An Epidemiologic Study on Emergency Department Mortality

Sahar Mirbaha[1], Amin Saberinia[1*], Sepide Ghesmati[2], Mohammadmehdi Forouzanfar[1]

1. Department of Emergency Medicine, Shohadaye Tajrish Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
2. School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

Corresponding author: Amin Saberinia; Email: aminsaberinia@gmail.com

Abstract

Introduction: Epidemiologic evaluation generally starts with recording the raw data regarding mortality, and healthcare managers should have a national plan executed for this purpose.

Objective: The present study was planned and performed with the aim of epidemiologically evaluating mortality cases among patients admitted to the emergency department (ED) of a major hospital in Tehran, Iran in order to plan and provide proper equipment for decreasing the mortality of patients.

Method: This cross-sectional study was performed in Shohadaye Tajrish Hospital, Tehran, Iran. All cases of mortality, recorded in the ED of the studied hospital from 20 March 2016 until 21 June 2016, were included in the study. A checklist was prepared for gathering data and the clinical profiles of all the considered patients were reviewed. Using this checklist, demographic data, chief complaint, history of underlying disease, pathologic findings of imaging modalities, and cause of death were extracted from the patients' profiles.

Result: Over the mentioned period of time, in total, the data of 8420 admissions to the ED were recorded. Out of these patients, 76 (0.9%) had died, the mean age of whom was 67.66 ± 21.40 years. Based on these findings, among patients who had presented to the ED, 42.1% died due to the complications of heart attack and 13.2% died from complications caused by cancer.

Conclusion: Based on the findings of the present study, cardiovascular complications were the most leading cause of mortality in the studied ED and complications resulting from malignancy were in the second place. Trauma and accidents leading to intracranial hemorrhage were in the next places.

Key words: Cause of death; Emergency department; Epidemiologic studies; Mortality

INTRODUCTION

Death is the complete and irreversible cessation of the body's vital activities and the cause of death from a physician's point of view is a disease or injury and a condition under which death occurs. Rapid and easy access to hospital and improvement in transportation equipment has resulted in a considerable number of cases on the verge of unavoidable death also be transported to hospital. This has resulted in a large portion of deaths in society being recorded in hospitals. A study carried out from 1910 to 1987 on 2566 cases of death in South Australia shows that the rate of death at home was 55.6% in 1910 and 26.2% in 1970 and reached 25% after that and in 1970 more than 2 thirds of deaths have occurred in hospitals, which shows a decrease in the rate of mortality at home (1). Therefore, performing epidemiologic studies aiming to identify the changes and also evaluating the pattern of mortality causes seems important. The performed studies show a shift in the main causes of death from infectious diseases to chronic illnesses due to advances in technology and improvements in healthcare (2).

Epidemiologic evaluation generally starts with recording the raw data regarding mortality, and healthcare managers should have a national plan executed for this purpose. Despite the sheer importance of having accurate data related to mortality cases for planning and managing the healthcare system of a society, sadly only a few developed countries have recorded these statistics accurately. On the other hand, only a limited number of Latin America and East Asia have been able to reach a stable and statistically comparable order for recording mortality cases (3). Raw mortality rate of Iran in 2011 has been 5.5% - 5.9% (4). While in the studies performed on the healthcare system of England, raw rate of mortality varies between 3.4% and 13.6% (4). This reveals that epidemiology, type of hospital, and social conditions affect the rate of mortality. Many of the patients with terminal illnesses such as various

types of malignancies refer to the more equipped hospitals and there are many cases that have died in other provinces and due to a lack of a proper referral system, they were never even counted in the mortality rate of the province. On the other hand, many of the cases that die due to accidents or heart attacks and brain strokes die before reaching the hospital, the reason for which might be found in problems existing in timely transportation of the patients facing an accident or brain stroke or heart attack to a healthcare center, a problem which in turn may be due to various problems.

Despite numerous shortcomings, it seems that data are available in this regard in Iran. Mortality rate has been reported to be about 320 to 350 thousand individuals per year and the most common cases with the rate of 35%-40% belong to cardiac diseases and accidents are in the second place with a rate of 18%-20% (5). Evaluating this kind of data on the hospital level has an undeniable importance and generally, hospitals evaluate the process of diagnostic and therapeutic measures of some mortality cases by forming a mortality committee and holding sessions. Hospital mortality rate is closely related to medical equipment and facilities of the hospital, type of hospital service and maybe the quality of providing healthcare by physicians and nurses, the characteristics of patients presenting as well as the epidemiology of disease in that area. Obtaining these data is no doubt one of the most basic fundamentals of planning, management, evaluation, and the management being responsible to senior managers and of course the public. Therefore, the present study was planned and performed with the aim of epidemiologically evaluating mortality cases among patients admitted to the emergency department (ED) of a major hospital in Tehran, Iran.

