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ORIGINAL ARTICLE

Identification of Substantial Factors Associated with Mortality in the Emergency Department

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ABSTRACT

In this paper, the prime focus is to identify key factors that are directly related to the mortality in critical medical patients presenting to the emergency department in a collapsed state and the research study was conducted at a tertiary care university hospital (April- July 2020) on medical patients presenting in critical condition. Some imperative variables like demography, premorbid, presenting vitals, GCS, blood sugar, oxygen saturation, diagnosis, treatment, and outcomes were recorded. Statistical analysis was done using the chi-square test along with Fisher's exact test for computational evaluation. Hence, the absent pulse, low conscious level, and temperature at presentation are significant clinical findings associated with mortality of critical medical patients.

Keywords: Critical patients, Mortality, Emergency Department

INTRODUCTION

Competent provision of emergency medical care has been approved to diminish patient mortality around the globe. The World Health Organization has recently recommended the strengthening of acute care capacity of health systems in low pay countries as a key priority. Pakistan has now been position at 152 on United Nations Human Development Index[1] and its medical care framework is struggling to improve but is under intense pressure due to lack of healthcare resources.

Pakistan is among those developing countries that are on way to establish emergency care despite many difficulties. Emergency services are provided to most patients especially in government set up free of cost that could be a reason for receiving a huge number of patients in the emergency department. At the same time, the government's focus on emergency services than the wards has empowered the field of emergency to upgrade its services to recognized standards. Albeit significant upgrades were achieved in all degrees of health care yet these may not do the trick considering sheer increases in patient numbers and high mortality rates in the emergency departments.

Few endeavors have been made to identify factors that are answerable for persistent mortality. However, the results have been contradictory in most cases, i.e. some reports consider patients with risk factors have higher rates of death than without but still precise identification of such measurable variables has not been studied. Therefore, more studies are needed to make a true judgment about patient mortality in the emergency department.

Previous studies have indicated that cardiovascular conditions, road traffic accidents, traumas and cancers are the significant etiologies of mortalities in emergency department[2] but such etiological mortality pattern differ in various geographical locations like hilly areas have higher mortality rates with trauma while motor vehicle accidents are more in urban areas[3].

As it has been figure out that 15-60% of all the hospital mortalities occur in the emergency department[4] but this huge variation depends upon various factors like location, the scope of services, and availability of professionals. A study conducted in Africa concluded that mortality in the emergency department is multifactorial and incorporate both a significant burden of trauma, disease pattern and limited access to quality health services, lack of equipment, medications, and trained health providers[5] on the other end of spectrum, the study held in England and Wales calculated that almost 33% of patients were initially misdiagnosed and that this contributed in expanded mortality[6].

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Therefore it is important to search out the significant factors that are directly related to mortality and layout suggestions to overcome this challenge of high mortality in the emergency department.

METHODS

The study was designed to identify substantial factors that are directly related death of critical patients in the emergency department. After approval from the ethical committee of the hospital, this analytical cross-sectional study was carried out for a period of 4 months from April to July 2020 at the Department of Emergency Medicine at a tertiary care university-affiliated Holy Family Hospital, Rawalpindi, to detect the parameters responsible for the mortality of patients presented with precarious conditions. In this study, 318 critical patients were included that presented to emergency department were registered but only 242 were included in the study according to the inclusion criteria. Inclusion criteria was adult patients with medical conditions in collapsed state with unstable vitals (heart rate < 60 beats per minute, blood pressure < 90/60 or >140/90mmHg, respiratory rate <10 or > 20 breaths per minutes, temperature<35.5 or >38.2^{0}C). Patients with DNR (don't resuscitate) status, failure to consent, surgical, gynecological, and pediatrics cases were excluded. All included patients were assessed by ED physician in triage and subsequently managed/admitted to ER accordingly. The research team did not interfere with the medical diagnosis in triage nor the emergency care. Informed consent was taken from the patient family or escorting person. All the patients received standardized treatment as per emergency department protocol. Resuscitation was carried out on all cases according to advance cardiac life support guidelines. Survivals were admitted to intensive care/medical wards or referred to a specialist center for further care/interventions.

