Department of Medicine

Rapid Door to Balloon Time in the Treatment of Acute ST- Elevation Myocardial Infarction Meaningfully Reduces Overall Hospital Stay

Amit N. Nanavati MD
Lehigh Valley Health Network, Amit_N.Nanavati@lvhn.org

Nainesh Patel MD
Lehigh Valley Health Network, nainesh_c.patel@lvhn.org

Bruce Feldman DO
Lehigh Valley Health Network, bruce.feldman@lvhn.org

J Patrick Kleaveland MD
Lehigh Valley Health Network, J_Patrick.Kleaveland@lvhn.org

Orlando E. Rivera RN
Lehigh Valley Health Network, Orlando_E.Rivera@lvhn.org

See next page for additional authors

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Authors

Amit N. Nanavati MD, Nainesh Patel MD, Bruce Feldman DO, J Patrick Kleaveland MD, Orlando E. Rivera RN, and David A. Cox MD

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Amit Nanavati, MD, Nainesh Patel, MD, Bruce Feldman, DO, J. Patrick Kleaveland, MD, Orlando Rivera, RN, David Cox, MD

Lehigh Valley Health Network, Allentown, Pennsylvania

Introduction

- Coronary artery disease and its extreme manifestation - ST-Elevation Myocardial Infarction - remains among the leading cause of death in the United States. Significant research has been devoted to reducing the morbidity and mortality of this condition. Early reperfusion has been established as an important consideration in improving outcomes.

- As such, in 2007 the American College of Cardiology and American Heart Association set a goal of reperfusion of the infarct artery to within 90 minutes of presentation. This benchmark was shown as a cutoff time beyond which significantly worsened outcomes could be expected, and became known as "door to balloon time."

- In addition to mortality, major adverse cardiac events are also reduced with improvements in door to balloon time. However, fewer studies have examined the relationship between door to balloon time and in-hospital complications.

- At Lehigh Valley Health Network, we have established a protocol for rapid transfer to the cardiac catheterization laboratory that can be initiated by ED, Cardiology or EMS. The 'MI Alert' pathway standardizes medications and therapies and has helped reduce door to balloon time. **(Figure 1)**

Figure 1. MI Alert Protocol

Objective

- Our study examined the relationship between door to balloon time and time to hospital discharge. We believe that time to hospital discharge is an effective surrogate for measuring in-hospital complications. The hypothesis is that time to hospital discharge would be reduced as door to balloon time is improved.

Methods

- We examined 77 patients presenting to Lehigh Valley Health Network from 2008-2011 with Acute ST-Elevation Myocardial Infarction, as determined by activation of the 'MI Alert' pathway who were deemed to be acceptable candidates for emergency cardiac catheterization and percutaneous intervention.

- Of these 77 patients, 40 (52%) had a door to balloon time of less than 30 minutes (referred to as the "early" cohort) and 37 (49%) of which had a door to balloon time of > 90 minutes ("late" cohort).

- Eight patients were excluded from the final analysis in the late cohort (termed "late cohort with exclusions") Of these eight patients, six were excluded for presence of cardiogenic shock, one for preexisting multiorgan failure and one for ventricular fibrillation arrest requiring hypothermic cooling. No patients were excluded from the early group.

- Door to balloon time of the cohorts is presented below. **(Table 1)**

- Demographic data such as age, as well as coronary artery disease risk factors such as male gender, hypertension, tobacco use, history of coronary artery disease, diabetes, dyslipidemia, prior CVA and age were similar between the two groups **(Table 2)**. (p-values represent difference between early cohort and late cohort with exclusions).

Results

- Overall mean time to hospital discharge in the early group was 3.33 days whereas it lengthened to 5.02 days in the late group with exclusions (p = 0.011). Without exclusions the mean time to hospital discharge was 6.83 days. **(Graph 1)**

- Five deaths were noted (4 from cardiac etiologies) in the late group. No deaths were seen in the early group.

- In the late group, six patients were diagnosed with cardiogenic shock compared with one in the early group.

- Left ventricular ejection fraction is significantly lower in the late groups. The prevalence of anterior myocardial infarction trended higher in the late groups. **(Table 3)**

- Even after excluding patients in cardiogenic shock, a clear difference is still noted in time to hospital discharge as it relates to door to balloon time.

Table 1. Door to Balloon Time

	Early (n=40)	Late (n=37)	Late with Exclusions (n=29)	p value
Door to Balloon (min)	24.9 +/- 4.7	134.8 +/- 61.2	128.7 +/- 48.0	

Table 2. Demographic Data and Risk Factors

Risk Factors	Early (n=40)	Late (n=37)	Late with Exclusions (n=29)	p value
Average age (yrs)	61.3 +/- 9.9	65.9 +/- 13.1	64.1 +/- 13.8	0.365
Male Gender	72.5%	76.3%	81.8%	0.314
Hypertension	72.5%	63.2%	50.0%	0.545
Tobacco Use	25.0%	28.9%	26.3%	0.407
Prior CAD	25.0%	34.2%	21.1%	0.814
Diabetes	25.0%	36.8%	31.6%	0.164
Dyslipidemia	77.5%	65.8%	55.3%	0.639
Prior CVA	2.5%	15.8%	10.5%	0.114
Combined	2.275	2.38	2.55	0.309

Table 3. Procedure and EKG Data

	Early (n=40)	Late (n=37)	Late with Exclusions (n=29)	p value
Left Ventricular Ejection Fraction (EF%)	50.8 +/- 8.8	39.1 +/- 11.2	40.7 +/- 11.0	<0.001
Drug Eluting Stent	52.5%	45.9%	51.7%	0.950
Anterior Infarction by EKG	22.5%	45.9%	44.8%	0.058

Time to Hospital Discharge

Conclusions

- Reducing door to balloon time meaningfully reduces hospital stay.

- Short door to balloon times were associated with fewer mortalities and episodes of cardiogenic shock.

- A hypothesis for this difference could include salvage of more myocardial muscle by faster revascularization, as demonstrated by a statistically higher left ventricular ejection fraction in those revascularized early.

- Confounding factors include increased prevalence of anterior myocardial infarction in the late cohort.

- Future direction involves quantifying scar burden by follow-up echocardiogram or MRI as well as examining outcomes at 30 days and 1 year.

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