

In hospital Mortality and its Predictors among STEMI suffering patients treated with Streptokinase

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ABSTRACT

Aim: To determine the in-hospital mortality rate and its predictors among acute ST elevation myocardial infarction (STEMI) suffering patients treated with Streptokinase at tertiary care hospital, Gujranwala, Pakistan.

Methods: This was a cross-sectional study conducted in the Department of Cardiology, GMC Teaching hospital, Gujranwala from June 2017 to May 2018. The data was collected by purposive sampling after written informed consent. The patients admitted with STEMI, of both genders, and all age groups, who were treated with Streptokinase injection were included. Statistical analysis was done using SPSS version 25. Independent sample T test and Chi-square test for independence were used for quantitative and qualitative variables respectively to determine the significant factors associated with in-hospital mortality.

Results: In-hospital mortality rate among 668 STEMI patients was 3.7%. The group of patients who died had a statistically significantly higher age ($p=0.019$), BMI ($P<0.001$), and serum potassium level ($p=0.013$). The group of patients who did not die had a statistically significantly higher systolic BP ($P<0.001$) and diastolic BP ($p=0.036$) at presentation. Death rate was also significantly higher among STEMI patients having diabetes mellitus ($p=0.045$), obesity ($p<0.001$), inferior wall involved in STEMI ($p=0.014$) and right ventricle involved ($p<0.001$), while survival rate was significantly higher among patients whose ST segment on ECG got settled >50% at 1st post-admission day ($p<0.001$).

Conclusion: The STEMI patients treated with Streptokinase had an excellent survival rate and low mortality rate in our population. Increasing age and serum potassium level, and right ventricular involvement were the significant predictors of in-hospital mortality among STEMI patients in regression analysis. Higher the systolic and diastolic blood pressures at presentation and >50% settlement of elevated ST segment on ECG at first post-admission day were significantly associated with survival of these patients. It was also found that the mortality was also enhanced by increasing BMI and the presence of obesity, diabetes, hypertension, and inferior cardiac wall involvement by infarction in our patients

Keywords: STEMI, in-hospital mortality rate, cross-sectional study, SPSS

INTRODUCTION

ST-segment Elevation Myocardial Infarction (STEMI) is a leading cause of morbidity and mortality throughout the world¹. It accounts for up to 40% of all acute coronary syndrome hospital admissions². In USA, the incidence of first MI in both genders is approximately stable during last 10 years, that is 1.7% and 1.1% per year in women and men, respectively³. The people of our subcontinent are more prone to MI, where annual incidence is approx 6.44%⁴. Primary percutaneous coronary intervention (PCI) is superior to thrombolytic therapy, especially if it is done within 90 minutes⁵. However, second one is still widely used in our setting due to deficient of angiographic suites and expertise. The in-hospital mortality among STEMI patients treated with fibrinolytic therapy is 2.8 to 4.6%^{6,7,8}. It is known that mortality is affected by age⁹, geographic region¹⁰, gender¹¹, setting, time-based delays, and shock on presentation¹². However, assessment of local protocols for quality improvement is necessary. The aim of this study was to determine the in-hospital mortality rate and its predictors among acute ST elevation myocardial infarction (STEMI) suffering patients treated with Streptokinase at tertiary care hospital, Gujranwala.

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MATERIAL AND METHODS

This was a cross-sectional study conducted in the Department of Cardiology, GMC Teaching hospital, Gujranwala from June 2017 to May 2018 after approval from the Ethical Committee.. The data was collected by purposive sampling after written informed consent. The patients admitted with STEMI, of both genders, and all age groups, who were treated with Inj. Streptokinase were included in this study. The outcome of hospitalization was categorized into two groups; one who got discharge and second who died. Statistical analysis was performed using the SPSS, version 25. Age, BMI, time from onset of symptoms till arrival at hospital in minutes, door to needle time in minutes, baseline pulse, systolic BP at presentation, diastolic BP at presentation, minimum ST segment elevation, maximum ST segment elevation, serum creatinine conc., serum sodium conc. and serum potassium conc. were the quantitative variables, while gender, history of smoking, hypertension, diabetes mellitus, personal H/O IHD, History of IHD in male family member of age <55years, History of IHD in female family member of age <45years, obesity, cardiac wall involved by STEMI, right ventricular involvement, ST segment settlement >50% at 1st post-admission day, and outcome of hospitalization were the qualitative variables. Independent sample T test and Chi-square test for independence were used for

quantitative and qualitative variables respectively to determine the significant factors / predictors associated with in-hospital mortality among STEMI patients. Then, binary logistic regression analysis was also performed on the significant factors associated with in-hospital mortality rate. The p values were taken statistically significant if $p < 0.05$