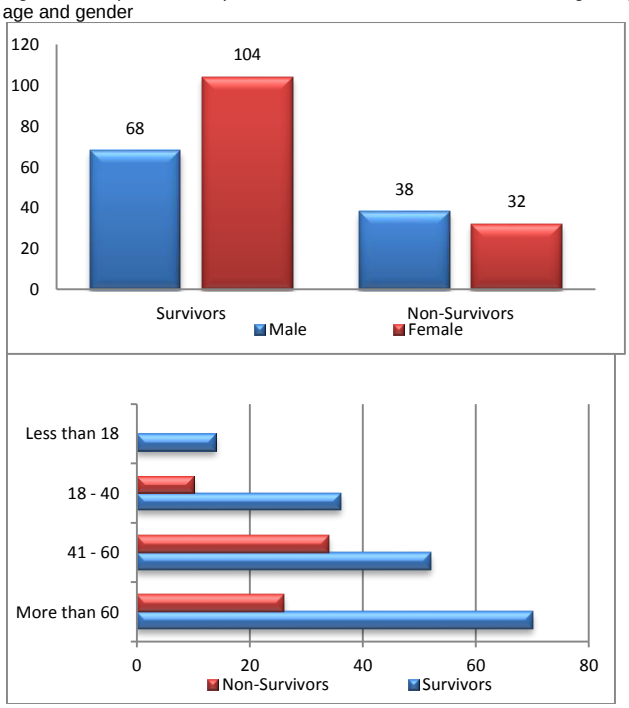
Study variables were recorded in a structured format. Variables included demographic details (name, age, gender, area of residence), premorbid conditions, admission diagnosis, vitals on admissions, oxygen saturation, presenting GCS score, blood sugar levels, treatment received (airways, breathing, and circulatory support), final diagnosis and outcome (survival, non-survival). SPSS vr 25 was used to record and analyze the gathered data. Descriptive statistics and frequencies of variables were measured. Grouping of variables is carried out accordingly. Analysis of variables for survival and non-survival carried out using the chi-square test and Fisher's exact test as appropriate. P-value < 0.05 was considered significant for bivariate analysis. Result of the analysis compiled and conclusions drawn.

RESULTS

The results of Table 1 reveal that among 242 patients, 107(44.2%) were males and 135(55.8%) were females. The mortality rate was higher in males 38(54.3%) higher than the females 32(45.7%) as depicted in Figure 1. The mean age was 54.08 years with the youngest being 13 years and the oldest of 90 years. Maximum patients were of 70 years 18(7.4%). While the mean age of survivors and non-survivors were 52.9+20.2 and 56.5+13.7 respectively (p=0.336 CT 95%). Most of the cases presented from local areas of Rawalpindi district 52.06% (n=126) while remaining were from Islamabad and peripheries. In Table 2, a higher rate of mortality was observed with patients whose initial diagnosis was septic/hypovolemic shock (45.8%) or any cardiac ailment (38.1%) or respiratory disease (25%). Considering the co-morbid conditions, 76 patients who had only one premorbid 54(71.1%) among survivals and 22(28.91%) who died. 14(5.78%) patients were having four premorbid conditions.

According to the results of Table 3 along with Figures 2 and 3 represent that the maximum patients were having hypotension n=88(36.36%) while 32(13.22%) patients were having high blood pressure on presentation. Among 72 patients with un-recordable blood pressure, 40(55.6%) patients survive while 32(44.4%) expired in ED. Almost one-fourth (25%) of the hypotensive patients did not survive. Bivariate analysis of mortality showed heart rate (p=0.011), body temperature (p=0.03), and Glasgow Coma score in between 3 to 6 (p=0.02) were significant factors considering deaths in the emergency department.

Figure 1: Graphical description of survivors versus non-survivors regarding age and gender



In Table 4, the final diagnosis did not have a positive impact on mortality at the ED (p=0.336). Similarly, the patient's socio-demographic variables, gender, geographical location, premorbid, oxygen saturation at Room air, blood pressure, assisted ventilation, and circulatory support given at the ED, did not influence mortality. Chi-square test showed a significant relationship of parameters like initial diagnosis, heart rate, body temperature, respiratory rate, GCS with mortality of the patients at the ED during four months. Factors associated with the healthcare process were statistically significant for timely diagnosis (p=0.032), evaluation of HR (p=0.011), body temperature (p=0.03), respiratory rate (p=0.003) and GCS (p=0.024). Other studied variables that did not shown any statistical significance in relation to morality were peripheral oxygen saturation (p=0.11), blood sugar levels (p=0.55), treatment rendered with airway care (p=0.15), ventilation provided (p=0.30), circulatory support (p=0.87) and final diagnosis (P=0.33) [95% CI; p>0.05].

