
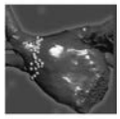
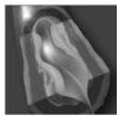

Comparing transradial with transfemoral approaches for STEMI patients: the importance of time-to-intervention

"While the selection of the arterial access site has not been considered an area that might be favorable to improve [door-to-balloon], recent studies have challenged the standard transfemoral artery approach."

KEYWORDS: door-to-balloon time ▪ reperfusion strategy ▪ transradial artery catheterization

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"When you are through changing, you are through."
– Bruce Barton

Efforts to improve reperfusion strategies for patients presenting with ST-segment elevation myocardial infarction (STEMI) have been the focus of several quality initiatives directed by the American College of Cardiology (ACC; who set up the Door-to-Balloon [D2B] Alliance) and, more recently, the American Heart Association (AHA; who set up the Mission Lifeline). Paradigms designed to improve early recognition and diagnosis (i.e., performing and transmitting a 12-lead ECG from the field), along with improvements in coordinating an interventional cardiology team (i.e., a 'one-page' system), have in part contributed to the success of these programs. The ability to create a system that capitalizes on the concept of 'shared governance', which includes paramedics, emergency medicine physicians, nurses, interventional cardiologists and hospital administrators, is one of the challenging (yet clinically rewarding) issues facing the creation of STEMI programs. Given the need for changes in practice patterns, the benefits of creating a program that fosters a collaborative and trusting environment cannot be overemphasized. Trained paramedics or emergency medicine physicians – the group of first medical contacts – prove to be an integral component of a process by which early activation of a STEMI system achieves significant reductions in D2B. Changes in how we identify and triage a STEMI patient have translated into improvements in patient care and outcome.

As hospitals search to advance strategies that focus on time-to-reperfusion, the benchmark continues to be debated and modified. Internationally recognized STEMI guidelines have defined optimal (within 90 min) D2B for all patients, although consideration for reducing D2B for patients with larger amounts of myocardium at risk [101]. The issue relating to D2B for patients initially presenting to non-percutaneous coronary intervention (PCI)-capable sites has proved challenging. Recognition of PCI-related time delay, which potentially mitigates the benefits of mechanical reperfusion (over fibrinolytic therapy), continues to pose concern for healthcare providers as it relates to the ideal reperfusion therapy for an individual patient. Many cardiologists have challenged current guideline targets leading efforts to make '60 the new 90'. While operational efforts designed to reduce D2B have concentrated principally on protocols outside the purview of the cardiac catheterization laboratory, if the system is to change, the question arises as to what the interventional team can offer to further reduce D2B. More specifically, should the interventional cardiologist approach the STEMI patient differently in an effort to improve the time to infarct-related artery reperfusion?

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Once in the cardiac catheterization laboratory, angiography and left ventriculography are routinely performed in an effort to define the patient's coronary artery anatomy, assess regional wall motion abnormalities and identify potential mechanical complications. This information has been deemed essential for the planning of the interventional procedure that follows the diagnostic study. As D2B has become synonymous with reductions in mortality (and among institutions as a measure of technical efficiency), interventional cardiologists have altered their cardiac catheterization routine. Imaging of the infarct-related artery (based on 12-lead ECG findings

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and the specific current of injury patterns) followed by PCI is one potential new strategy to reduce time-to-reperfusion. After treating the culprit lesion, imaging of the non-infarct-related vessel and concluding left ventriculogram can be performed without influencing D2B. Initial imaging with a guiding catheter as opposed to a diagnostic catheter enables rapid deployment of PCI equipment as soon as the infarct-related artery is confirmed. This strategy eliminates the need to change catheters. The low rate of emergency cardiac surgery for patients presenting with STEMI, in addition to the encouraging observational reports relating to the treatment of left main lesions with stents (bare-metal and drug-eluting), have contributed to changes in interventional imaging protocols and routines. Unless hemodynamic instability or mechanical complications occur at the time of presentation or during the diagnostic phase of the procedure, the preponderance of STEMI patients are promptly treated with catheter-based therapies in the cardiac catheterization laboratory. While changes in imaging protocols have been successfully integrated into treatment strategies, another aspect of the interventional procedure that offers an opportunity for potential improvement in D2B relates to the vascular access site.

