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Prediction of acute myocardial infarction outcome: A record based cohort study

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Abstract

Context: In this research work, death as an outcome was predicted among Acute Myocardial Infarction patients. The said outcome was analyzed with patient related demographic and risk variables, for determining factors influencing the poor prognosis.

Objectives

1. To predict the outcome of Acute Myocardial Infarction (AMI) patients,
2. To predict death as an outcome after AMI, using demographic and risk variables.

Methods: Record based retrospective cohort study was conducted at a hospital in Gulbarga city, India. Data for 6 months (May-Nov 2006) was collected from case-sheets of 112 patients diagnosed with AMI.

Statistical analysis: Chi-square and other appropriate tests.

Results: Patient associated demographic (6) and risk (6) variables were analyzed with outcome of AMI episode (Survived or Died). Out of the 112 patients studied, 71 had survived (63.4%) and 41 (36.6%) had died. Among the demographic variables, death as outcome was most prevalent among elderly (>70 yrs) age group (48.3%), females (41.7%), urban residents (37.5%), patients with symptom onset between 12 am – 8 am (38.2%), patients with upto 6 hrs of time elapsed before initiation of treatment (37.5%), and patients with hospital stay of <48 hrs (79.3%). Hospital stay (<48 hrs) was found to be significantly associated with death as outcome. Among the risk variables, death as outcome was most prevalent among patients with past history of cardiovascular diseases (35.3%), diabetes (29.1%), hypertension (40%), non-smokers (36.8%) and alcoholics (30.8%) and in those with normal lipid profiles (32.9%).

Conclusion: Although data shows association between some of these variables with death as outcome among AMI patients, only duration of hospital stay was significantly associated. Risk factors thus determined, will enable implementation of effective interventions to prevent death among AMI patients.

Keywords: acute myocardial infarction, demographic variables, risk variables

1. Introduction

WHO has drawn attention to the fact that coronary heart disease (CHD) is our modern epidemic and an unavoidable attribute of aging. In developed countries where cardiovascular disease (CVD) is responsible for ~50% of the total deaths, CHD dominates the picture. In India, it has been found that CHD affects the population a decade earlier than the west [1]. In our Country, CHD prevalence in urban population increased from 3.5% in 1960's to 9.5% in 1990's. In rural areas, it increased from 2% in 1970's to 4% in 1990's [2]. Coronary risk factors are more common among urban Indians and are confirmed by case-control studies.

Episodes of AMI are fatal in one third of patients [2]. Its personal and social costs are profound, both for individuals and the Society. Hence in the present study, an attempt has been made to determine the in-hospital outcome after AMI, using patient's admission variables.

2. Literature review

Kakade S.V *et al.*, study used a logistic regression model to predict death after AMI, using the demographic and clinical variables of patients recorded during hospital admission. The analysis identified age, sex, residence, time gap in initiation of treatment, and hospital stay as the significant variables [3].

In a study by Geoffrey H. *et al.*, the hospital and follow-up mortality (1 and 4 years) after AMI was twice as high for patients 65 to 75 years of age compared with those <65 years (14 vs 7%, p<0.001). The prevalence of baseline risk factors was significantly higher among the older group: history of congestive heart failure (14 vs 7%, p<0.001), previous AMI (28 vs 23%, p<0.05), angina pectoris (42 vs 34%, p<0.05), systemic hypertension (64 vs 52%, p<0.01), diabetes mellitus (24 vs 17%, p<0.05) and gender being female (37 vs 24%, p<0.001). Patients with duration of hospital stay (<48 hours) had a significant (p<0.0001) risk of death [4].

Maynard C *et al.*'s study found that women were 20% more likely to die in the hospital (OR:1.22,95% CI:1.06-1.39), yet long term survival was similar in the 2 groups (Hazard ratio:0.97, 95% CI:0.9-1.05) [5].

Risk factors among first time AMI patients for a Gulf Arab population, in a study by Al Roomi K.A *et al.* showed significance for - inadequate physical activity (OR:3.06, 95% CI:1.24-5.15), hypertension (OR:5.04,95% CI:2.82-9.0) and diabetes (OR:3.28,95% CI:1.73-6.20). Cigarette smoking and infrequent consumption of fruits and vegetables also appeared to be associated with an increased risk [6].

Jiang He *et al.*'s study among Chinese in Beijing, found that women have a higher short-term mortality (within the first 28 days) after myocardial infarction compared with men (20.4% vs 7.1%,p<0.001). The risk persisted even after adjustment for demographic and clinical variables (OR:1.74,95% CI:1.17-2.6) [7].

The Canadian Assessment of Myocardial Infarction (CAMI) study by Rouleau J.L.*et al.* during 1990, found that the in-hospital mortality rate of patient's ≤75 years old was 8.4% (significant) and that at 1 year after hospital discharge was 5.3%. Female patients had double the risk of dying in the hospital. A greater re-infarction rate in patients >75 years old (17.4% vs 9.6%, p<0.001) may have contributed to their poorer outcome [8].