Table 1. Description of demographic variables

	Survivors (n=172)	**Non-survivors n=70**	***P-value***
Average Age (in years)	52.9±20.2	56.5±13.7	*0.336*
Age (in Groups)			
Less than 18 years	14(100%)	0(0%)	*0.119*
18-40 years	36(78.3%)	10(21.7%)	
41-60 years	52(60.5%)	34(39.5%)	
More than 60 years	70(72.9%)	26(27.1%)	
Gender			
Male	68(39.5%)	38(54.3%)	*0.138*
Female	104(60.5%)	32(45.7%)	
Geographical Location			
Islamabad	2(1.2%)	0(0%)	*0.805*
Rawalpindi	90(52.3%)	36(51.4%)	
Periphery	80(46.5%)	34(48.6%)	

Table 2. Comparison of variables among survivors and non-survivors

Admitting Diagnosis	**Survivors n=172**	**Non-survivors n=70**	*p-value*
Respiratory	24(75%)	8(25%)	*0.032*
Cardiac	26(61.9%)	16(38.1%)	
Neuro	32(84.2%)	6(15.8%)	
Renal	10(62.5%)	6(37.5%)	
Endo	6(50%)	6(50%)	
Poisoning	32(94.1%)	2(5.9%)	
GIT	14(100%)	0(%)	
Shock(septic/Hypovol)	26(54.2%)	22(45.8%)	
Misc.	2(33.3%)	4(66.7%)	
Premorbid Frequency			
No Disease	40(83.3%)	8(16.7%)	*0.215*
Single Disease	54(71.1%)	22(28.9%)	
2 Diseases	46(76.7%)	14(23.3%)	
3 Diseases	24(54.5%)	20(45.5%)	
4 Diseases	8(57.1%)	6(42.9%)	

Table 3. Vitals and GCS analysis among survivors and non-survivors

Blood Pressure (BP)	**Survivors n=172**	**Non-survivors n=70**	***p-value***
Unrecorded	40(55.6%)	32(44.4%)	*0.135*
Hypo 40-89	66(75%)	22(25%)	
Normal	42(84%)	8(16%)	
Hypertensive 140-170	10(83.3%)	2(16.7%)	
Sever HTN>170	14(70%)	6(30%)	
Heart Rate Analysis			
HR(Descriptively)	96.54±36.621	82.03±56.162	*0.171*
HR(Categorically)			
Absent pulse	10(38.5%)	16(61.5%)	*0.011*
Brady <60	18(69.2%)	8(30.8%)	
Normal	74(84.1%)	14(15.9%)	
Techy 101-140	64(72.7%)	24(27.3%)	
Sever Techy >140	6(42.9%)	8(57.10%)	
Body Temperature			
Normal	22(50%)	22(50%)	*0.033*
Low fever <100	18(64.3%)	10(35.7%)	
Hi Fever >100	132(77.6%)	38(22.4%)	
Respiratory Rate			
Hypoventilation <10	44(52.4%)	40(47.6%)	*0.30*
Normal 10-20	40(87%)	6(13%)	
Tachypnea >20	88(78.6%)	24(21.4%)	
GCS Score			
GCS 3-6	40(52.6%)	36(47.4%)	*0.024*
GCS 7-11	58(78.4%)	16(21.6%)	
Dec-14	48(82.8%)	10(17.2%)	
Normal	26(76.5%)	8(23.5%)	

Figure 2: Graphical depiction of survivors versus non-survivors regarding heart rate