METHODS
Study design
This cross-sectional study was performed in Shohadaye Tajrish Hospital, Tehran, Iran. Its protocol was approved by the ethics committee of Shahid Beheshti University of Medical Sciences. The researchers adhered to the principles of confidentiality and all data were extracted and used in a coded manner and anonymously.
Study population
All cases of mortality, recorded in the ED of the studied hospital from 20 March 2016 until 21 June 2016, were included in the study and there was no exclusion criterion.
Data gathering

A checklist was prepared for gathering data and the clinical profiles of all the considered patients were reviewed. Using this checklist, demographic data, chief complaint, history of underlying disease, pathologic findings of imaging modalities, and cause of death were extracted from the patients' profiles.
Statistical analysis
Values were expressed as frequency (number and percentage) and tables, as appropriate. Fisher's exact test and chi-square tests were used for comparisons of categorical variables; also independent t-test was used to compare numerical variables. In statistical tests, p-values less than 0.05 were considered statistically significant. Statistical analyses were performed using the SPSS software package, version 22 (SPSS Inc., Chicago, IL, USA).

RESULTS
Over the mentioned period of time, in total, the data of 8420 admissions to the ED were recorded. Out of these patients, 76 (0.9%) had died, the mean age of whom was 67.66 ± 21.40 years (minimum 45 days and maximum 100 years). Baseline characteristics of these cases are reported in table 1. Age mean (SD) were 65.3 (23.7) and 71.5 (16.7) in male and female, respectively. Most of these patients (42.1%) were in the 61 to 80 age range and then ≥80 year. Loss of consciousness was the most prevalent chief complaint on admission with 49 cases (64.5%) and heart attack with 12 cases (15.8%) was the second most common complaint on admission. Hypertension (38.2%) and diabetes (23.7%) were respectively the first and second most prevalent underlying disease among the studied patients.

Pathologic findings observed via imaging modalities have been reported in table 2. Based on the results, the findings of imaging modalities were normal in 21.1% of the patients. Cardiomegaly (18.4%) and consolidation (18.4%) in plain chest radiography of the patients were the most common findings.

The cause of death in studied cases has been summarized in table 3. Based on these findings, among patients who had presented to the ED, the complications of heart attack were the most common final diagnoses being found 42.1% of the patients. Complications caused by cancer were found in 13.2% of the patients and reached 2nd place.

Comparing mortality cases based on time from emergency department admission to death
The shortest duration of stay at the ED was 3

Table 1: Baseline characteristics of studied patients

Variable	Number (%)
Sex	
Male	47 (61.8)
Female	29 (38.2)
Age (year)	
Mean (SD)	67.6 (21.04)
≤ 20	3 (3.9)
21-40	6 (7.9)
41-60	11 (14.5)
61-80	32 (42.1)
≥ 81	24 (31.6)
Underlying disease	
Hypertension	29 (38.2)
Diabetes mellitus	18 (23.7)
Ischemic heart disease	14 (18.4)
Stroke	5 (6.6)
Alzheimer's disease	4 (5.3)
Malignancy	3 (3.9)
Congestive heart failure	2 (2.6)
Epilepsy	1 (1.3)
Chief complaint	
Loss of conscious	49 (64.5)
Heart attack	12 (15.8)
Multiple trauma	7 (9.2)
Dyspnea	4 (5.3)
Gastrointestinal bleeding	2 (2.6)
Suicide	1 (1.3)
Unknown	1 (1.3)

Table 2: Frequency of pathologic findings in imaging modalities performed on studied patients

Variable	Number (%)
Chest X-ray	
Consolidation	14 (18.4)
Cardiomegaly	14 (18.4)
Rib fracture	4 (5.3)
Hemothorax	3 (3.9)
Pleural effusion	3 (3.9)
Pneumothorax	1 (1.3)
Brain CT scan	
Brain mass	1 (1.3)
Ischemic stroke	2 (2.6)
Hemorrhagic stroke	8 (10.5)

Table 3: Frequency of cause of death in studied patients

Variable	Number (%)
Complications of Myocardial infarction	32 (42.1)
Complications of malignancy	10 (13.2)
Sever traumatic injury	7 (9.2)
ICP raising following spontaneous intracranial hemorrhage	7 (9.2)
CNS insult due to Stroke	4 (5.3)
Multi organ failure due to Septic shock	4 (5.3)
Hemorrhagic shock due to massive GI bleeding	3 (3.9)
Respiratory failure due to sever pneumonia	2 (2.6)
Distributive shock due to pulmonary emboli	1 (1.3)
Unknown	6 (7.9)

minutes and the longest time was 10320 minutes and median duration of hospitalization in the ED was 558 minutes. Fifty patients (65.8%) stayed less than one day and 26 individuals (34.2%) stayed in the ED for more than 1 day. Comparison of the data resulting from mortality cases in ED based on their