3. Material and Methods

The present study was conceptualized to understand the influence of demographic and clinical variables, on the in-hospital outcome of acute myocardial infarction (AMI) patients. It was a hospital record based retrospective cohort study. The records (in-patient case sheets) of subjects admitted with a diagnosis of AMI during the period May 2006 to Nov 2006 at a hospital in Gulbarga city, India, were reviewed. The data from records of 112 cases were collected and analyzed. The study model followed by Kakade S.V. *et al.* [3] was applied to our study design. The demographic variables recorded were age (years), sex, place of residence (rural/urban), time of onset of disease symptoms (hours), time elapsed in treatment (hours) and hospital stay (hours). The clinical variables recorded were past history of cardiovascular diseases, diabetes, hypertension, smoking, alcoholism and dyslipidemia.

Bi-variate analysis was performed to understand the role of each variable on the outcome variable: hospital discharge status that is survived or died. The differences were tested using the chi-square test.

4. Results

Out of the 112 patients studied, 71 had survived (63.4%) and 41 (36.6%) had died.

Death as an outcome during treatment was analyzed with respect to variables such as age, sex, place of residence, time of onset of disease symptoms (24 hours clock), time elapsed in treatment (hours), hospital stay period (hours), habit of alcoholism and smoking, history of cardiovascular disease, hypertension, diabetes and dyslipidemia.

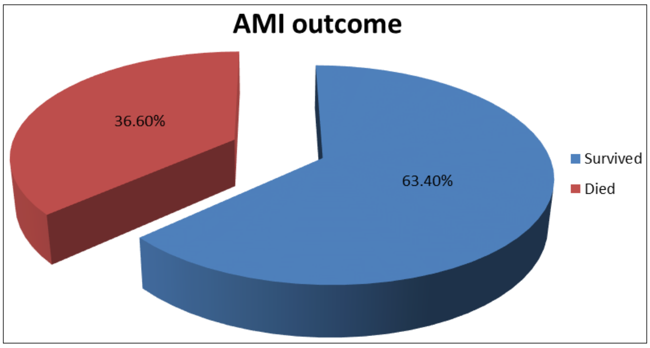

Fig 1: Outcome among AMI patients

Death as a likely outcome was predominantly found among elderly (>70 yrs) age group (48.3%). Females with AMI were more likely to die (41.7%) as compared to males. Death as an outcome was more prevalent among urban residents with AMI (37.5%) as compared to their rural counterparts. Patients with symptom onset between 12 am mid-night to 8 am of the day were more likely to die (38.2%), when compared with AMI patients with symptom onset during other hours. Patients with >6 hours of time elapsed after the AMI episode, before the onset of treatment – predominantly showed death as the outcome (37.5%). However, statistical significance was not found for any of these variables.

Death as an outcome was significantly associated with the variable: Hospital stay (<48 hours) (79.3%).

Table 1: Distribution of demographic variables

Sl. No.	Variables	Subjects (n=112)		Survived (n=71)		Died (n=41)		'p' value
		No.	%	No.	%	No.	%	
1	Age (yrs)							
	<50	25	22.3	19	76	6	24	0.18
	50-70	58	51.8	35	60.3	23	39.7	
	70+	29	25.9	15	51.7	14	48.3	
2	Sex							
	Male	76	67.9	53	69.7	23	30.3	0.234
	Female	36	32.1	21	58.3	15	41.7	
3	Place of residence							
	Rural	88	78.6	59	67	29	33	0.677
	Urban	24	21.4	15	62.5	9	37.5	
4	Time of disease onset							
	0-8	34	30.4	21	61.8	13	38.2	0.877
	8-16	25	22.3	18	72	7	28	
	16-24	26	23.2	17	65.4	9	34.6	
	Not available	27	24.1	18	66.7	9	33.3	
5	Time elapsed in treatment (hrs)							
	0	46	41.1	33	71.7	13	28.3	0.917
	6	16	14.3	10	62.5	6	37.5	
	12	12	10.7	8	66.7	4	33.3	
	24	38	33.9	26	68.4	12	31.6	
6	Hospital stay (hrs)							
	<48	29	25.9	6	20.7	23	79.3	<0.001*
	48-96	15	13.4	6	40	9	60	
	>96	68	60.7	59	86.8	9	13.2	

*Statistically very significant

Table 2: Distribution of risk variables

Among the risk variables, patients with history of cardiovascular disease in the past had a higher percentage (35.3%) of death as outcome. History of Diabetes did not show much of a difference with respect to death as an outcome (29.1% vs 25.8%), however a higher percentage of patients with hypertension suffered death as an outcome (40%). Ironically, death was high among patients who did not smoke (36.8%) or who did not consume alcohol (30.8%). Dyslipidemic patients showed a higher percentage of death as the outcome (32.9%).

