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Pre-hospital trauma care and hospital length of stay among road traffic accidents patients: a retrospective cohort study in Nablus/ Palestine†

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ABSTRACT

In Palestine, trauma is considered as the seventh leading cause of death. In most cases death occurs before hospital arrival. Although of the conflict and large numbers of causalities in Palestine, no studies have examined trauma care in Palestine. The aims of this study were to investigate pre-hospital care provided by emergency medical system for road traffic accidents patients in Nablus, Palestine, in 2017 and follow up those patients to assess their outcome and hospital length of stay (LOS). The Palestinian Red Crescent Society archive was searched for road traffic accidents patients in 2017 that were transported by ambulance to the emergency department, and then patients were followed up in their receiving hospitals. The New Injury Severity Score (NISS) and the New Trauma Score (NTS) were used to stratify injury severity. Out of 307 patients, 77.52% were males and 22.48% were females with mean age of (32 ± 14.51) years. About 84.08% were discharged by doctors after completing therapy. NISS has mean of 4.1 and hospital LOS mean was 32.2 hours. Mean of NTS at scene was 10.63 and 10.59 at arrival with mean of differences 0.04. Response and Transfer time means were 6.05 and 17.5 minutes and the ranges were (0 – 56) and (3 - 45) minutes, respectively. Only Oxygen administration, splint, and dressing were significantly different between the emergency medical system and the hospitals (p value < 0.01). Hospital LOS had significant correlation only with NISS (p value < 0.01) and NTS at scene (p value=0.02). The trauma system in Palestine has some weakness especially in organization and documentation. Hospital LOS does not reflect the patient clinical situation and many stay for non-medical causes. Prevention of unnecessary hospitalization can decrease the economic burden.

Keywords: Road Traffic Accidents, Length of Hospital Stay, Emergency Medical Service System.

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INTRODUCTION

Trauma constitutes an important public health problem leading to approximately 10% of deaths [1, 2]. It is one of the leading causes of preventable deaths and disabilities in the developing world. Each year, 5.8 million people die from injury, and 90% of these deaths occur in low and middle-income countries. Disabilities resulting from similar causes further affect the lives of nearly 650 million people worldwide [3]. Road traffic accidents (RTA) have a large contribution in traumatic injuries, almost 1.24 million people die annually and 20 to 50 million people are exposed to non-fatal injuries on the world's roads [4]. In Palestine, traumatic injury is considered as the seventh cause of death, accounting for 5.3% of all deaths. In 2016,8229 RTA cases were recorded, of which 8077 were injured and 152 were dead. The incidence rate was 302.2 and death rate was 5.7 per 100 000 of population [5].

Most of all trauma deaths occur during the pre-hospital period, before a patient

reaches a healthcare facility, in both developing and developed countries. Thus, pre-hospital care defined as the medical assessment and treatment provided at the scene of an accident or in route to a healthcare facility should be a key focus in any effort to reduce trauma mortality and morbidity. Early care provision and swift transportation of the injured improve long-term outcomes by reducing loss of lives and incidence of short-term disability. First responders should, therefore, have extensive training in scene management, rescue and stabilization, and safe transport of patients [6]. Pre-hospital care is an important link in the chain of survival in trauma patients and medical emergencies. There are many emergency medical service (EMS) systems that established a survival benefit for patients by early interventions performed by pre-hospital providers [7].

Although the organization of emergency medical system varies between different countries, the level of care for trauma patients can be divided into two main categories: Basic Life Support (BLS) and Advanced Life Support (ALS). Basic life support assumes the management of injured patients by noninvasive methods. The principles of Basic Life Support assume release of the airway, oxygen supplementation, cardiopulmonary resuscitation, stopping of the external bleeding, and immobilization of the fractures and spine. The main goal of the BLS is to maintain cardiac and respiratory function during patient's transportation to the trauma center, without causing further damage. Advanced Life Support involves the use of invasive procedures for initial management of trauma patients: more sophisticated procedures for airway management, cardiac monitoring and defibrillation, intravenous catheterization and drugs administration [8].

Palestinian Red Crescent Society (PRCS) is, by mandate, responsible for providing pre-hospital care in Palestine. In Nablus city the services are provided over 24 hours a day by four ambulances, two per shift, covering 85 km^2 with a population of 153,061 [5]. Each ambulance is accompanied by two to three well trained paramedics who are qualified to do the basic life support. According to the situation and upon need the staff may include medical doctors or nurses. The pre-hospital care provided includes measurement of vital signs and Glasgow coma scale, taking brief history, providing basic and advanced life support at scene and stabilization of patient during transportation to the hospital. There are seven local hospitals, six of them have surgical emergency department and can deal with trauma cases.