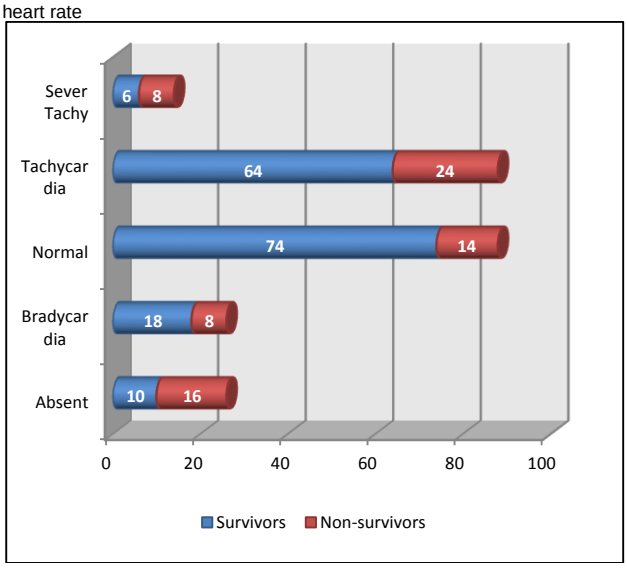
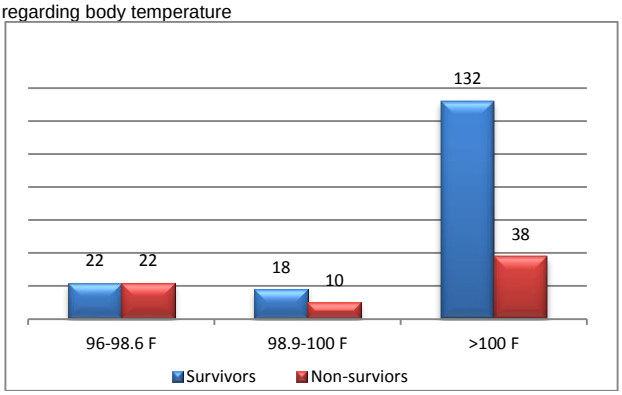


Table 4. Detail of insignificant variables among survivors and non-survivors

	Survivors n=172	**Non-survivors n=70**	*P-value*
SPO2			
SPO2 (Descriptively)	63.7±36.563	51.71±38.299	***0.112***
SPO2 (Categorically)			
No SPO2	38(63.3%)	22(36.7%)	***0.744***
0-60%	14(63.6%)	8(36.4%)	
60-80%	36(72%)	14(28%)	
81-90%	30(75%)	10(25%)	
91-100%	54(77.1%)	16(22.9%)	
Blood Sugar Levels			
RBS(Descriptively)	160.26±117.3	174.89±138.051	***0.556***
RBS(Categorically)			
Low	32(69.6%)	14(30.4%)	***0.976***
Normal	102(71.9%)	36(28.1%)	
Hi	48(70.6%)	20(29.4%)	
Airway			
Patent	122(75.3%)	40(24.7%)	***0.159***
Airway Inserted	42(58.3%)	30(41.7%)	
FB removed	4(100%)	0(0%)	
Patent but airway Inserted	4(100%)	0(0%)	
Assisted Vent			
Not Needed	24(85.7%)	4(14.3%)	***0.309***
Supplemental O2	118(72.8%)	44(27.2%)	
Bag Mask Ventilation	2(100%)	0(0%)	
Invasive Ventilation	2(50%)	2(50%)	
Multiple	26(56.5%)	20(43.5%)	
Circulatory			
Not Needed	4(66.7%)	2(33.3%)	***0.874***
IVF	12(60%)	8(40%)	
Antibiotics	10(71.4%)	4(28.6%)	
Combination	146(72.3%)	56(27.7%)	
Final Diagnosis			
Respiratory	36(72%)	14(28%)	***0.336***
Cardiac	26(56.5%)	20(43.5%)	
Neuro	24(75%)	8(25%)	
Renal	14(63.6%)	8(36.4%)	
Endo	2(100%)	0(0%)	
Poisoning	28(93.3%)	2(6.7%)	
Misc.	42(70%)	18(30%)	

Figure 3. Graphical representation of survivors versus non-survivors regarding body temperature



DISCUSSION

Mortality in the emergency department is unavoidable. Survival of critical patients is multifactorial. Presetting vitals, the severity of illness, associated risk factors, and comorbid diseases are the key concerns in treating these patients. At the same time, identification of disease and its severity, right treatment delivered at right time is the key to manage controllable factors.

Age is considered as an important risk factor as Ozakin considered that age is the most significant factor afecting the 60-day in-hospital mortality[7] in patients admitted in emergency department requiring intubation, fluid resuscitation and with multiple comorbid. While in our study, all the young patients survived while the highest mortality was noted in the age group of 41-60years. Arif and Kaya studied that emergency physician diagnostic accuracy varied between 70 and 78% in medical cases.[8] However diagnostic accuracy is more difficult in elderly patients with multiple comorbidities and hence to determine the exact factor leading to death is difficult with complex mechanisms between diseases. Still, diagnostic accuracy can improve with active observation and reassessment of critical patients.

Higher survival rates have been observed in females than males 60.5% and 39.5% respectively. The possible explanation could be of privileged social values and male dependency that leads to early attention for medical care. Males being bread earners with hectic life mostly delay the care and risk their lives. Rogers stated in his study that men have a 30% to 83% higher mortality rate as compared to females[9].

