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Patterns and Effects of Time from Admission to Balloon Deployment on Health Outcomes in Patients Under 75, 75 to 84, and 85 and Up Suffering from ST-Elevation Myocardial Infarction

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Abstract:

ST-elevation myocardial infarction (STEMI) patients are strongly advised to receive mechanical reperfusion in a timely manner, as defined by guidelines: door-to-balloon time (DTBT) of less than or equal to 90 minutes. The precise effects of prompt reperfusion on clinical outcomes for patients aged 75–84 and 85 years and older remain unknown. Our analysis comprised 100 consecutive STEMI patients. Patients aged less than seventy-five years were classified as younger, those aged seventy-five to eighty-four years as elderly, and those aged eighty-four to more than eighty years as very elderly. Mortality at 12 months and major adverse cardiovascular events (MACE) constituted the primary endpoints. With a mean age of 60 ± 10 years, 75 patients were under the age of 75 and 16 were between the ages of 75 and 84, and 9 patients were 85 years or older. Younger and elderly patients have experienced a substantial decline in DTBT over the past decade (p-for-trend <0.05 and 0.04, respectively), with the very elderly showing a trend (p-for-trend 0.09). The very elderly had a greater 12-month mortality rate (4.7% vs 11.8% vs 30.5%; $p < 0.05$) and MACE rate (11.9% vs 21.7% vs 34.6%; $p < 0.05$) than the younger and elderly patients, respectively. On univariate analysis, DTBT for less than 90 minutes was linked to enhanced outcomes; however, it did not serve as an independent predictor of 12-month mortality (OR 0.95, 95% CI 0.65–2.42) or MACE (OR 0.90, 95% CI 0.78–2.27). In summary, DTBT improved for patients aged 75 years and older and 75–84 years over a ten-year period; however, DTBT lasting less than 90 minutes did not serve as an independent predictor of 12-month outcomes. Therefore, determining whether patients older than 85 years are appropriate candidates for invasive treatment does not inherently result in unfavorable clinical outcomes.

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Key words: ST-elevation myocardial infarction, door-to-balloon time, major adverse cardiovascular events, mortality, adverse cardiovascular events.

Introduction:

Percutaneous coronary intervention (PCI) is the preferred reperfusion therapy for all patients presenting with ST-elevation myocardial infarction (STEMI), according to international guidelines, regardless of age [1-4]. Emphasis has been placed on mechanical reperfusion in a timely manner. Achieving a door-to-balloon time (DTBT) of less than or equal to 90 minutes has thus emerged as an indicator of care quality [5,6]. Patients aged >75 years who have suffered a STEMI, and especially those older than 85 years, constitute a heterogeneous group characterized by significant co-morbidities, cognitive and functional impairment, and varying degrees of infirmity. These individuals may present with atypical symptoms [7,8]. It is imperative that these critical factors be evaluated expeditiously within the framework of STEMI. It is unsurprising that elderly patients undergo DTBT for extended durations than younger cohorts [9,10]. Furthermore, in the context of invasive management for the elderly, where a more comprehensive evaluation is necessary prior to initiating reperfusion, it remains uncertain whether prompt reperfusion results in enhanced clinical outcomes. The objective of this observational cohort study was to examine the patterns of DTBT and the influence of timely reperfusion on the clinical outcomes of patients presenting with STEMI who were 75 years or younger, 84 years or older, or 85 years or older, over a ten-year duration.

Materials & methods:

Prospectively recorded on case report forms are demographic, clinical, procedural, and in-hospital outcome data, all of which are defined using standardized criteria. Now of mortality or discharge, in-hospital outcomes were documented. At the 30-day and 12-month follow-up, outcomes were assessed through a telephone interview and/or review of medical records, utilizing the [10]. At thirty days and twelve months, the follow-up rates were 99.6% and 97.1%, respectively. The coordination of the registry is carried out by the Centre of Cardiovascular Research and Education in Therapeutics, an autonomous research organization situated within Monash University's School