Palestinian territories suffer greatly from RTA in terms of health outcomes and economic burden. Therefore, it is important to investigate the care provided to victims of RTA which may affect their morbidity and mortality as well as other economic burden on the health system including hospitalization and length of stay. The aim of this research is to investigate pre-hospital care provided by PRCS for RTA patients and follow up those patients to assess their outcome and hospital length of stay (LOS). Additional aim is to identify the variables that may affect patients' outcome. This study is conducted on the hypothesis that pre-hospital trauma careaffectshospital length of stay among road traffic accident patients in Nablus, Palestine, in 2017.

METHODS

Study design and setting

This is a retrospective cohort study that is conducted in Nablus in Palestine between the period of January 2017. To December 2017

Study population

All RTA patients who were transported by PRCS ambulances directly from the scene to the hospital within 24 hours of the injury in Nablus city in 2017 were included. Patients who were transported to the emergency department (ED) by private means or brought in by the police or patients found dead at the scene or died during transportation were excluded from the study.

Sample Size and Sampling Technique

The total Number of RTA patients that PRCS responded to was obtained from PRCS archive to be 1507 in 2017. Sample size was estimated by Rao soft online sample size calculator (http://www.raosoft.com/samplesize.html), to be 307 patients. The Sample size was estimated with confidence level 95% and margin of error 5%.

Data Collection methods, instruments used and measurements

Data was collected from ambulance records in PRCS archives, the records had been examined manually. All RTA patients who

were transported by ambulance to the emergency department were followed up through manual revision of their medical records in the hospitals that received them.

Data have been included according to the following variables; demographic data (age, gender) and clinical information including patients' vital signs (pulse rate, respiratory rate and blood pressure), Glasgow coma scale (GCS), at scene and at arrival to the hospital, and patient outcome. Data also was gathered about the pre-hospital and in-hospital managements that have been done for those patients. Managements included cervical spine protection, splints to the limbs, intravenous infusion, oxygen therapy, airway management, control of external bleeding and pain relieving.

New Injury Severity Score (NISS) and New Trauma Score (NTS) at arrival to scene and to hospital were calculated by an investigator to minimize bias. Hospital lengths of stay (LOS) in hours, and PRCS response and transportation times in minutes have been calculated.

Outcome measures

The end point of this study is patient outcome reflected by hospital lengths of stay (LOS).

Statistical analysis

Continuous data were reported as medians, range and means ± standard deviation. Categorical data were reported as numbers and percentages. The Person chi-square test was applied to determine the relationships between pre-hospital and in-hospital management. Linear regression models have been used to find the correlation between LOS and other variables. Data were analyzed using STAT Aprogram, version14.P-value< 0.05 was considered statistically significant.

Ethical consideration

This study was approved by institutional review board at An-Najah National University. Approval was obtained by PRCS and all hospitals participated in the study to log in their archives. Confidentiality was and will be ensured.

RESULTS

Out of the307 patients who were included in the study, 238 were males (77.52%) and sixty-nine were females (22.48%). The mean age of patients was (32 ± 14.51) years. NISS among patients was generally low, seventy-six (30.4%) of patients had NISS less than three. Only seven (2.8%) were severely injured with an NISS > 15. NTS for patients at scene ranged between 9.08 and 10.68(mean = 10.63±0.21), and has not changed significantly at arrival to hospital (mean = 10.59±0.31).Table 1 describes the study variables in term of median, mean, standard deviation and range.

Table (1): Variables of the road traffic accident patients transported by the Palestinian Red Crescent Society ambulances in Nablus city in 2017.

Variable	Median	Mean	STD	min-max
Age	28.00	32.00	14.50	0.10 – 72.00
Response time	5.00	6.05	5.26	0.00 – 56.00
Transfer time	16.00	17.50	7.89	3.00 – 45.00
NISS(1)	3.00	4.16	4.59	0.00 – 34.00
NTS(2) at scene	10.68	10.63	0.21	9.08 - 10.68
NTS at hospital	10.68	10.59	0.31	7.84 - 10.68
NTS difference(3)	0.00	0.04	0.38	-1.60 – 2.84
Hospital LOS(4)	23.50	32.22	38.25	2.00 – 312.00

Abbreviations:(1) New injury severity score. (2) New trauma score. (3) Difference between NTS1 and NTS2 (NTS2-NTS1). (4) Hospital length of stays for patients who discharged by doctor after completing therapy.

