Original Article

CARDIAC MORTALITY TRENDS IN THE EMERGENCY DEPARTMENT OF A TERTIARY CARE CARDIAC CENTRE

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ABSTRACT

Objectives: Limited information is available on trends in mortality from cardiovascular diseases in Pakistan. The objective of this study was to examine the various cardiac causes of early deaths and asses the treatment strategies in emergency department of a tertiary care cardiac centre.

Methodology: We conducted a prospective observational study of early deaths over an eight months period. Data of emergency admissions from June 2006 to January 2007 was analyzed.

Results: There were 357 early deaths; median age 60 years, and median survival time 1.55 hours. There were 6221 emergency admissions, with 4.6% of men and 9.4% of women having early mortality in emergency department. Only 14 were non-cardiac deaths and 314 (88%) were cardiac related deaths. Valvular heart disease comprised 6% of cardiac deaths. There were 373 cases received dead in emergency and assumed to be sudden cardiac deaths. Cardiogenic shock (CS) was the leading cause (265, 74%) of cardiac deaths and ST elevation myocardial infarction (STEMI) comprised nearly half of those deaths (130, 49%). Only 39% (51/130) of STEMI patients were thrombolysed and there was only marginal difference in the survival time of patients with or without lytic therapy. ST depression was seen in 17% of CS patients. Ventricular fibrillation and ventricular tachycardia constituted only 20% of cardiac deaths. Complete heart block (CHB) was seen in a quarter of CS patients and emergency transvenous pacing was successful in 67% (42/63). The survival time was shorter in patients with failure to pace acutely; men (0.50 vs. 1.30 hrs), women (1.00 vs. 2.15 hrs)

Conclusions: A very large number of early deaths were cardiac and cardiogenic shock was the major cause. Only half of cardiogenic shock patients had diagnostic ECG changes of ST segment elevation and less than half of these were thrombolysed.

KEY WORDS: Cardiac mortality, Emergency mortality, Cardiogenic shock, Myocardial infarction.

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INTRODUCTION

The mortality from ischemic heart disease (IHD) has significantly decreased in most developed countries in recent years.[1] However different trends have been observed in many developing countries.[2] The decline in incidence and decrease in mortality from IHD in the West is related to improvement in both primary and secondary prevention, resulting in reduction in sudden cardiac death and in-hospital mortality.[3] Whereas, in the developing world, it is related to increasing incidence and prevalence of IHD and lack of acute cardiac care facilities. Cardiogenic shock is the main cause of

acute in-hospital deaths in IHD patients, and its incidence and mortality rate remain high.[4] However, the prognosis for patients with CS who arrive in hospital alive has improved considerably in recent years because of early aggressive treatment.[5]

There is scanty scientific data on the trends in early mortality in specialized cardiac care centres in Pakistan. This study was conducted to examine the various causes of death, the age and gender based differences and their association with clinical and ECG variables.

PATIENTS AND METHODS

The study was conducted at Punjab Institute of Cardiology, which is a tertiary care centre with interventional facilities and backed up by a cardiothoracic surgical unit. Mortality data was collected by reviewing emergency department patient notes on a weekly basis. Where the details were not clear, enquiries were made from the residents who had supervised care of the patients and certified the death. The data was recorded by an experienced cardiology resident in a supervising capacity and later on reviewed by a consultant.

The study population comprised of the entire emergency department admissions over an eight months period from June 2006 to January 2007. All the fatalities occurred within 36 hours of presentation, and were defined as "early deaths". Patients received dead were also entered into data and recorded as sudden deaths. Deaths were classified carefully into various categories. The symptoms of chest pain, dyspnoea, syncope, altered consciousness, past history of documented cardiac events and specific diagnostic tests of cardiac enzymes, troponin levels, and echocardiography were used to aid in categorisation of deaths. Where clinical assessment created doubt about the cause of death being cardiac or otherwise, a category of "possible cardiac" was allotted. Similarly, where the death was definitely cardiac but doubt about being "cardiogenic shock", it was entered as "other cardiac" cause. Only those patients who survived for an adequate period of time for reliable clinical or investigational assessment and fulfilled the standard definition were categorized as having CS. Cardiogenic shock was defined as a systolic blood pressure of less than 80 mm Hg in the absence of hypovolemia and associated with cyanosis, cold extremities, changes in mental status, persistent oliguria, or congestive heart failure. From the hospital records of patients, we also extracted demographic, clinical and electrocardiographic data as well as information about the use of therapeutic interventions.