Table 4: Epidemiologic findings of mortalities based the length of stay in the emergency department

Variable	ED length of stay		p
	≤ 1 day (n=50)	> 1 day (n=26)	
Age	67.5 ± 25.5	77.5 ± 19.8	0.067
Sex			
Male	31 (62.0)	16 (61.5)	0.969
Female	19 (38.0)	10 (38.5)	
Underlying disease			
Hypertension	16 (32.0)	13 (50.0)	>0.05
Diabetes mellitus	11 (22.0)	7 (26.9)	
Ischemic heart disease	11 (22.0)	3 (11.5)	
Stroke	3 (6.0)	2 (7.7)	
Alzheimer's disease	1 (2.0)	3 (11.5)	
Malignancy	2 (4.0)	1 (3.8)	
Congestive heart failure	2 (4.0)	0 (0.0)	
Epilepsy	0 (0.0)	1 (3.8)	
Chief complaint			
Loss of conscious	28 (56.0)	21 (80.8)	0.032
Heart attack	12 (24.0)	0 (0.0)	0.002
Multiple trauma	6 (12.0)	1 (3.8)	0.708
Dyspnea	2 (4.0)	2 (7.7)	0.411
Gastrointestinal bleeding	0 (0.0)	2 (7.7)	0.113
Suicide	1 (2.0)	0 (0.0)	0.999
Unknown	0 (0.0)	1 (3.8)	0.999
Cause of death			
Complications of Myocardial infarction	24 (48.0)	8 (30.8)	0.016
Pulmonary embolism	1 (2.0)	0 (0.0)	
Hemorrhagic shock due to massive GI bleeding	1 (2.0)	2 (7.7)	
CNS insult due to Stroke	2 (4.0)	2 (7.7)	
Severe pneumonia	0 (0.0)	2 (7.7)	
Complications of malignancy	9 (18.0)	1 (3.8)	
Severe traumatic injury	5 (10.0)	2 (7.7)	
ICP rising following spontaneous intracranial hemorrhage	1 (2.0)	6 (23.1)	
Multi organ failure due to septic shock	2 (4.0)	2 (7.7)	
Unknown	5	1	

duration of ED stay being more than or less than one day is presented in table 4.

Comparing the mean age of patients who were hospitalized for less than 1 day and more than 1 day showed no statistically significant difference (p=0.067). Sex distribution of patients who died in the 2 groups and frequency of underlying illnesses in the groups also did not show any significant statistical difference (p>0.05).

In both groups, loss of consciousness had the highest rate among the chief complaints on admission. 56.0% of those who died in less than 1 day and 80.8% of those who died after 1 day were affected by it and the frequency was significantly different between the 2 groups (p=0.032). All mortality cases who had presented with chief complaint of heart attack died in less than one day and there was a statistically significant correlation between cardiac failure and duration of hospitalization in ED (p=0.002). No statistically significant difference was observed between the 2 groups regarding the rate of other complaints (p>0.05).

The rate of individuals with a normal imaging in the group of patients who were hospitalized for more than a day (23.1%) was more than the other group (20.0%) but this difference was not statistically significant (p=0.755). Regarding the frequency of pathologic findings, apart from intracranial hemorrhage (ICH), the frequency of other pathologic findings in imaging was not different between the 2 groups. However, the frequency of ICH cases in the group who survived in the ED for more than 1 day was significantly higher than those who had died on the day of admission to ED (p=0.002).

After the complications caused by heart attack, the complications caused by malignancy was the final diagnosis of the highest number of mortality cases with less than a day of stay in ED; on the other hand, among those who were hospitalized for more than 1 day, after complications due to heart attack, ICH

was the most frequent final diagnosis. Overall, the 2 groups were significantly different regarding the final diagnosis (p=0.016).

DISCUSSION

Based on the findings of the present study, cardiovascular complications were the leading cause of mortality in ED and complications resulting from malignancy were in the second place. Trauma and accidents leading to intracranial hemorrhage were in the next places.

Mortality in ED is a sensitive topic that has received attention and is sometimes suggested as the department's performance index. The aim of treating patients in every ED is to prevent patient mortality or decrease the rate of injury to patients. Although in most cases mortality of patients is unavoidable, but in some cases it is due to mistakes or delay in taking necessary measures, which are known as "avoidable deaths".

