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Optimized STEMI Pathway for Rapid Door-to-Balloon Times: A Quality Improvement Initiative at Fortis Flt. Lt. Rajan Dhall Hospital

Jagdish Singh Negi[1], Dr. Dheeraj P Arya[2], Dr. Gurvinder Kaur[3]
Fortis Flt Lt Rajan Dhall Hospital

Abstract: ***ST-elevation myocardial infarction (STEMI) is a time-sensitive cardiac emergency where rapid reperfusion therapy significantly reduces morbidity and mortality. International guidelines recommend achieving a door-to-balloon (DTB) time of ≤90 minutes for patients undergoing primary percutaneous coronary intervention (PCI). This clinical audit evaluated the implementation of an optimized CODE STEMI pathway at Fortis Flt. Lt. Rajan Dhall Hospital with the objective of improving DTB compliance from 60% to 100% by March 2025.***

The project utilized a Plan–Do–Study–Act (PDSA) quality improvement framework focusing on streamlined triage, direct emergency physician-to-cardiologist communication, rapid consent processes, faster cath lab transfer, staff training, and reduction of administrative delays. Data were collected from July 2024 to February 2025 across pre-intervention, intervention, and post-intervention phases.

Post-intervention analysis demonstrated substantial reductions in treatment intervals, with DTB time decreasing from 88 minutes to 71.66 minutes. Compliance with DTB ≤90 minutes improved from approximately 46% to 97%, with 100% compliance sustained for three consecutive months. The findings highlight that a structured, multidisciplinary CODE STEMI pathway significantly enhances emergency cardiac care delivery and patient outcomes.

I. INTRODUCTION

Acute STEMI remains one of the leading causes of cardiovascular mortality worldwide. Early reperfusion through primary PCI is the gold standard treatment, and clinical outcomes are highly dependent on minimizing ischemic time. The American Heart Association recommends a DTB time of ≤90 minutes as a benchmark for quality cardiac care.

Despite established protocols, delays frequently occur due to inefficient triage, communication gaps, consent delays, administrative formalities, and poor coordination between emergency, cardiology, and inpatient departments. These delays negatively impact myocardial salvage, increase complications, and prolong hospitalization.

To address these barriers, Fortis Flt. Lt. Rajan Dhall Hospital implemented an optimized CODE STEMI pathway designed to accelerate emergency cardiac interventions and improve compliance with international standards.

II. AIM AND OBJECTIVES

A. Aim

To optimize the CODE STEMI clinical pathway and achieve DTB time ≤90 minutes for all eligible STEMI patients undergoing primary PCI.

B. Objectives

1) Improve DTB compliance from 60% to 100% by March 2025.
2) Reduce delays in triage, consent, cath lab transfer, and balloon inflation.
3) Enhance multidisciplinary coordination between ER, cardiology, ICU, admission, and administrative teams.
4) Improve patient outcomes and emergency cardiac care efficiency.

III. METHODOLOGY

A. Study Design

Interventional observational clinical audit using the PDSA quality improvement model.

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B. Study Setting

Department of Medical Administration and Emergency Services, Fortis Flt. Lt. Rajan Dhall Hospital.

C. Study Duration

- Pre-intervention phase: July 2024 – October 2024
- Intervention phase: November 2024
- Post-intervention phase: December 2024 – February 2025

D. Study Population

All STEMI patients presenting to the emergency department and undergoing primary PCI.

E. Audit Tools

- CODE STEMI activation system
- STEMI performance sheets
- Emergency dashboards
- Monthly audit reports
- Real-time tracking sheets

F. Key Indicators Monitored

- Door-to-ECG time
- Door-to-consent time
- Door-to-cath lab transfer time
- Door-to-balloon (DTB) time

IV. PRE-INTERVENTION GAP ANALYSIS

Several operational and clinical gaps contributed to delays in STEMI management:

Identified Challenge	Impact
Inadequate triage awareness	Delayed STEMI identification
Atypical presentations missed	Delayed ECG and diagnosis
Poor communication during consent	Increased decision-making delay
IPD coordination issues	Delayed transfer to cath lab
No direct ER-cardiologist communication	Increased activation time
Limited ER resuscitation confidence	Dependency on ICU/cardiology teams
Excessive paperwork	Increased treatment delay
Financial clearance delays	Delayed emergency transfer
Lack of accountability	Workflow inefficiency

V. INTERVENTIONS IMPLEMENTED

1) Triage Optimization

- Regular triage training sessions conducted.
- ECG incorporated into primary assessment for high-risk patients.
- Shift briefings conducted for urgent cardiac cases.

