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Optimizing primary PCI beyond "door to intervention time"—are we there yet?

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Abstract

Aim: To assess the effects of shortened door-to-intervention (DTI) time on appropriate clinical decisions regarding the four most critical and costly decisions during primary percutaneous coronary intervention (PCI): cath-lab activation (CLA), use of glycoprotein IIb/IIIa inhibitors (GPI), use of PCI, and deployment of drug-eluting stent (DES).

Background: STEMI PCI patients are frequently subject to decision making based on abbreviated medical encounter and limited medical information.

Methods: Clinical data were prospectively collected in a STEMI registry over 19 months. Retrospective chart reviews were conducted to determine the level of appropriateness of the above-mentioned decisions.

Results: Between June 2006 and December 2007, 200 EKGs with suspected STEMI were transmitted; 88 (44%) resulted in CLA. Compared to prior year, DTI times decreased from 145.7 to 69.9 min (P=.00001). DTI was longer during nights and weekends (87.5 vs. 51.8 min, P=.001) and the initial 6 months of the registry (86.8 vs. 66.8 min, P=.07). Nineteen (21.6%) of the patients undergoing angiography did not require revascularization, 56 (63.6%) received GPIs, and 65 patients (73.8%) underwent at least one vessel PCI, and at least one DES was used in 39 patients (60% of PCI cohort). When assessed for appropriateness, CLA was appropriate in 81.8% of the time and rendered borderline or inappropriate in 5.7% and 12.5%, respectively. GPI use was appropriate in 66% of the patients but seemed borderline or inappropriate in 28.5% and 5.4%, respectively. PCI was appropriate in 90% of the lesions treated, and borderline or inappropriate in 7.1% and 2.9%, respectively. DES use was viewed appropriate in 38.4%, and borderline or inappropriate in 51% and 10.2% of the DES deployments, respectively.

Conclusions: (1) In view of expedited care, certain information required for decision-making process is either not available or ignored during primary PCI. (2) Appropriate use of resources in primary PCI needs to be better defined. (3) Measures of extracting patients' previous medical records and imaging studies along with in-lab immediate blood work and echocardiography and establishing new "time-out" protocols for STEMI patients may improve resource utilization and patient care and outcome.

Keywords: ST-elevation myocardial infarction; Primary PCI; Glycoprotein IIb/IIIa ihibitors; Drug eluting stents; Bare metal stents; Door to intervention time

1. Introduction

The door-to-balloon initiative inspired many algorithms and innovations to reduce the time from the initial medical encounter of patients with STEMI to the reperfusion of the infarct-related artery.

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The University Hospital at Newark was the first hospital to report the use of simultaneous wireless network EKG transmission and cath-lab activation (CLA). This innovative strategy was prospectively assessed in a registry (STAT MI registry [1]). The simultaneous wireless transmission resulted in immediate notification of off-site cardiologists and cardiology fellows, emergency department and cath-lab personnel. The fellow with the interventional attending could assume at that point patient care and make triage decisions (allowing direct admission of suitable patients to the cath lab). The cardiology fellow could also attempt to extract patients' old records, EKGs, and imaging studies. Upon arrival to the cath lab, the patient is examined by the cardiac fellow, consented for coronary angiography and primary percutaneous coronary intervention (PCI), and undergoes coronary angiography. In a recent report based on the National Cardiovascular Data Registry (ACTION), it was determined that the use of prehospital EKG transmission was associated with better reperfusion times, higher use of reperfusion therapy, and a trend toward reduced mortality; however, only one quarter of the patients transported by EMS received prehospital EKG [2].

As required by the state of New Jersey, we reported our door-to-intervention (DTI) times which have dramatically improved. We did however notice in various primary PCI setups that (1) the patients' blood work (chemistry, blood counts, and cardiac enzymes) were usually available only upon termination of PCI procedure. (2) Although echocardiography or, alternatively, ventriculography and aortography were readily available to us, these modalities were not always used prior to PCI. In a few memorable cases, we failed to pick up pathologies that were essential for our decision-making process (critical aortic stenosis, severe mitral regurgitation, and even an aortic dissection). (3) We also noticed that we have made inappropriate decisions in view of emerging clinical details extending from religious issues (refusal to receive blood products), social issues (drug addiction and dependence, poor compliance, dementia, lack of financial means and medical insurance, lack of social support), coexisting illnesses (undiagnosed iron-deficiency anemia, bleeding disorders, planned surgery, or aspirin and clopidogrel intolerance), and abnormal laboratory results (profound anemia, renal failure, hyperglycemia, hyperkalemia, and acidemia). It is all too frequent that the interventional cardiologist at the end of the procedure will state, "…I wish I knew that!"

Indeed, speed can compromise care on many other avenues (like trying to save time on essential patient-supporting measures such as mechanical ventilation, transvenous pacing, intra-aortic counterpulsation when these are required; or attempting challenging anatomy with inappropriate guiding catheter size or shape or suboptimal wiring). In this report the authors attempt to analyze the appropriateness of the decision-making process with regard to the four key clinical decisions: CLA, use of glycoprotein IIb/IIIa inhibitor (GPI), PCI, and drug-eluting stent (DES) deployment. Since there is no clear consensus regarding the definitions of appropriateness, the authors attempt to define their perception of appropriateness, which is the basis of this analysis.

2. Methods

2.1. Patients

Analyzed were 88 consecutive patients enrolled in a registry to determine time intervals and outcomes for patients admitted using the wireless network activation.

2.2. Analysis of appropriateness

Analysis of appropriateness was performed in view of patient history and physical examination, previous medical records and imaging studies, admitting laboratory work, and echocardiogram. Social (including insurability, compliance, and drug addiction) and religious issues were not ascertained due to the difficulty to determine their impact on outcomes.

2.3. Criteria for appropriateness

Procedures and therapy in individual patients were categorized according to three categories: appropriate, when the authors believed the benefit is likely to exceed the risk of the therapy; borderline appropriate, when the procedure has marginal clinical justification and the potential benefit is in question; and inappropriate, when the expected harm exceeds any benefit.

2.4. Cath-lab activation

Cath-lab activation was viewed as appropriate when both typical chest pain and EKG changes (consistent with EKG criteria for STEMI based on fibrinolysis criteria) were present. They were rendered borderline if the EKG criteria did not meet the fibrinolysis criteria but demonstrated ST shifts and defined inappropriate when there was either no change from baseline EKG or that the EKG did not demonstrate any significant ischemic changes.

2.5. Glycoprotein IIb/IIIa inhibitor

GPIs were rendered appropriate only for major vessels (dominant proximal mid and distal RCA, proximal mid and distal LAD, proximal circumflex, mid or distal dominant circumflex), if time from onset of pain <12 h, and there are no increased bleeding propensity. Bleeding propensity markers were any of the following: age >80, renal dysfunction with creatinine ≥1.8, hepatic failure with