Statistical analysis: All variables were entered in statistical package for the social sciences (SPSS version 13.0). Medians with interquartile range (IQR) were calculated for non-normally distributed metric variables and frequencies or percentages for non-metric variables. The survival times were calculated by using survival analysis.

RESULTS

There were 357 early deaths (219 men, 138 women). The median age (± IQR), 60±20 years with 95% CI (57.21-60.42) and median survival time (± SE) was 1.55±3.58 hours with 95% CI (2.9-3.88). There were 6221 emergency admissions for the same period of time, with 4.6% of men and 9.4% of women having early mortality in emergency department (Table-I). Only 14 were definite non-cardiac deaths and 314 (88%) were cardiac related deaths with predominance of cardiogenic shock as a cause of death (265, 74%). Valvular heart disease comprised 6% of cardiac deaths. There were 373 patients received dead in emergency and assumed to be cardiac cases and sudden deaths in the majority.

Comparison of data by gender and frequency calculation of various variables of patients with cardiac deaths is shown in Table-II. There were

Table-I: Emergency data over eight months period

	Men	*Women*	*Total*
A&E Admissions	4759	1462	6221
A&E Deaths	219 (4.6%)	138 (9.4%)	357
Received Dead	285	88	373

Table-II: Frequency distribution of various variables

	Men {n=219(61%)}	Women {n=138(39%)}
Age (11-94 yrs), median ± IQR	60± 20	60±17
Non cardiac	11 (5)	3 (2.2)
Possible cardiac	20 (9.1)	15 (10.9)
Cardiogenic shock	166 (75.8)	99 (71.7)
Other cardiac	26 (11.9)	23 (16.7)
INF MI	22 (10)	15 (10.9)
INF-Post MI	14 (6.4)	9 (6.5)
ANT-LAT MI	40 (18.3)	19 (13.8)
ANT Septal MI	5 (2.3)	2 (1.4)
Lateral MI	4 (1.8)	0
ST Depression	31 (14.2)	14 (10.1)
LBBB	9 (4.1)	7 (5.1)
RBBB	29 (13.2)	13 (9.4)
Other	20 (9.1)	16 (11.6)
Complete Heart Block	38 (17.4)	27 (19.6)
Idio Ventricular Rhythm	13 (5.9)	12 (8.7)
V FIB	26 (12)	11 (8.0)
V Tach	17 (7.8)	10 (7.2)
Temporary Pacemaker (TPM)	37 (16.9)	26 (18.8)
Succesful TPM	24 (65)	18 (69)
Thrombolysed	34 (15.5)	17 (12.3)
Previous MI	28 (12.8)	19 (13.8)
Previous Angiography	31 (14.2)	11 (8.0)
Previous Severe CAD	25 (11.4)	7 (5)
Previous CABG	8 (3.7)	1 (0.7)
Previous Heart Failure	42 (19.2)	23 (16.7)
Previous PCI	5 (2.3)	1 (0.7)
Valvular Heart Disease	10 (4.6)	9 (6.5)
Diabetes Mellitus	58 (26.5)	60 (43.5)
Hypertension	21 (9.6)	33 (23.9)

130 CS patients with ST elevation myocardial infarction (STEMI); 51% men and 45% women. Extensive anterolateral MI was the commonest STEMI group. Only 39% (51/130) of STEMI patients were thrombolysed and streptokinase was the sole drug used. ST depression was seen in 17% of CS patients. Complete heart block (CHB) was seen in a quarter of CS patients (n=65). Sixty-three CHB patients had temporary lead inserted without fluoroscopy guidance in emergency department and it was successful in 67% (42/63). Only a small number of cardiac deaths had previous history of myocardial infarction (47, 15%). There were a larger number of known heart failure patients (65, 21%). Only a small number (n=42) of cardiac death patients had previously been investigated with coronary angiography, and similarly a minority had previous revascularisation