After excluding sixty-two patients who lost follow-up, two hundreds and six (84.08%) were discharged by doctors after completing therapy and thirty-nine (15.92%) were self-discharged against medical advice. No deaths were reported. Mean LOS for patients discharged by doctors was 32.22 hours, and for self-discharged patients was 8.57 hours.

Regarding pre-hospital emergency medical services, response time mean was 6.05 ± 5.26 (median=5, range (0 - 56) minutes). Transfer time mean was 17.50 ± 7.89 (median= 16, range (3 - 45) minutes), Table 1. Oxygen administration, splint, and dressing were significantly dissimilar between EMS and in-hospital service (P < 0.01). Airway protection

(P = 0.83), spine immobilization (P=0.28) and intravenous fluid administration (P = 0.32) were insignificantly varied between EMS and hospitals. Pain relief (P = 0.05) had borderline significance. Intravenous access was obtained for all patients in ED, in 10.96% it was obtained before arrival to the hospital. No cardio-pulmonary resuscitation was recorded(Table2). The effect of provided pre-hospital care was assessed by measuring NTS difference. Large percentage of cases (79.27 %) demonstrated no changes.13.99% of cases showed decrease in NTS (max=2.84, min=0.29), and 6.74% showed increase in NTS (max=1.60, min=0.10).

Table (2): Comparison of pre-hospital and in-hospital managements done for road traffic accident patients transported by Palestinian Red Crescent Society ambulances in Nablus city in 2017.

Procedure	Pre-hospital		In hospital		P-value
	Number	%	Number	%	
Airway protection (n= 240)	10	4.20	1	0.42	0.83
Oxygen therapy (n= 239)	22	9.21	6	2.51	<0.01
Spine immobility (n = 238)	100	42.02	56	23.53	0.28
Splints (n = 238)	77	32.35	39	16.39	<0.01
Dressing (n = 237)	12	5.06	22	9.28	<0.01
Intravenous access (n = 155)	17	10.97	155	100.00	NA(1)
Intravenous fluid (n = 247)	36	14.57	190	76.92	0.32
Pain relief (n = 238)	3	1.26	223	93.70	0.05
Cardio-pulmonary resuscitation	0	0.00	0	0.00	NA(2)

Abbreviations:(1) Not available because all patients had intravenous catheterization at hospital. (2) Not available because none of the patients have received cardio-pulmonary resuscitation.

The results showed that hospital LOS had significant correlation with NISS (P < 0.01) and NTS at scene (P = 0.02), but not with NTS at hospital arrival (P = 0.55). There was no significant correlation between LOS and age (P = 0.29), sex (P = 0.30), ambulance response time (P = 0.80) or time elapsed during transfer to hospital (P = 0.56).Correlation between hospital LOS and study variables are shown in Table 3. Using the linear regression analysis, the relation between LOS and NISS was represented by the following equation: LOS = 0.32 + (5.3)*NISS.

Table (3): Correlation between hospital length of stay (LOS)of road traffic accident patients who discharged by doctor after completing therapy and other variables in Nablus city in 2017.

Variable	Coefficient	Standard error	P-value	95%confidence interval	
Age	-0.12	0.11	0.29	-0.35	0.10
Sex	4.11	4.03	0.30	-3.85	12.09
NISS(1)	5.30	0.32	<0.01	4.67	5. 94
NTS(2) at scene	18.34	7.88	0.02	2.76	33.92
NTS at hospital	-2.86	4.88	0.55	-12.51	6.77
NTS difference(3)	NA(3)	NA	NA	NA	NA
Response time	0.03	0.25	0.80	-0.45	0.57
Transfer time	0.12	0.21	0.56	-0.29	0.54

Abbreviations:(1) New injury severity score. (2)New trauma score.(3) Difference between NTS1 and NTS2 (NTS2-NTS1).(4)Not available because NTS difference= 0 in 77% of observations.

DISCUSSION

Owing to the large burden of trauma in our society, especially road traffic accidents, and the fact that most of deaths and disabilities occur in young, productive individuals, the socioeconomic consequences of inadequate trauma care are of great importance. This is the first study in Palestine that tried to approach several aspects of the local trauma system, and to evaluate the hospital LOS and its correlation with the patients' variables, and the pre-hospital care provided.