In comparison with the study by Faridaalaee et al. performed in 2013 in Imam Khomeini Hospital, Urmia, Iran, regarding mortality in ED, age and sex distribution and mean length of stay in ED were similar. In the present study, the most common causes of death were related to cardiovascular disease, malignancy, trauma and ICH. However, in Faridaalaee et al. study, the most common causes of death were reported as respiratory diseases, cardiovascular diseases and trauma (6).

A 1-year study in ED of a Belgian hospital in 1998 has shown that in 13.3% of the cases, the final diagnosis regarding the cause of death has remained unknown. Patients who were affected with sudden cardiac arrest with unknown cause were evaluated after death. It was shown that cardiac diseases (51.7%), infections (10.3%), non-traumatic hemorrhage (10.3%) and pulmonary embolism (3.4%) were the main causes of death (7).

Currently, it seems that with an increase in age, being affected with diseases increases by 3-5 times and cancers also follow the same pattern and increase with age. On the other hand, accidents also have a significant correlation with age and usually affect the active members of the society. A study in Scotland shows that 49% of the cases who died due to trauma were aged less than 40 years and mostly men and 7% of mortalities had occurred 1-4 hours after injury and 17% had died after 4 hours (8). A study performed from 1999 to 2000 in Iran shows that 79% of road traffic accidents occur in men and 65% of the cases are 40 years old or younger and head trauma with 66% is the most common cause of death in road traffic accidents among both men

and women and in all ages (9).

In a study by Frosyth et al., it was shown that out of the 2 million death cases around the world in 2006, more than 17 million were due to infectious and parasitic diseases, more than 15 million were caused by cardiovascular disease, 6 million had resulted from cancers and about 3 million were due to respiratory diseases(6). The statistics regarding causes of death in 2008 in America indicate that cardiovascular diseases are in the first place with 710760 cases, malignant neoplasms with 553091 cases, cerebrovascular diseases with 167661 cases and respiratory illnesses with 122009 cases are in the second to fourth place, respectively (10, 11). In Iran, the ministry of health with the association of the registry office has executed a plan for recording mortality cases based on the cause and ID characteristics of those who died and therefore, an important step in determining the pattern of death in the country and monitoring its trend has been taken. The result of this assessment is using the findings for developing and executing national programs and evaluating the programs relating to general population health. Identifying the pattern of mortality and monitoring its trend will aid in determining health priorities and allocating resources and prioritizing health-based development in the healthcare system as well as eliminating the major causes of premature deaths and performing epidemiologic studies.

Limitations

Establishing a data registry system seems to be necessary in this regard. Because despite the considerable advances, there are still significant problems in hospital registry systems. In the present study, also, not all the baseline characteristics required by the researchers were available or completely entered in the system

CONCLUSIONS

Based on the findings of the present study, cardiovascular complications were the leading cause of mortality in the studied ED and complications resulting from malignancy were in the second place. Trauma and accidents leading to intracranial hemorrhage were in the next places.

AUTHORS' CONTRIBUTION

All the authors met the standards of authorship

based on the recommendations of the International Committee of Medical Journal Editors.

REFERENCES

1. Hunt R, Bond M, Groth R, King P. Place of death in South Australia. Patterns from 1910 to 1987. The Med J Aust. 1991;155(8):549-53.

2. Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJ. Measuring the global burden of disease and risk factors, 1990–2001. Global burden of disease and risk factors. 2006;1:1-14.

3. Sibai AM. Mortality certification and cause-of-death reporting in developing countries. Bull World Health Organ. 2004;82(2):83.

4. IndexMundi. Available from: https://www.indexmundi.com/g/g.aspx?v=26&c=ir&l=en.

5. Davoodi S. Iranian health challenges. 1st edition ed: Ebtkar Dansh Publication; 2008.

6. Faridaalaee G, Nikzad F, Rahmani SH. Cause of Death in Emergency Department&59; a Brief Report. Iranian J Emerg Med. 2015;2(1):45-8.

7. Vanbrabant P, Dhondt E, Sabbe M. What do we know about patients dying in the emergency department? Resuscitation. 2004;60(2):163-70.

8. Wyatt J, Beard D, Gray A, Busuttil A, Robertson C. Rate, causes and prevention of deaths from injuries in south-east Scotland. Injury. 1996;27(5):337-40.

9. Montazeri A. Road-traffic-related mortality in Iran: a descriptive study. Public health. 2004;118(2):110-3.

10. Mathers CD, Fat DM, Inoue M, Rao C, Lopez AD. Counting the dead and what they died from: an assessment of the global status of cause of death data. Bull World Health Organ. 2005;83(3):171-7.

11. Heron M. Deaths: leading causes for 2008. Natl Vital Stat Rep. 2012;60(6):1-94.