RESULTS

Amongst 668 patients who presented with STEMI, 3.7% died while 96.3% got discharge from hospitalization (Fig. 1). According to independent sample t-test results, the group of patients who died had a statistically significantly higher age ($p=0.019$), BMI ($P<0.001$), and serum potassium level ($p=0.013$). On the other hand, the group of patients who did not die had a statistically significantly higher systolic BP ($P<0.001$) and diastolic BP ($p=0.036$) at presentation (Table 1). Chi-square test of independence showed that in-hospital mortality was significantly higher among STEMI patients having diabetes mellitus ($p=0.045$), obesity ($p<0.001$), inferior wall involved in STEMI ($p=0.014$) and right ventricle involved ($p<0.001$). On the other hand, no death i.e. discharge as outcome of hospitalization was significantly higher among patients whose ST segment on ECG got settled $>50\%$ at 1st post-admission day ($p<0.001$). A logistic regression was performed to ascertain the effect of age, BMI, systolic BP at presentation, diastolic BP at presentation, serum sodium, serum potassium, diabetes mellitus, hypertension, inferior wall involved in STEMI, right ventricular involvement, and elevated ST segment settlement $>50\%$ at 1st post-admission day on the likelihood that participant admitted with STEMI would die. The logistic regression model was statistically significant, $p<0.05$. The model explained 31.2% (Nagelkerke R^2) of the variance in the mortality group of patients and correctly classified

96.3% of cases. Increasing age was associated with an increased likelihood of exhibiting the death as the outcome of the hospitalization ($p=0.013$). Similarly, increasing serum potassium level was associated with an increased likelihood of exhibiting death among STEMI patients ($p=0.009$). STEMI patients with right ventricular involvement were more likely to die as compared to who had STEMI without right ventricular involvement ($p=0.001$) (Table 3).

Fig.1: Prevalence of in-hospital mortality among patients admitted with STEMI (n=668)

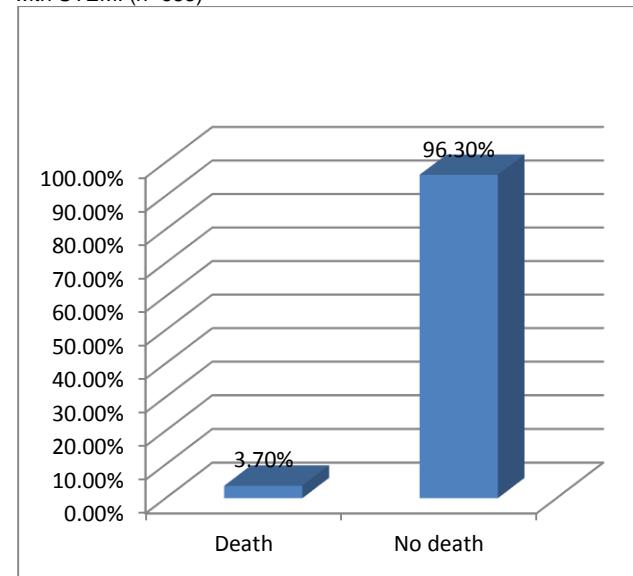


Table 1: Associations of in-hospital mortality with various quantitative variables among STEMI suffering patients treated with Streptokinase (n = 668)¹