Most of the patients presented with low to absent blood pressure 160(66.11%) and high blood pressure readings were recorded in 24(9.91%) cases. Mortality was higher in the former group constituting 22.31% to 3.3% in a later group. A similarly higher death rate of 45.8% was noted in patients that presented in a shocking state. The same findings have been found by Otilia and Dan mentioned that low systolic blood pressure at admission increases mortality. Even a single episode with prolonged hypotension (<100mmHg) of non-traumatic ED patients is a significant contributing factor for unexpected in-hospital death[10].

In our data, most of our patients we admitted in shocked state and cardiac problem 48(19.82%) and 42(17.3%) respectively and similar mortality was obtained in each group 22(45.8%) and 16(38.1%) accordingly. Comparing the final diagnoses to the initial diagnosis, the analysis showed that cardiac case mortality was higher at 43.5% versus 38.1% with a p-value of 0.336. Similar results have been published by Alimohammadi showing that cardiovascular diseases (39.2%) are the most important etiology of early death in patients referred to the emergency department[11].

The majority of deaths due to myocardial infarction take place during the first few hours of symptoms appearance and delay in presentation leads to mortality. Decreases in mortality due to cardiac diseases have been reported in recent years (from 64% to 49%) however, they still have the highest incidence rates.[12]

Another significant finding was conscious level at the presentation that was directly related to mortality (P=0.02). Especially patients whose presenting Glasgow Coma Scale was between3-6 was having higher mortality rates 47.4% than with high GCS score. Another study also concluded that GCS score of 3 on presentation has terrible prognostic outcome.[13] A similar study was done in India to determine predictors of 1-year mortality among patients admitted with trauma and their study showed that after the 6th day of admission GCS score is the only significant factor affecting mortality. The study showed 97.85% mortality within 8 weeks after injury.[14] In series of published studies, the outcome of patients with a GCS score of 3-6 has been found particularly poor prognostic factor. In particular, a GCS score of 3 at the time of presentation is particularly associated with poor outcome[15].

Out of 242 cases, 84 patients (34.71%) required maintenance of the airway, and 4(1.65%) presented with foreign bodies occluding the airway. Many of patients 214(88.42%) required oxygen support ranging from supplement oxygen via face mask (66.94%) to requiring intubation and mechanical ventilation 21.4%. The rest of the 11.5% cases presented with normal oxygen saturation and did not require oxygen support at presentation. Considering the circulatory support, in most of the cases, 97.52% required intravenous fluids IVF and vasopressors to support the life. Overall 168(71.78%) patients survived after resuscitation efforts and 68(28.8%) expired.

Discussing the other presenting features of critical patients like peripheral oxygen saturation (SPO2), blood sugar levels, temperature, and respiratory rate showed important data regarding mortality. Among the above features, the only temperature on presentation was significantly associated with mortality with a p-value of 0.03 at a 95% confidence interval. Higher mortality rates were observed in patients with fever at 48(19.82%) than normal temperature upon arrival to ED 22(9.09%). Maximum patients were having a higher respiratory rate of more than 20 per minute n=112(46.28%) than hypoventilation n=84(34.71%) but mortality was not significantly associated with the respiratory rate (P=0.30). Similarly, most of the patients were having oxygen saturation less than 90% 72(71.07%) while 24.79% of patients were having unrecordable oxygen saturation with the highest mortality rate of 36.7% than recordable saturation. However presenting oxygen saturation was not significantly associated with mortality (p=0.74) that justifies its dependency on blood pressure, peripheral temperature skin temperature, and condition of vascular flow. Similarly, blood sugar levels were also not associated with mortality (P-0.55) although mortality rates were higher in hypoglycemic patients 30.4% versus 28.1% with normal glucose levels. A study conducted in India stated that abnormal respiratory rate was found to be significant parameters on the logistic regression model (p=0.012) affecting mortality in injured adult patients admitted with trauma[16].

Limitation: As per study design, critical cases related to surgical, gynecological conditions, and pediatric population were excluded therefore the study parameters apply to only patients with medical conditions. Multicenter trials with a higher sample size should be planned and executed to validate the findings in different ethnic groups.

CONCLUSION

Immediate identification of factors related to mortality (absent pulse, poor conscious level, and temperature abnormalities at presentation) in critical medical cases presenting to the emergency department and early intervention can help us to reduce mortality. Pre-hospital attention to these substantial factors could be more beneficial in saving lives.

Conflict of interest: Nil

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