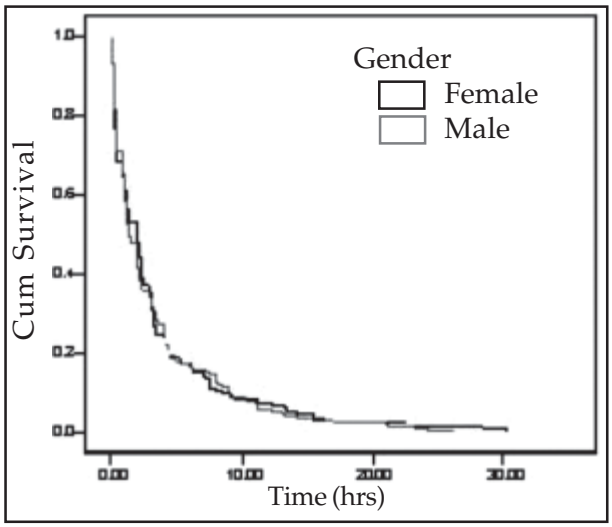

Fig-1: Men & Women with comparable surivival times.

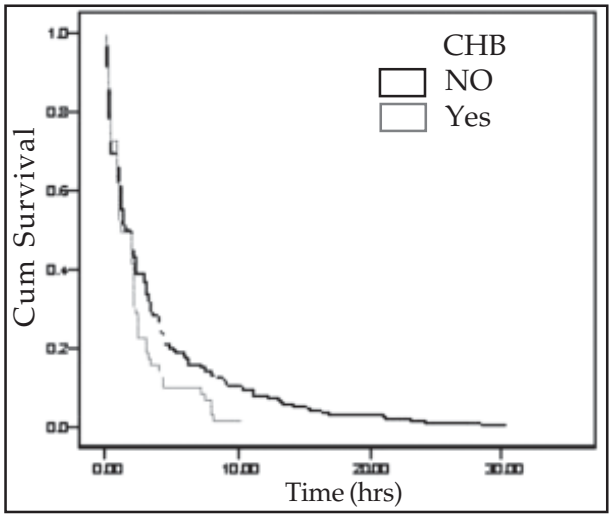

Fig-2: Patients with complete heart block requiring temporary pacing having shorter survival time.

procedure. Although the number was small for any statistical comparison, there were fewer women than men. Almost one third of patients with early deaths had diabetes mellitus. There was predominance of women with history of diabetes mellitus (44% vs. 27%), and hypertension (24% vs. 10%).

The median survival times in hours, for the patients with early mortality were also calculated, and comparison was made by gender (Table-III). The survival times were comparable in the CS group (men 2.00 ± 0.26 vs women 2.00 ± 0.31), (Fig-1). Patients with CHB requiring pacing died sooner (Fig-2). The survival time was even shorter in patients with failure to pace acutely; men (0.50 vs 1.30), women (1.00 vs 2.15). There was marginal difference in the survival time of patients thrombolysed or not. The further subgroup analysis of patients with severe acute myocardial ischemia [n=191, 72% (STEMI, LBBB, ST depression)] showed that majority of patients were in age group of 51-70 years and younger patients had shorter survival time (Fig-3). Median survival time (±SE) for this age group was 2.15 (±0.23).

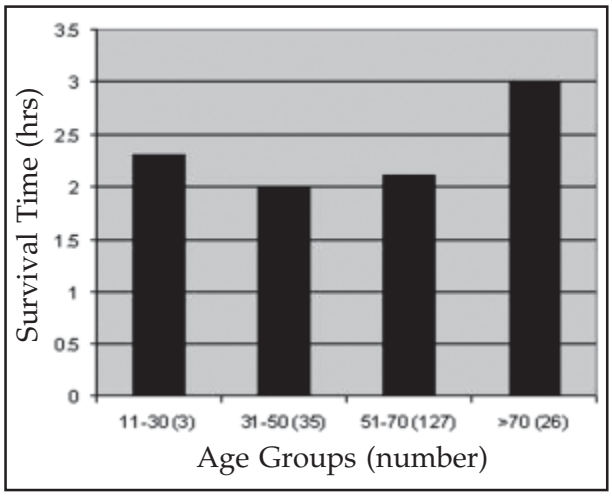

Fig-3: Survival times for patients with cardiogenic shock & acute MI (ST Elevation, LBBB,ST Depression)

DISCUSSION

The results of this observational mortality study suggest that only a small number of people dying in emergency department of a tertiary cardiac center have non-cardiac causes. Cardiogenic shock comprised 74% of early deaths, and 72% of these had ECG evidence of severe myocardial ischemia. CS is a leading cause of death for patients with acute MI who reach hospital alive. Its incidence (5-15%) has remained unchanged over recent decades. The mortality for CS remains high (50%) and it is even higher in those who present with CS on admission rather than developing it during hospitalization. A strategy of early revascularisation by coronary artery bypass