Quantitative variables	Outcome of hospitalization		Mean difference	p-value
	Death (mean + SD)	No death (mean + SD)		
Age (years)	59.48 ± 11.91	53.59 ± 12.34	5.89	0.019
BMI (Kg/m ²)	31.36 ± 5.59	26.89 ± 4.01	4.47	<0.001
Time till arrival (minutes) ¹	204.00 ± 106.77	281.37 ± 361.84	-77.37	0.287
Door to needle time (minutes)	25.92 ± 18.56	27.79 ± 36.33	-1.87	0.798
Baseline pulse (per minute)	82.04 ± 22.83	86.14 ± 18.87	-4.10	0.291
Baseline systolic BP (mmHg)	113.60 ± 29.28	131.96 ± 25.93	-18.36	<0.001
Baseline diastolic BP (mmHg)	75.20 ± 17.11	82.84 ± 17.89	-7.64	0.036
ST segment elevation, minimum (mm)	2.04 ± 0.98	2.53 ± 1.54	0.49	0.118
ST segment elevation, maximum (mm)	4.00 ± 1.63	4.94 ± 3.24	-0.94	0.148
Serum creatinine (mg/dl)	1.05 ± 0.15	1.12 ± 0.83	-0.07	0.681
Serum Sodium (mEq/L)	138.84 ± 5.29	136.99 ± 5.37	1.85	0.091
Serum Potassium (mEq/L)	4.11 ± 0.46	3.78 ± 0.65	0.33	0.013

¹Independent sample T-test was used; 1=Time from onset of symptoms till arrival at hospital (minutes)

Table 2: Qualitative factors associated with outcome of hospitalization among STEMI suffering patients treated with Streptokinase (n = 668)¹

Predictors / Factors	Outcome of hospitalization		Total	p-value
	Death	No death		
Male	21 (84%)	494 (76.8%)	515 (77.1%)	0.477
Female	04 (16%)	149 (23.2%)	153 (22.9%)	
History of smoking:				
Yes	10 ('40%)	352 (54.7%)	362 (54.2%)	0.157
No	15 (60%)	291 (45.3%)	306 (45.8%)	

History of diabetes mellitus:				0.045
Yes	12 (48%)	185 (28.8%)	197 (29.5%)	
No	13 (52%)	458 (71.2%)	471 (70.5%)	
History of hypertension:				0.414
Yes	16 (64%)	345 (53.7%)	361 (54%)	
No	09 (36%)	298 (46.3%)	307 (46%)	
Personal history of IHD:				0.500
Yes	09 (36%)	184 (28.6%)	193 (28.9%)	
No	16 (64%)	459 (71.4%)	475 (71.1%)	
History of IHD in male family member of age <55years:				0.212
Yes	05 (20%)	76 (11.8%)	81 (12.1%)	
No	20 (80%)	567 (88.2%)	587 (87.9%)	
History of IHD in female family member of age <45years:				0.212
Yes	05 (20%)	76 (11.8%)	81 (12.1%)	
No	20 (80%)	567 (88.2%)	587 (87.9%)	
Obesity:				
Yes	16 (64%)	137 (21.3%)	153 (22.9%)	<0.001
No	09 (36%)	506 (78.7%)	515 (77.1%)	
Cardiac wall involved by STEMI:				0.014
Inferior wall	17 (68%)	275 (42.8%)	292 (43.7%)	
Other walls	08 (32%)	368 (57.2%)	376 (56.3%)	
Right ventricular involvement:				<0.001
Yes	9 (36%)	44 (6.8%)	53 (7.9%)	
No	16 (64%)	599 (93.2%)	615 (92.1%)	
ST elevation settled >50% at 1st post-admission day:				<0.001
Yes	0 (0%)	527 (82%)	527 (78.9%)	
No	25 (100%)	116 (18%)	141 (21.1%)	

*Chi-square test for independence was used

Table 3: Binary Logistic Regression Analysis to predict in-hospital mortality among STEMI suffering patients treated with Streptokinase (n = 668)

Risk Factors	B	S.E.	Wald-Statistic	p-value	Odds Ratio	95% C.I. for EXP(B)	
						Lower	Upper
Age (years)	.049	.020	6.148	.013	1.050	1.010	1.092
BMI (Kg/m ²)	.066	.072	.842	.359	1.069	.927	1.232
Baseline systolic BP (mmHg)	-.024	.019	1.613	.204	.977	.942	1.013
Baseline diastolic BP (mmHg)	-.002	.023	.008	.929	.998	.955	1.043
Serum Potassium (mEq/L)	.887	.341	6.769	.009	2.427	1.244	4.733
Diabetes mellitus (Yes/No)	-.659	.478	1.901	.168	.517	.203	1.320
Obesity (Yes/No)	-1.149	.793	2.099	.147	.317	.067	1.500
Inferior wall Myocardial infarction (Yes/No)	.040	.570	.005	.944	1.041	.340	3.184
Right ventricle involvement (Yes/No)	-2.086	.626	11.107	.001	.124	.036	.423
Constant	-5.691	3.486	2.665	.103	.003		