2) CODE STEMI Activation

- Emergency physician empowered to activate CODE STEMI immediately after ECG confirmation.
- Direct communication established between ER physician and cardiology consultant.

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3) *Consent Process Improvement*
   - Standardized counseling process for patient relatives.
   - Rapid communication strategy implemented to reduce consent-related delays.
4) *Cath Lab Coordination*
   - Early cath lab pre-alert system introduced.
   - IPD and admission teams informed simultaneously during activation.
5) *Administrative Simplification*
   - Minimal STEMI documentation form introduced.
   - Essential paperwork prioritized while non-critical documentation deferred.
6) *Resuscitation and Simulation Drills*
   - Regular CODE STEMI mock drills organized.
   - Debriefing sessions conducted after emergency activations.
7) *Financial Process Streamlining*
   - Patients allowed transfer to cath lab after consent without waiting for financial clearance.
8) *Team Accountability*
   - Defined responsibilities from gate security to cath lab staff.
   - Real-time escalation mechanisms introduced.

VI. PDSA CYCLE FRAMEWORK

1) Plan: Identify causes of DTB delay and design corrective interventions.
2) Do: Implement CODE STEMI optimization strategies across departments.
3) Study: Monitor monthly DTB performance indicators and identify residual delays.
4) Act: Refine workflows through continuous feedback and multidisciplinary reviews.

VII. RESULTS

Comparison of Pre- and Post-Intervention Timings

Performance Indicator	Pre-Intervention Average (min)	Post-Intervention Average (min)	Time Reduced
Door to ECG	2.05	1.79	0.26 min
Door to Consent	60	32.37	27.63 min
Door to Cath Lab	66	44.58	21.42 min
Door to Balloon (DTB)	88	71.66	16.34 min

DTB Compliance Performance

Phase	DTB ≤90 min Compliance
July–October 2024	~46%
November 2024–February 2025	~97%
November–January	100% sustained compliance

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Major Causes of Residual Delay

Delay Cause	Percentage
Consent delays	25%
Procedural/multiple reasons	10%
Financial delays	5%
Cath lab unavailability	5%
Medical instability	5%

VIII. DISCUSSION

The audit demonstrated that implementation of an optimized CODE STEMI pathway significantly reduced treatment delays and improved compliance with recommended DTB standards. The most substantial improvements were observed in consent processing and cath lab transfer times, indicating that communication and coordination were critical determinants of pathway efficiency.

Direct ER-to-cardiologist communication enabled rapid decision-making and immediate cath lab activation. Similarly, empowering ER physicians and minimizing unnecessary documentation reduced administrative bottlenecks.

The intervention also reinforced the importance of multidisciplinary collaboration. Sustained compliance was achieved through continuous monitoring, real-time feedback, regular training, and clearly assigned responsibilities.

Although minor delays persisted due to consent and procedural issues, overall performance improved remarkably and aligned closely with international STEMI management standards.

IX. IMPACT OF THE INITIATIVE

A. *Clinical Impact*

- Faster myocardial reperfusion
- Reduced ischemic injury
- Improved patient survival potential
- Better patient experience and satisfaction

B. *Operational Impact*

- Improved coordination among ER, cardiology, ICU, and admissions
- Enhanced emergency preparedness
- Reduced process variability
- Improved accountability and communication

C. *Organizational Impact*

- Strengthened quality improvement culture
- Improved compliance with evidence-based care standards
- Enhanced emergency cardiac care reputation

X. RECOMMENDATIONS

1) Continue regular triage and CODE STEMI training.
2) Conduct mandatory mock drills and debriefing sessions.
3) Maintain direct ER-to-consultant communication pathways.
4) Continue rapid consent counseling practices.
5) Sustain streamlined documentation systems.
6) Ensure cath lab readiness at all times.
7) Promote multidisciplinary accountability and ownership.
8) Continue monthly audits and real-time performance monitoring.