Table-III: Median survival times in hours with standard error and (confidence intervals)

	Men (219)	*Women (138)*
All deaths	1.45 ± 0.22 (1.02-1.89)	2.05 ± 0.32 (1.43-2.67)
Cardiogenic shock	2.00 ± 0.26 (1.49-2.51)	2.00 ± 0.31 (1.39-2.61)
Other cardiac	1.30 ± 0.16 (0.99-1.61)	2.30 ± 0.68 (0.97- 3.63)
Acute MI	2.10 ± 0.28 (1.55-2.64)	2.15 ± 0.23 (1.70-2.60)
ST Depression	2.45 ± 0.70 (1.09-3.81)	2.15 ± 0.84 (0.50-3.80)
Complete Heart Block	1.00 ± 0.26 (0.50-1.50)	2.00 ± 0.82 (0.40-3.61)
Idio Ventricular Rhythm	0.40 ± 0.51 (0.30-0.50)	0.30 ± 0.03 (0.24-0.36)
V FIB	1.10 ± 0.30 (0.51-1.70)	2.30 ± 0.63 (1.06-3.54)
V Tach	1.10 ± 0.05 (1.00-1.20)	2.30 ± 0.20 (2.07-2.53)
Temp Pacemaker	1.05 ± 0.20 (0.65-1.45)	2.10 ± 0.80 (1.95-2.25)
Succesful TPM	1.30 ± 0.54 (0.24-2.36)	2.15 ± 0.03 (2.08-2.22)
Failed TPM	0.50 ± 0.36 (0.00-1.20)	1.00 ± 0.72 (0.00-2.41)
Thrombolysed	2.30 ± 0.58 (1.16-3.44)	2.15 ± 0.76 (0.67-3.63)
Previous MI	1.20 ± 0.17 (0.88-1.52)	2.15 ± 1.23 (0.00-4.57)
Previous heart failure	2.20 ± 0.62 (0.98,3.42)	2.05 ± 0.80 (0.46,3.62)
Diabetes Mellitus	1.30 ± 0.57 (0.18-2.42)	2.05 ± 0.39 (1.29-2.81)
Hypertension	1.30 ± 0.80 (0.00-2.87)	2.25 ± 0.55 (1.18-3.32)

grafting (CABG) or percutaneous intervention (PCI) is superior to initial aggressive medical therapy, in particular in patients less than 75 years of age.[5,6] In SHOCK trial survival for CS patients having early revascularisation was significantly higher at one year and also long term at 6 years follow up (62% vs. 44%).[5] United States National registry for MI (NRMI) shows that mortality for CS has decreased in hospitals that perform early revascularisation.[6] In our study none of the patients who died had undergone early revascularisation. This reflects the current practice in our unit, mainly due to lack of resources. Early aggressive therapy with the use of intraaortic balloon pump (IABP) without revascularisation has also shown improved survival. In our setup even this type of aggressive medical treatment is not feasible. Accounting for resources, probably, revascularisation rather than IABP would be more cost effective. Impact of resources on the outcome of CS after MI has been observed before in randomized trials.[7] In GUSTO trial, 30-day and 1-year mortality was significantly lower among patients treated in the USA than among those treated in other countries. This difference in mortality may be due to the greater use of invasive diagnostic and therapeutic interventions in the USA.

Nearly half of our cardiogenic shock patients had diagnostic ECG changes (ST elevation) for acute MI. Less than half of these were thrombolysed. This in part is due to the misconception, which still prevails that hypotensive patients are not to be thrombolysed with streptokinase. Although thrombolytic therapy has consistently been shown to decrease mortality after acute MI, no large randomized controlled trial has found that the use of clot-lysing therapy improves survival after CS has developed. In GUSTO-1, patients treated with accelerated recombinant tissue plasminogen activator were significantly less likely to have shock; this finding suggests the possible benefit of early reperfusion that is associated with the use of this thrombolytic regimen. The same trial (GUSTO-1) showed that 56 percent of all patients with CS died in the hospital, regardless of the thrombolytic regimen used.[8] Patients with CS have frequently been excluded from clinical trials of thrombolytic agents. As a result, data on the efficacy of thrombolytic agents in these patients is extremely limited. Nonetheless, it is rational to assume that restoring coronary blood flow in the infarct-related artery by means of thrombolytic agents, percutaneous transluminal coronary angioplasty or coronary artery bypass grafting would improve survival among patients with cardiogenic shock.