An estimated less than 2% of all cardiac catheterization laboratories in the USA currently utilize the radial artery for arterial access [1]. While the selection of the arterial access site has not been considered an area that might be favorable to improve D2B, recent studies have challenged the standard transfemoral artery approach. In 1989, Lucien Campeau (Montreal Heart Institute, Quebec, Canada) pioneered the transradial artery approach for percutaneous coronary artery interventions [2]. Unfortunately, recent surveys have demonstrated that in the USA, this vascular access site has been slow in gaining acceptance. Recently, Weaver *et al.* at the Penn State Heart and Vascular Institute (PA, USA) reported our experience in using the transradial artery approach for STEMI [3]. While our group is technically proficient in both techniques (transfemoral and transradial artery approaches), the report revealed several interesting findings. While time to set-up was 2 min longer in the transradial artery group compared with the transfemoral artery group, time from arterial access to balloon inflation and mean D2B were significantly reduced in patients treated with the transradial artery approach. Changing the arterial access site resulted in a reduction in mean D2B of approximately 10 min compared with the standard transfemoral artery group. This observational finding compares favorably with the strategies outlined by Bradley *et al.*, which includes having emergency medicine physicians activate the catheterization team (a mean reduction in D2B of 8.2 min); having a single central paging system (a mean reduction in D2B of 13.8 min); and having the STEMI system activated prior to the patient's arrival at the hospital (a mean reduction in D2B of 15.4 min) [4]. While the transradial artery approach to cardiac catheterization may not be ready for 'prime time' – owing to limited operator and cardiac catheterization laboratory staff experience – the time has come to change.

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Additional benefits in performing PCI via the transradial artery approach include reductions in vascular complications (i.e., vascular dissections, arteriovenous fistulae and pseudoaneurysms) compared with the transfemoral artery approach [5]. Given the small size and ease of compressibility of the radial artery, bleeding complications are also decreased (i.e., hematomas and retroperitoneal bleeds) [6]. In the setting of STEMI, when patients receive antiplatelet, anti-thrombin and possibly a fibrinolytic agent (i.e., rescue PCI), the risk for bleeding is increased. Rao *et al.* demonstrated an association between bleeding complications and adverse clinical outcome along with increased mortality in patients presenting with acute coronary syndrome [7]. A benefit of the transradial artery compared with the transfemoral artery approach is that if bleeding at the access site becomes an issue, it is recognized in a more timely manner, which allows for a more prompt intervention. Recently, a study based on National Cardiovascular Data Registry (NCDR) data (NCDR Research Network) examined the effects of vascular closure devices and the antithrombin agent bivalirudin as part of a bleeding avoidance strategy [8]. The authors cited the need for additional research to "better understand why higher-risk patients are least likely to receive bleeding avoidance strategies". Given the potential for reduction in bleeding complications with the transradial artery technique, particularly in those patients identified to be at high risk, perhaps this approach should be defined as a bleeding avoidance strategy.

Compared with our European colleagues, interventional cardiologists in the USA have been slow to embrace a technique that has been demonstrated to reduce vascular and bleeding complications and, with the preliminary findings of Weaver and colleagues, may offer an additional strategy to improve D2B. Cardiologists who routinely perform catheterizations using the transradial artery approach also recognize the reduction in patient recovery time when compared with patients who require manual compression following access of the femoral artery. Given the current infrastructure challenges (i.e., beds and nursing) for hospitals, radial artery access allows for more timely recovery of patients undergoing diagnostic catheterizations.

Changes in practice patterns are difficult and the majority of interventional cardiologists have received formal training in the transfemoral artery technique during their fellowship years. The ACC and the Society of Cardiac Angiography and Interventions (SCAI) have dedicated educational training sessions at their annual meetings that focus on case selection in an effort to expand the teaching of the transradial artery technique. As newly trained fellows complete their education and enter the workforce and established interventional cardiologists become comfortable with the transradial artery approach, the paradigm will shift. However, this change must include an organizational practice plan that involves education and the training of physicians, cardiac catheterization teams and the nursing staff who recover the patients. As physicians, we should support this type of change as we would any paradigm that serves to enhance the overall quality and delivery of healthcare. At present, it is not enough to state that one is facile in the transfemoral artery approach and that there is no need to learn alternative techniques. Interventional cardiologists should be encouraged to observe case presentations (at national meetings) and become trained in performing diagnostic cardiac catheterization using the transradial artery approach. Working with colleagues experienced in this technique should also be encouraged. An individual's level of confidence required for performing primary PCI by the transradial artery approach can be acquired by initially performing elective interventional procedures. As case complexity and volumes increase, physicians and the cardiac catheterization staff will become more proficient in using this site for access (when appropriate) and expand this to include their STEMI patients.

The time has come to change. National organizations have recognized this and have provided training opportunities to physicians who express an interest in developing this new skill set and advancing their technical efficiency. Together, we can and we will make a difference.

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