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of Public Health and Preventive Medicine in Melbourne, Australia. Periodically, an examination is conducted at each institution of a five percent sample of procedures to identify verifiable domains. The data accuracy for the 27 fields that were evaluated in the most recent audit was 98% [11]. This is in good comparison to the audits conducted by other sizable registries [12]. Each participating hospital's ethics committee has granted approval for the MIG registry, which incorporates the implementation of "opt-out" consent. This means that unless the patient "opts out" after receiving a "Patient Information Sheet," consent is presumed. The patient's data are not gathered if he or she communicates to a staff member their decision not to participate. Patients who were diagnosed with STEMI and presented within 12 hours of the onset of symptoms were included. STEMI was classified as the presence of ST segment elevation or a newly formed or suspected newly formed left bundle branch block on electrocardiograms, both of which persisted for a duration of 20 minutes. ST-segment elevation at the J-point in two contiguous electrocardiographic leads is characterized as either new or presumed new, persistent ST-segment elevation (≥0.2 mV in males or ≥0.15 mV in females in leads V2 to V3 and/or ≥0.1 mV in other leads). Additionally, cardiac biomarkers must surpass the upper limits of normalcy established by the appropriate institution, and the patient must exhibit a clinical manifestation that is either consistent with or indicative of cardiac ischemia.

Exclusion criteria included patients who had experienced an out-of-hospital cardiac arrest, had a delayed presentation (≥12 hours since onset of symptoms), or were undergoing thrombolysis treatment. The principal outcome measures assessed in this research were mortality at 12 months and MACE. MI, and target vessel revascularization were combined to form MACE. Secondary endpoints consist of mortality at 30 days and MACE. The endpoint for safety was in-hospital hemorrhaging. MI was characterized by the presence of three times the upper limit of normal creatine kinase or creatine kinase-MB, an increase in ST-segment activity, the formation of new Q waves in at least two contiguous electrocardiographic leads, or the emergence of a new left branch bundle block pattern in conjunction with the onset of new clinical symptoms. In-hospital bleeding was characterized as hemoglobin loss exceeding 3 g/dL, transfusion-dependent hemorrhage, or prolonged hospitalization.

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The individual has the following risk factors for coronary artery disease: estimated glomerular filtration rate, hypertension, diabetes, hypercholesterolemia, coronary artery bypass graft surgery, left ventricular ejection fraction, multivessel coronary artery disease, chronic lung disease, cardiogenic shock, glycoprotein IIb/IIIa use, drug-eluting stent use, long stent (>20 mm), and small diameter (<25).

Statistical analysis:

The analysis of the data was conducted utilizing Stata 13.1 (StataCorp LP, College Station, TX). A p-value less than 0.05 was deemed to indicate statistical significance.

Results:

With a mean age of 60 ± 10 years, 75 patients were under the age of 75 years and 16 were between the ages of 75 and 84, and 9 patients were 85 years or older. Younger and elderly patients have experienced a substantial decline in DTBT over the past decade (p-for-trend <0.05 and 0.04, respectively), with the very elderly showing a trend (p-for-trend 0.09). The very elderly had a greater 12-month mortality rate (4.7% vs 11.8% vs 30.5%; $p < 0.05$) and MACE rate (11.9% vs 21.7% vs 34.6%; $p < 0.05$) than the younger and elderly patients, respectively. On univariate analysis, DTBT for less than 90 minutes was linked to enhanced outcomes; however, it did not serve as an independent predictor of 12-month mortality (OR 0.95, 95% CI 0.65–2.42) or MACE (OR 0.90, 95% CI 0.78–2.27).

The younger cohort exhibited a reduced incidence of high-risk characteristics, including atrial fibrillation, congestive heart failure, multivessel coronary artery disease, left ventricular dysfunction, and cardiogenic shock, and had a lower incidence of co-morbidities. The acute outcomes and angiographic characteristics are detailed in Table 2. A greater proportion of patients (less than 75 years old) were prescribed glycoprotein IIb/IIIa inhibitors and drug eluting stents. Additionally, they exhibited reduced lengths of hospital stays, higher rates of successful procedures, and lower incidences of complications while in the hospital, in contrast to the geriatric and very elderly.

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Discussion:

The encouraging improvement in DTBT for the entire cohort over the last decade exemplifies the global adoption of a systematic approach to STEMI care [4]. However, in individuals aged 85 years and older, no statistically significant improvement was observed. This is despite the fact that the geriatric population comprises the largest proportion of patients who are renotified by ambulances and whose catheterization laboratories are activated. Thus, it appears that patients who are extremely elderly are not transported to the catheterization laboratory promptly. Comparable to other studies involving patients of comparable age, our DTBT of 80 minutes for patients 85 years and older is acceptable [5,6]. Given that invasive management is not universally implemented for all patients with STEMI in this age group, it is conceivable that DTBT has reached a plateau [7]. As a result, screening and evaluation prior to intervention become critical, which almost certainly results in time delays. STEMI is anticipated to manifest in an expanding number of patients aged 85 years and older, in light of the aging population. Priority should be given to the pursuit of opportune reperfusion in this population only after suitability for invasive management has been evaluated.