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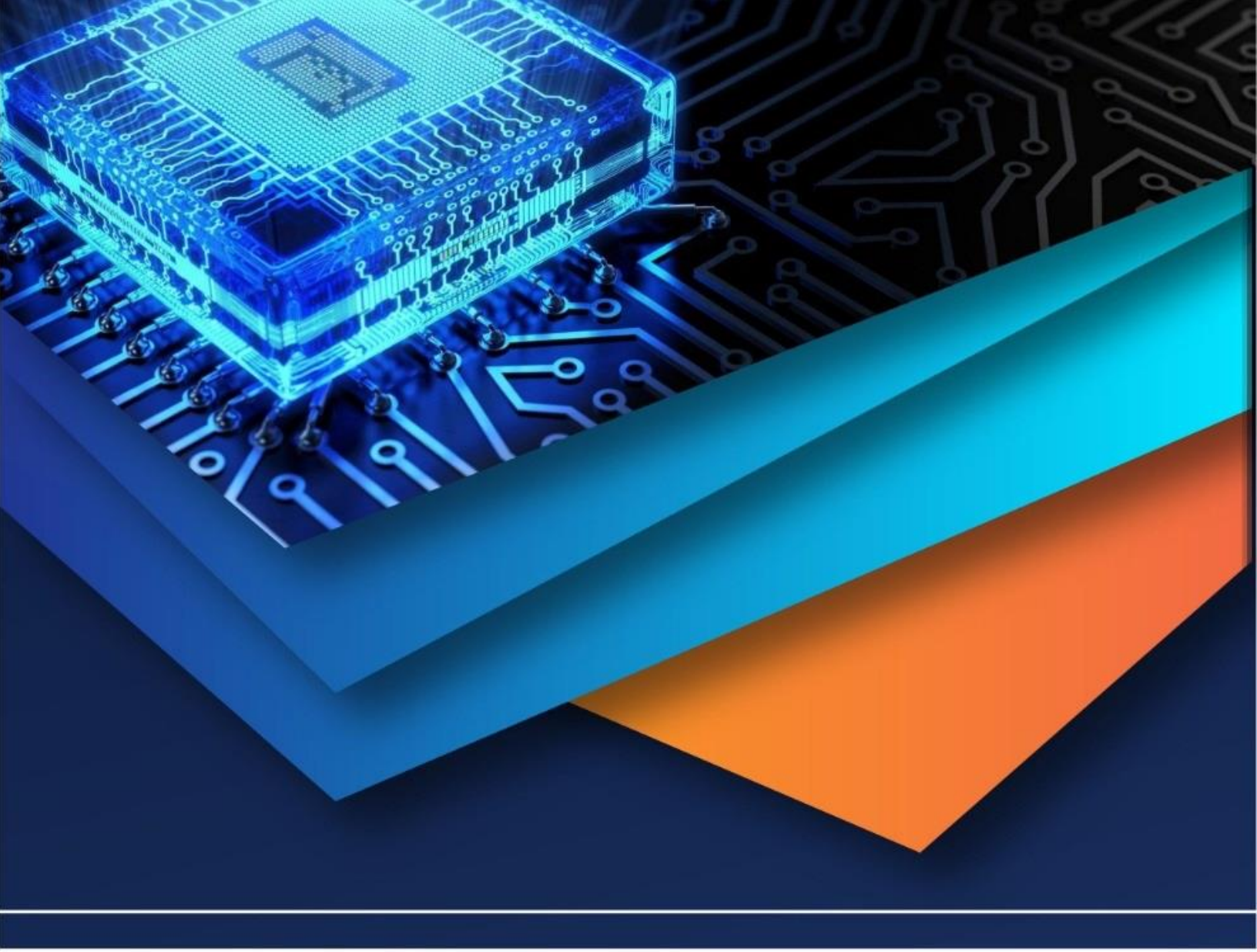
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XI. CONCLUSION

The optimized CODE STEMI pathway at Fortis Flt. Lt. Rajan Dhall Hospital successfully improved door-to-balloon performance and significantly enhanced emergency cardiac care delivery. Through targeted interventions, streamlined workflows, rapid communication, and continuous monitoring, the hospital achieved near-complete compliance with the recommended DTB benchmark of ≤90 minutes.

This clinical audit demonstrates that structured pathway optimization and multidisciplinary collaboration can dramatically improve STEMI management outcomes, operational efficiency, and patient safety in acute cardiac care settings.

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