One of the strength areas of this research is the random selection of sample using computer programs. Another strength point is starting from PRCS records and follows up the cases in the hospitals. This was by using the date of admission and the full names taken from PRCS records to ensure full matching of patients' files in the hospitals.

Assessment using one scoring system has been proposed to overcome the difficulties of interpreting two scoring systems with one outcome. Best suggestion was the new trauma and injury severity score (NTRISS)[9]. However, available data was not suitable for calculating this score as there is no measurement of respiratory rates in hospitals. Instead, two distinct scores were applied, NTS to assess the effect of pre-hospital management, and NISS to assess the severity of injury. NISS replaced the traditional ISS in trauma outcome researches considering its easier calculation and better predictive power[9]. Average values have been used for substituting the missing data regarding respiratory saturation for calculating NTS on scene as there is large fraction of patients was assessed by measuring respiratory rate. This was the most conservative solution, as it will not bias our statistical analysis.

The mean of ISSs in the study was general ylow; this can be attributed partly to the relatively low velocity of vehicles during accidents. This is due to the roads' situation that does not permit high velocity and the absence of high way roads in Nablus city. The means of response time and transfer time were not high but reasonable, in relation with city area. NTS values have not changed significantly or have not changed at all before and after hospital arrival, this could be due to the short transfer time, the already low trauma scores of patients, or the focus on stabilization rather than improving the patient situation[10].

There was no significant variation between management provided by PRCS and that by ED in most of the cases. Oxygen administration and splint show significant difference. This could be due to the need of these two procedures during stabilization and transportation more than at hospital, or due to non-routine recording. Intravenous access was obtained for all patients in the hospitals due to admission purposes. No significant difference in NTS before and after hospitalization, correlation between hospital LOS and NTS difference could not be measured because majority of differences were zero.

There was no correlation between LOS- and either age, six, response or transfer times, this maybe because of the low injury severity scores of patients. LOS correlates strongly with NISS and NTS1, however it still considered high for the low scores. In fact, we believe that most patients of very low NISS (NISS$\leq$3) do not even have to be admitted to hospital, they can be observed in ED until they can be safely discharged. The percentage of those patients reaches more than 75%. The financial burden of such unnecessary hospitalization is heavy because it is associated with an unacceptable waste of hospital and health economic resources. Insurance companies cover almost all RTA cases and bear the largest portion of such burden. This also undermines the productive capacity of the population through time lost during hospitalization. Furthermore, this can subject the patients for hospital acquired infections and other hospitalization risks.

Future studies should address this vital health care aspect in details with a larger sample size and in a wider study area. Specific measures should be taken into consideration to overcome the limitations we have faced. The risk of incomplete documentation at the local hospitals and the potential information bias is possible to be bypassed by legislations about documentation either in hospitals or-PRCS. Prospective researches enable visiting the hospital during the study period and maybe having one or more dedicated persons at every site of study locations to ensure full documentation.

Number of limitations must be taken into consideration when interpreting the results of this study. One main limitation was the lack of identical protocol in recording and management either between hospitals or between the hospital and the PRCS. Another important limiting factor is missing data, either due to inadequate file storage, incomplete recording, or documenting vital signs as "normal" without giving numerical readings. Many of patients, who were evaluated at the same scene, have unreasonably similar reports. A full year study period has a risk of seasonal influence on traffic and therefore on response and transfer times. In addition to that, we have not been able to find guidelines either to use in assessing trauma system and its outcome. No reference ranges were found to compare our results with, as the correlations between length of hospital stay and NISS, NTS, or NTS difference. The study was also conducted in one city; therefore, results might be limited to this specific city only.

CONCLUSIONS

The trauma system in Palestine has some weakness especially in organization and documentation. Hospital LOS does not reflect the patient clinical situation and many stay for non-medical causes. Prevention of unnecessary hospitalization can decrease the economic burden.

CONFLICTS OF INTEREST STATEMENT : The authors report no conflict of interests in this work.

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AUTHORS' CONTRIBUTION

AA, DS, RA and AB designed the study and its tools. DS and RA collected data and organized files revisions. AA, DS, and RA analyzed the data. AB and WS intellectually interpreted the results. All authors have read and approved the final version of this manuscript.

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