The theory underlying the importance of timely reperfusion is that by minimizing ischemic time through prompt reperfusion, myocardial necrosis can be reduced, and the extent of the infarct can be restricted [8]. Large observational studies that demonstrate superior outcomes with shorter DTBT lend support to this theory. International guidelines have therefore recommended the implementation of a DTBT for no more than 90 minutes per class I. However, mortality has not always been correlated with DTBT reductions, according to all studies [9]. Although demonstrated that DTBT efficacy has significantly improved over the past four years, this improvement has been substantial [4]. Notwithstanding this pattern, it failed to result in improved 30-day or in-hospital outcomes for either the entire cohort or the subgroup of patients aged 75 years and older. Considering the intrinsically elevated risk and reduced physiologic reserve of geriatric patients, it is theoretically most advantageous to minimize myocardial necrosis and restore blood flow promptly in this age group [6]. Our findings, similar to those of [5] did not indicate that a DTBT lasting less than 90 minutes was a significant predictor of reduced 12-month mortality or MACE. Despite the fact that a DTBT of 90 minutes or less should continue to be the objective of STEMI

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management, there may be situations in which failure to do so does not constitute a significant hazard. For instance, we have recently demonstrated that timely reperfusion was not an independent predictor of mortality in patients with STEMI who were presented with cardiogenic shock, cardiac arrest, or Killip class ≥2. However, this finding held true for patients with STEMI who were considered low risk [9]. Patients who have an intrinsically elevated mortality risk, such as those aged 85 years or older, may find prognostic factors other than timely reperfusion to be considerably more significant. As the decision to perform invasive management in extremely elderly patients is frequently multifactorial and requires clinical, functional, and social assessment to ensure the patient's best interests are prioritized, this has significant clinical implications. Therefore, it is encouraging to note that this postponement does not seem to be linked to a substantial risk of death for the specific patients who undergo primary PCI.

Due to the substantial morbidity and mortality burden associated with STEMI in the elderly, every effort must be made to enhance outcomes. Based on our data, it is apparent that drug-eluting stents and glycoprotein IIb/IIIa inhibitors are administered less frequently to elderly patients, despite the fact that these treatments independently correlate with improved survival. A recent randomized trial comparing everolimus-eluting stents to bare metal stents in octo-generians found the drug-eluting stents to be safe, effective, and associated with a reduced risk of MI and target vessel revascularization at one year, without an increased incidence of major hemorrhage. The age-related modifications for the utilization of glycoprotein IIb/IIIa inhibitors in STEMI are not addressed in any of the 23 Guidelines [4,5]. Due to concerns regarding the risk of bleeding associated with these agents in geriatric patients, their routine application should be avoided in favor of selective usage.24 Additionally, our data revealed that patients aged 75 to 84 and 85 years utilized aspirin, statins, and angiotensin converting enzyme inhibitors at reduced rates. Unless contraindications exist, every effort should be made to ensure that all patients receive optimal secondary prevention pharmacotherapy, given their demonstrated efficacy following MI [6,7]. This underscores a deficiency in treatment, whereby augmenting the application of these therapies could potentially enhance results for elderly patients. Our investigation has a number of limitations. In light of the observational design of our research, which entails inherent limitations,

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it is important to acknowledge that our associations might not be definitive. Significant bias and unaccounted-for factors, whether measured or unmeasured, are probable and do not figure into our model. Furthermore, the sample size for the extremely geriatric group was comparatively small, which might have constrained our ability to identify any significant impact of DTBT in this particular subgroup. Lastly, since this is a PCI registry, patients with STEMI who were conservatively managed have not been accounted for, despite the fact that this appears to be a significant proportion of patients aged 85 years and older [11-13].

Conclusion:

DTBT demonstrated a substantial enhancement in patients aged 75 years and below, 75 to 84 years, and 85 years and older over a ten-year duration. A DTBT of less than 90 minutes did not predict adverse outcomes at the 12-month mark independently. Therefore, it is consoling to know that a postponement in determining whether patients aged 85 years or older are appropriate candidates for invasive treatment does not invariably result in unfavorable clinical outcomes.

Conflict of interest:

There is no conflict of interest.

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