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Research Article

ASSESSING THE EFFECTIVENESS AND IMPROVEMENT IN THE DOOR TO NEEDLE TIME OF STREPTOKINASE IN ST- ELEVATION MYOCARDIAL INFARCTION IN CORONARY CARE UNIT OF A TERTIARY CARE HOSPITAL IN A DEVELOPING COUNTRY

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Abstract:

Introduction: Early start of treatment including coronary revascularisation has been recognized as crucial variable in the outcome of acute ST-segment Elevation Myocardial Infarction (STEMI), timely treatment with antithrombotic agents plays a key role in reducing an AMI mortality rate.

Objectives: The present study aimed to assess the time interval between the admission of ST-Elevation MI suspected patients and treatment initiation in coronary care unit.

Methods: This cross-sectional study was conducted on 910 patients admitted to the emergency department Coronary care unit of Hayatabad Medical Complex, Peshawar, from 1st January 2018 to 31st December 2019. To analyze the data, student t- test and analysis of variance were used.

Results: In this study 431 female and 479 male subjects were included, respectively. The mean time to receive the first dose of streptokinase was 28 minutes, varying from 37 minutes in January, February and March, 34 minutes in April, May and June 24 minutes in July, August and September, and 20 minutes in October, November and December. Major adverse cardiac events that is arrhythmias, heart blocks, heart failure, were reduced in those patients with door to needle time less than 30 minutes.

Conclusions: The door-to-needle (DTN) time, in a standard setting, is recommended to be less than 30 minutes. According to the results of this study, the DTN time is improved in last three months of our study. Different variables including emergency staff, physicians, patient's characteristics, and environmental/physical factors induced this difference.

Keywords: Acute Myocardial Infarction, Emergency Service, Needle Stick Injuries, Streptokinase, Arrhythmia, heart block, heart failure.

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INTRODUCTION:

Ischemic heart disease (IHD) is a major cause of mortality and morbidity worldwide, especially in industrialized countries.¹ In keeping with international studies, mortality from IHD was higher in males than females.² Myocardial infarction is the major cardiac emergency presented in the emergency coronary care unit of Hayatabad medical complex. While primary prevention of IHD is considered the ideal, mortality and morbidity in patients presenting with acute myocardial infarction (AMI) can be reduced with early interventions such as fibrinolysis or percutaneous coronary intervention (PCI).³ Many studies have shown that early PCI is more advantageous in reducing mortality from reinfarction and the need for a coronary artery bypass graft (CABG) than fibrinolytic drug therapy⁴⁻⁶. In the United States, approximately 6 - 7 million people, suspected of coronary artery diseases, are admitted to emergency departments (EDs) of hospitals each year. Around 20% - 25% of these patients are diagnosed with coronary artery diseases and should receive the required treatments. In keeping with the mantra "Time is muscle", early administration of fibrinolytic therapy preserves left ventricular function by increasing patency of occluded vessel and thus limiting infarct size.^{7,8} Maximal benefit from fibrinolysis is seen when the fibrinolytic is given within the first hour of symptom onset.^{9,10} Delaying fibrinolytic therapy by one hour increases the hazard ratio of death by 20%, (95% confidence interval (CI) 7 - 88), and a delay of 30 minutes or more can reduce the average life expectancy by one year.¹¹ The period between the onset of symptoms to administration of fibrinolytic therapy can be divided as :1. Interval between onset of symptoms to seeking medical attention; 2. Period taken to transport patient to definitive care; 3. Interval between arrival at hospital to initiation of fibrinolytic (door-to-needle time). The first two components can be improved by public education and developing efficient pre-hospital systems. For example, North Carolina has adopted a state wide STEMI referral strategy that

advises paramedics to "bypass" local hospitals and transport STEMI patients directly to a PCI-capable hospital, even if a non-capable hospital is closer. This results in shorter reperfusion times.¹² but door-to-needle time is the one in-hospital factor that can be addressed by medical practitioners. Association/American College of Cardiology (AHA/ACC) guidelines recommend a door-to-needle time of 30 minutes or less for administration of fibrinolytic for STEMI patients. European Society of Cardiology recommends First Medical Contact time to ECG time of Less than 10 minutes and also recommends door to needle time of less than 30 minutes.¹⁵

PATIENTS AND METHODS:

The subjects of this cross sectional study were acute myocardial infarction patients who received thrombolytic therapy, streptokinase in emergency coronary care unit of Hayatabad medical complex Peshawar, from 1st January 2019 to 31st December 2019. All adult patients with acute ST segment elevation, new onset left bundle branch block (LBBB), or posterior infarct on electrocardiogram (ECG) meeting AHA/ACC criteria for thrombolysis, who received thrombolytics in the emergency coronary care unit of HMC. The exclusion criteria were lack of patient's consent, past myocardial infarction with Q waves in ECG, lack of indications for thrombolytic therapy or contraindications to the treatment, streptokinase administration within the last 6 months, warfarin therapy, active peptic ulcer diseases, bleeding disorders or uncontrolled hypertension, and cerebrovascular accident within the past 6 weeks. Data was collected and analyzed was patient demographics, pre-hospital ECG acquisition and presence or absence of attendants. Time intervals calculated were time of presentation to hospital (taken from Emergency slip) to time of ECG acquisition, time from ECG acquisition to actually commencing thrombolytics and the sum of the above time intervals constitutes the total door-to-needle time. Simple descriptive statistics

were used to describe the meantime to ECG, ECG to fibrinolytic, and total door to-needle times. Subgroup analysis was performed for determining prevalence of STEMI patients fibrinolysed based on gender and age group; and pre hospital ECG acquisition. The symptoms on presentation were also assessed. Typical symptoms were defined as an acute onset of chest pain with radiation to the left arm, neck or jaw with associated autonomic symptoms (sweating, nausea or vomiting). Ethics approval was granted from research and ethical committee of Hayatabad medical complex.

RESULTS:

910 patients with acute myocardial infarction meeting the criteria of thrombolysis were enrolled in our study. 431(47.3%) were female patients and 479(52.6%) were male patients. The mean door to needle time in twelve months in our patients was 28 minutes. The door to needle time in the month of January was 41 minutes, in February 38 minutes and March 32 minutes. In April 32 minutes, may 34 minutes and

June 37 minutes. Similarly in July 27 minutes, august 24 minutes, September 22 minutes. In the last three months, the DNT was reduced, October 20 minutes, November 22 minutes, and December 18 minutes as shown in table 1.

While looking at the adverse cardiac events that is Arrhythmias, heart blocks and heart failure, in the first three months on average 6 patients had arrhythmias including ventricular tachycardia and ventricular fibrillation, 10 patients had complete heart block, and 7 patients had acute heart failure. From April to June on average 7 patients had arrhythmias, 8 patients had complete heart block and 3 patients had acute heart failure. In the month of July, august and September on average 4 patients had arrhythmias, 2 patients had complete heart block and 4 patients had acute heart failure. Similarly in the last three months the adverse cardiac events were reduced that is only 2 patients had arrhythmias, 1 patient had complete heart block and 1 patient had acute heart failure.

Table 1: Door to needle time in minutes in respective months in 2019

Month	Door to needle time in minutes	Mean Time in minutes
January February March	41 minutes 38 minutes 32 minutes	37 minutes
April May June	32 minutes 34 minutes 37 minutes	34 minutes
July August September	27 minutes 24 minutes 22 minutes	24 minutes
October November December	20 minutes 22 minutes 18 minutes	20 minutes

Table 2: Reduction in morbidity and mortality in patients with reduction in door to needle time.

Month	No. of Patients		
	Arrhythmias	Complete heart block	Acute heart failure
January	3	5	3
February	2	2	4
March	1	3	0
Total	6	10	7
April	4	2	1
May	3	4	0
June	0	2	2
Total	7	8	3
July	2	1	2
August	0	0	2
September	2	1	0
Total	4	2	4
October	2	1	0
November	0	0	0
December	0	0	1
Total	2	1	1

DISCUSSION:

The prognosis of acute myocardial infarction patients depends on timely administration of fibrinolytic therapy.^{9,10,35} American Heart Association and European Society of Cardiology recommends door to needle time of 30 minutes for fibrinolytic therapy.^{13,15} But unfortunately these guidelines are not followed. Adherence to these guidelines has improved care of patients with AMI and is associated with significant reductions in in-hospital mortality rates.^{16,17,18,19} Timely diagnosis of ST segment elevation myocardial infarction (STEMI) in the emergency department (ED) is made solely by ECG. Obtaining this test within 10 minutes of ED arrival is critical to achieving the best outcomes as recommended by ESC and AHA. A recent study published in Journal of American Heart Association in February 2017 evaluated performance of Emergency Department Screening Criteria for an Early ECG to Identify ST Segment Elevation Myocardial Infarction. They examined STEMI screening performance in 7 EDs, with the missed case rate (MCR) as their primary end point. The overall MCR for all 7 EDs was 12.8%. The lowest and highest MCRs were 3.4% and 32.6%, respectively. The mean difference in door to ECG times for captured and missed patients was 31 minutes, with a range of 14 to 80 minutes of additional myocardial ischemia time for missed cases. The prevalence of primarily screened ED STEMI was 0.09%. The 29.2% difference in MCRs between the highest and lowest performing