Half of the patients with CS had ECG changes other than ST elevation. In these subgroups, the earlier thrombolytic trials had not shown benefit of reperfusion. However, we need to identify certain high risk groups such as ST depression and LBBB in non-ST elevation MI, where early aggressive treatment has been shown to improve survival.[9] Patients with ST depression comprise a heterogenous group with left circumflex occlusions, multivessel disease with previous infarcts and left main disease. The striking finding of SHOCK trial registry was the high rate (35%) of circumflex-artery occlusion as the culprit lesion in patients with CS and non-ST-segment elevation MI.[10] The misinterpretation of non-ST-segment elevation as "nontransmural" MI also results in failure to thrombolyse patients with "true posterior" infarcts.

Recently IIb-IIIa inhibitors have also been shown to improve outcome in cardiogenic shock in patients with acute coronary syndrome without ST elevation.[11] Recent data also supports early revascularisation by intervention for non-ST elevation ACS patients. There is association between ST depression of more than 1mm on ECG and improved prognosis with revascularisation.[12]

In this study majority of patients with cardiogenic shock were younger, in the age group of 50-70 years. This probably reflects the life span in general population in comparison to longevity of life in Western world. The life expectancy for Pakistan is 65 years in comparison to 78 years and 79 years for USA and UK respectively. The mean age was 66 (±11) in

SHOCK trial and the maximum benefit of early revascularisation was seen in younger patients. This should encourage us to adopt the strategy of earlier revascularisation in our relatively younger population of CS patients. Another encouraging finding was the median survival time of 2.15 hours, indicating that if we are to plan early revascularisation by PCI, we would be able to meet the target of "door to balloon time" of ninety minutes in majority of our CS patients.[13]

In community, population of men and women is similar. According to 1998 census of city of Lahore, there were 2,707,220 men and 2,436,275 women. However, there was lower hospitalization rate for women but higher percentage of women had earlier death (9.4% vs 4.6%). This is consistent with the previous trials having shown increased mortality in women with acute MI as compared to men.[14] Also women dying with CS were more likely to have diabetes mellitus, and hypertension.[15] Women less often have ST elevation MI diagnostic ECGs, are less often treated by invasive strategy, and have higher complication rate of revascularisation procedures.[16]

In our study, number of patients received dead were about the same as early emergency department deaths and our assumption seems sound that majority of these were sudden cardiac deaths. It has been documented in the world literature that half of all IHD deaths are sudden. Framingham heart study also showed that trends in IHD mortality and SCD parallel each other.[3]

Heart block was found to be associated with increased in-hospital mortality in patients with acute MI even in thrombolytic era.[17] In our study a significant proportion of patients with cardiogenic shock had complete heart block, which required emergency pacing. The failure rate of pacing in our cardiogenic shock patients was 33%. The success of transvenous pacing is limited even by the experienced operator in critically ill patients in the emergency room without aid of fluoroscopy. This might have been important in saving extra human lives and certainly buying extra time for the management of these patients as shown by difference in survival times for the patients having success or failure in pacing. This certainly requires redirecting resources for acquiring the facility of external transcutaneous pacing or fluoroscopy in the emergency room.

In conclusion, CS is the leading cause of death for patients with acute MI who reach hospital alive. Recent trials have shown that early revascularisation reduces mortality in these patients. Lack of resources is the major factor limiting its availability to all suitable patients. However, mortality still remains considerably high even after CABG or PCI. Under these circumstances the social and economic impact of redirecting resources in general for an intervention, which has high global mortality, needs to be evaluated further. At the same time, the community at large, the general practitioners, the paramedics and ambulance services need to be educated for prompt recognition of sinister cardiac symptoms of chest pain and syncope. These are the most important factors in early transfer of high-risk patients to the medical care and so reducing the risk of death. This awareness can be increased by mass education programmes. As a large number of cardiac deaths are arrhythmic after acute MI and occur before reaching the hospital, training for basic life support in community and facilities for resuscitation like automated external defibrillators at public places would also help in reducing cardiac mortality.

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