Table 2: Risk variables

Sl. No.	Variables	Subjects (n=112)		Survived (n=71)		Died (n=41)		p value
		No.	%	No.	%	No.	%	
1	CVD in past							
	No history	44	39.3	31	70.5	13	29.5	0.528
	History present	68	60.7	44	64.7	24	35.3	
2	Diabetes							
	Absent	89	79.5	66	74.2	23	25.8	0.209
	Present	23	20.5	14	60.9	9	29.1	
3	Hypertension							
	Absent	77	68.8	54	70.1	23	29.9	0.291
	Present	23	31.2	21	60	14	40	
4	Smoking							
	Absent	68	60.7	43	63.2	25	36.8	0.431
	Present	44	39.3	31	70.5	13	29.5	
5	Alcohol consumption							
	Absent	78	69.6	54	69.2	24	30.8	0.268
	Present	34	30.4	27	79.4	7	20.6	
6	Dyslipidemia							
	Absent	73	65.2	49	67.1	24	32.9	0.428
	Present	39	34.8	29	74.4	10	25.6	

5. Discussion

The mortality of 36.6% observed in the study could be due to the delay in hospital admission. Usually, 50% of AMI deaths occur within one hour of the event. Hospital stay period was the most significant prognostic factor influencing the outcome. This may be due to the tender health status during this period, which needs more hospital stay to recuperate. Chances of survival increase with increasing hospital stay period. Similar findings were reported from Kakade S.V *et al.*'s study [3]. Death as the likely outcome was high among elderly age groups due to lowered recuperating capacity and immunity among them. Age associated differences have also been earlier described in studies covering risk factor profiles, infarct complications and causes of death [2]. Kakade S.V *et al.*'s [3] study also showed the same result. Rouleau J.L *et al.*'s [8] study also showed that age carried an independent in-hospital risk for death as an outcome among AMI patients.

Females were more likely to die after an AMI episode, due to lack of their physiological ability to withstand circulatory deficiencies. In conformity, Kakade S.V *et al.*'s [3], Geoffrey H. *et al.*'s [4], Maynard C *et al.* [5] and Rouleau J.L *et al.* [8] study also showed that women were more likely to die in the hospital.

Patients with symptom onset during daytime were more likely to survive the episode, as they could immediately access healthcare at the hospital. However at other times of the day, patients generally tend to postpone their visit to the hospital. Also, early access to healthcare proved decisive in preventing death as the AMI outcome. Patients with >6 hours of time elapsed in treatment initiation were more likely to die, as delayed intervention cannot prevent myocardial damage which is more likely to occur before 6 hours of symptom onset. Similar results were found in Kakade S.V *et al.*, [3] study.

Unusually urban patients were more likely to die as compared to their rural counterparts, which may reflect the urban life-style predisposing individuals to severe AMI and the natural ability of the rural populace to withstand physiological stress such as AMI to good effect. Kakade S.V *et al.* [3] study also showed a similar result. Patients with history of CVD in the past were more likely to die because of the damage already done to the myocardium, and the present attack compounding the already existing problem. Geoffrey H. *et al.* [4] study also showed that history of previous AMI was a risk factor for hospital mortality among admitted AMI patients. A greater re-infarction rate in patients >75 years old, might have contributed to poor outcome in Rouleau J.L *et al.* [8] study.

In our study, the association between diabetes and death as the likely outcome did not reinforce the existing knowledge about this association. However, hypertensive patients showed death as the likely outcome due to precedent complications such as hypertensive cardiomyopathy. Similarly, Geoffrey H. *et al.*, [4] study showed that hypertension was a risk factor for death as an outcome among AMI patients.

Risk variables such as smoking, alcohol consumption and dyslipidemia: although proven risk factors for a fatal AMI outcome, did not show a predominant association with death as the likely outcome in our study.

6. Conclusion

India is going through an epidemiological transition. Infectious and nutritional diseases are receding as causes of adult mortality and morbidity, while non-communicable diseases assume more menacing proportions.

Cases of CVD would rapidly increase in India during the next few years due to:

1. The sheer increase in the population size due to natural growth,
2. Aging of the population which makes people more vulnerable to chronic diseases,
3. Increased vulnerability to CVD, due to lifestyle changes that promote the same.

Sedentary life style, obesity, consuming processed foods and more calories, increased salt consumption, high carbohydrate diet, smoking, diabetes, high stress levels, urbanization and vanishing family security are the risk factors for CVD. Poverty and ignorance can make life difficult for the deprived. The early diagnosis and early treatment of AMI patients may enable health care providers to provide the timely medical care and reduce the loss of life.

7. Limitations

- A larger sample size would have possibly yielded the right associations. Since only one variable (duration of hospital stay) was found significant following bi-variate analysis, we did not perform the multivariate analysis.
- We did not study the following variables: obesity, diet and physical activity, as data regarding these variables were not available in the case-sheets.

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