EDs demonstrates room for improving timely STEMI identification among primarily screened ED patients.²⁰ In a Canadian registry of 3,088 AMI patients in 2000–2001, 63% of the patients failed to receive fibrinolytic therapy within 30 minutes of ED arrival.²¹ Another study done in Canadian province of QUEBEC in 2003 in 1189 patients showed median delay of reperfusion therapy was 32 minutes in patients receiving fibrinolytic therapy.²² Evaluation of door to needle time in a tertiary care hospital, in India in 2015 showed 73 percent of patients failed to receive thrombolytic therapy within 30 minutes.²³ Similar study done in 58 Urban Emergency departments in U.S. comprised of 3,819 patients who presented between 2003 and 2006, showed low to moderate concordance with guideline recommended processes of care for patients of AMI.²⁴ A data from Punjab Institute of Cardiology Lahore showed door-to-needle time of more than 30min in 46.2% patients.²⁵ Similar studies done in India, Saudi Arabia and Vancouver showed that ACCA recommendation of door to needle time is not properly followed.^{26,27,28,31.}

The mean door to needle time of streptokinase in acute myocardial infarction patients in emergency coronary care unit of Hayatabad medical complex was 28 minutes. The factors contributed in reducing the door to needle time were early ECG acquisition for at-risk patients, emergency staff training, and the presence of a senior doctor/physician on the floor or being readily

available, better co-ordination between hospital administration, emergency staff and physicians, improve auxiliary services to enhance patient flow, the ready availability of fibrinolytic medicine in the cardiac bay. Most quality improvement studies suggest a team-based approach to improving the time-to-reperfusion therapy for MI patients.^{22,24,30} A Study in Armed Forces Institute of Cardiology, Rawalpindi showed that more than 70% of the patients were thrombolysed within 30 minutes of arrival i.e. door to needle time <30 minutes.³² In hospital associated with Andhra Medical College, Visakhapatnam, Andhra Pradesh, India, they have been able to reduce the door to needle time for intravenous thrombolysis to about ten minutes by ensuring the presentation of a patient, with chest pain, directly to ICCU without going through the emergency room / outpatient registration. This revealed efficient hospital organizational strategy to handle cardiac patients.³³ Similarly doctors at a rural district general hospital in New Zealand conducted a research, which revealed that introducing a number of simple low-cost interventions that included educational sessions for junior doctors and cardiac nursing staff, as well as posters and training on the use of a remote electronic ECG interpretation system to streamline out-of-hours management, they have been able to achieve recommended door to needle time in 74 percent of patients as compared to 43 percent without these interventions.³⁴

The incidence of adverse cardiac events in terms of arrhythmias, ventricular tachycardia, ventricular fibrillation, complete heart block and acute heart failure was significantly reduced when door to needle time was reduced and all the protocols according the American college of cardiology criteria for thrombolysis in the settings of ST elevation acute myocardial infarction.

CONCLUSION:

Patients presenting with acute myocardial infarction meeting the criteria of thrombolysis should be thrombolysed according to the standard protocols that is less than 30 minutes. Reducing the door to needle time will improve patient mortality by reducing the incidence of adverse cardiac events like arrhythmias, ventricular tachycardia, ventricular fibrillation, complete heart block and acute heart failure. Different variables including emergency staff, physicians, patients' characteristics, and environmental/physical factors affect the duration of door to needle time. The main aim of our study is to emphasize the fact that the reduction of door to needle time has got a huge impact on the patient mortality and every effort has to be made to take and implement steps to ensure rapid delivery of

streptokinase to patients presenting with ST Elevation Myocardial Infarction especially in the developing countries where Percutaneous Coronary Intervention (PCI) facility is not readily available. The mean door to needle time 28 minutes of our emergency coronary care unit significantly reduced the morbidity and mortality.

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