Cox & Snell R Square = 8.5%, Nagelkerke R Square = 31.2%

DISCUSSION

The Global Registry of Acute Coronary Events (GRACE) stated 9 parameters as independent predictors for post-MI mortality. These include older age, history of heart failure, previously history of myocardial infarction, low systolic pressure and increased heart rate at presentation, increased initial creatinine level, ST segment depression on ECG at admission, increased cardiac biomarkers level, and the absence of percutaneous coronary interventions during the hospitalization for acute MI.(13) These clinical predictors may be useful for identifying the high risk patient who need early intensive care. Since, our patients from Gujranwala may have some differences regarding clinical aspects, coronary risk factors, and outcomes, by comparison with the STEMI patients from others cities or countries. We elaborated different clinical characteristics and predictors among our STEMI patients. In a study of 48422 STEMI patients treated with thrombolytic therapy,

mortality rate was 2.8%⁶. Ahmed Bendary et al noted 3% in-hospital mortality among STEMI patients treated with streptokinase⁷. Robert L. McNamara et al found 4.6% in-hospital mortality rate in acute MI patients⁸. Similarly, in our study, the in hospital mortality among STEMI patients was found 3.7%. In a logistic regression analysis, Onur Zorbozan and his colleagues found age ($P=0.002$) as a significant predictors of mortality in ST-elevation MI patients¹⁴. Omar Chehab et al found older age (> 65 years) and systolic blood pressure < 100 mmHg as the significant predictors of mortality in patients admitted with acute MI in a developing country¹⁵. Similarly, in our study, increasing age was found predictive of in-hospital mortality while higher systolic blood pressures at presentation predictive of survival. It is known that right ventricular involvement imposes a higher risk of negative outcome in inferior wall MI¹⁶. Our data found inferior cardiac wall MI and right ventricular involvement both as predictors of in-hospital mortality. In our study, >50% settlement of elevated ST

segment on ECG at first post-admission day was significantly associated with survival of these patients. Rolf Schröder et al found in their study that early ST segment elevation resolution in patients with acute MI infarction from intravenous Streptokinase was predictor of survival. Mortality rate in 3 groups of patients depending on ST segment resolution after SK i.e. with complete resolution ($\geq 70\%$), partial resolution (30-70%), and no resolution ($< 30\%$) was 2.2%, 3.4%, and 8.6% respectively¹⁷. In our study, it was also found that increasing BMI as well as the presence of obesity were predictors of in-hospital mortality among our patients. Similar findings were noted by Ibrahim Akin¹⁸ and Mercedes Camprubi¹⁹. However, Several trials showed an inverse relationship between BMI and rate of mortality, like PREMIER and TRIUMPH registries including 6359 acute STEMI patients²⁰ and KAMIR registry involving 3824 acute STEMI patients²¹. These findings were named as "Obesity paradox" in literature. Min Goo Lee et al²² found in their study that acute MI patients with a history of hypertension or DM had a higher mortality than acute MI patients without such a history. They also concluded that combination of hypertension and DM appeared to be more strongly associated with mortality than hypertension or DM alone. In our analysis, it was also noted that the mortality was enhanced by the presence of diabetes and hypertension.

CONCLUSION

The STEMI patients treated with Streptokinase had an excellent survival rate and low mortality rate in our population. Increasing age and serum potassium level, and right ventricular involvement were the significant predictors of in-hospital mortality among STEMI patients in regression analysis. Higher the systolic and diastolic blood pressures at presentation and $>50\%$ settlement of elevated ST segment on ECG at first post-admission day were significantly associated with survival of these patients. It was also found that the mortality was also enhanced by increasing BMI and the presence of obesity, diabetes, hypertension, and inferior cardiac wall involvement by infarction in our patients.

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