to our study included the temporary closure of the emergency department many times during the maintenance process of the imaging machines, and thus we could not measure the exact peak of flow of trauma patients to the ED.

The cross-sectional design presented an additional limitation in terms of defining the relation between admission delays and the proposed factors, whether it is causation or an association relationship. This point needs further longitudinal studies to prove or reject causation.

Furthermore, our sample size was not large enough to prove the statistical significance of the difference between the delay means for knowing the ambulance phone number, although our sample size was quite similar to other studies [16, 17]. Therefore, additional nationwide multi-centric studies are needed, hopefully through establishing a nationwide trauma registry, a pressing need that will transfer trauma research to a promising square.

Well-designed referral and triage protocols should be based on proper categorization of patients at the pre-hospital phase to direct the severely injured cases to specialized trauma care centers, define the proper timing for stabilization in nearby hospitals for patients from rural areas, and avoid overcrowding of specialized trauma centers with minor injury cases [11, 12]. The lack of such protocols results in prolonged hospital stay and increase incidence of mortality and morbidity with loss of the benefits of the golden hour concept with every minute of delay during the transferring process [10–12, 15, 18, 22]. Monitoring systems assessing the application of trauma protocols and guidelines would decrease the economic burden on specialized trauma centers and avoid the abuse of their facilities, such as imaging modalities, that was obvious in our study (98% of the cases were assessed by imaging studies).

This study is the first of its kind to present the magnitude and possible causes of emergency admission delays of traumatized patients in the emergency department of Ain Shams University Surgery Hospital; in addition, the first in Egypt that spotlights the issue of emergency admission delays hoping that it could be an initiative to motivate future research and direct decision making in the country.

Conclusion

This study demonstrated that the average reported transport time for patients from injury to hospital arrival was 3.8 h, while the mean ambulance response time was 45 min. It also highlighted the possible factors affecting these delays as knowledge of local ambulance phone number, referral process, method of transferring the injured patients, and type or diagnosis of injuries. The study pinpoints the need for additional nationwide research to establish the clear causation or association of these factors with the delay intervals.

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Compliance with ethical standards

Conflict of interest Haitham M. Saleh, Abdelrahman E.Elsabagh, Mohammad Gamal Elewa, Ahmed AlaaEldin Fawzy, Omar Mahmoud Hassan, Angela C.Comer, Ibrahim M. Abdelmonem, Jon Mark Hirshon, and Mohamed El-Shinawi declare that they have no conflict of interest.

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Statement of human and animal rights All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008 (5).

Statement of informed consent Informed consent was obtained from all patients for being included in the study.

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