

FACTORS AFFECTING DOOR-TO-BALLOON TIME

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INTRODUCTION

Recent years have brought dramatic advances in the procedures for treating patients with acute coronary syndrome (ACS). One treatment strategy, percutaneous coronary intervention (PCI), encompasses a variety of procedures used to treat patients with coronary artery disease. Several studies support the recommendation of PCI as the preferred reperfusion strategy for patients with ST-segment elevation myocardial infarction (STEMI).¹⁻⁷ However, it is critical that the PCI be performed promptly. The common adage “time is muscle” refers to the fact that the longer the heart goes without blood and oxygen, the greater the damage sustained by the heart muscle. One of the tools used in PCI is a slender balloon-tipped catheter. Hence, door-to-balloon time has become the term commonly used to refer to the time that elapses in emergency cardiac care from when the patient arrives in the emergency department to when the PCI is performed and reperfusion accomplished.

In November 2006, the American College of Cardiology (ACC) and the American Heart Association (AHA) launched a national Door-to-Balloon (D2B) Alliance. The goal of the D2B Alliance is for at least 75% of patients with STEMI to be treated within 90 minutes of hospital presentation. Door-to-balloon time is now often used as a core quality measure for hospitals and for accrediting organizations such as the Joint Commission (formerly the Joint Commission on Accreditation of Healthcare Organizations, or JCAHO).

In this article, we start with a brief review of ACS and PCI. We then examine factors that affect door-to-balloon times, and we consider strategies recommended for improvement. The article then includes a glossary of common terms related to the diagnosis, treatment, and management of coronary artery disease.

ACUTE CORONARY SYNDROME

What most patients simply call a heart attack is more accurately known as *acute coronary syndrome* (ACS), which is an umbrella term that refers to a set of signs and symptoms related to the heart. Acute coronary syndrome results from acute obstruction of a coronary artery. Consequences depend on the degree and location of the obstruction.

The subtypes of ACS include unstable angina and two forms of myocardial infarction (MI). ACS does not include, and should be distinguished from, *stable angina*. Stable angina is a chronic condition characterized by discomfort in the chest, jaw, neck, shoulder, back, or arm, and which occurs with exertion and resolves at rest. The symptoms of stable angina are fairly predictable and relate to underlying coronary artery disease.

UNSTABLE ANGINA

Symptoms of *unstable angina* include chest pain or discomfort that is unexpected and can occur while the patient is at rest. In unstable angina, symptoms often occur without any apparent trigger. The discomfort is typically more severe and prolonged than that experienced with stable angina. Unstable angina is often accompanied by shortness of breath, indigestion, and/or dizziness. Nitroglycerin often fails to relieve the pain. *New-onset angina* is also considered unstable angina, because it suggests a new problem in a coronary artery. In contrast to stable angina, unstable angina is most often caused by the actual rupture of a plaque in a coronary artery. The ruptured plaque, and the blood clot that is almost always associated with the rupture, result in a partial blockage of the artery. The size of the blood clot may fluctuate, producing angina that comes and goes in an unpredictable fashion. If the clot causes complete obstruction of the artery, the heart muscle supplied by the affected artery is in danger of sustaining irreversible damage. Hence, the imminent risk of an acute MI is high in patients with unstable angina. What sets unstable angina apart from the two forms of MI is that unstable angina is not associated with heart muscle damage.

MYOCARDIAL INFARCTION

The term *myocardial infarction* reflects cell death of myocytes, caused by interruption of blood supply to the heart muscle. The two forms of MI classified under

ACS are named according to the appearance of the electrocardiogram (ECG) as ST elevation myocardial infarction (STEMI) and non-ST elevation myocardial infarction (NSTEMI). The *ST* refers to a specific segment of the ECG. When the ST segment is elevated away from the baseline, it indicates that a relatively large amount of heart muscle damage is occurring. In a STEMI, the coronary artery is completely occluded by the clot, and, as a result, nearly all the heart muscle supplied by the affected artery starts to die. A STEMI is the more severe type of MI.

The less severe type of MI, a NSTEMI, does not produce characteristic elevation in the ST segment of the ECG. In a NSTEMI, the artery is only partially occluded, and, as a result, only a portion of the heart muscle being supplied by the affected artery dies. It can be difficult to differentiate NSTEMI from unstable angina. Measuring cardiac enzymes (also called biomarkers) such as troponin, which reflect heart muscle damage, is an important tool in making this distinction.

NSTEMI and unstable angina are often considered together because of their patient-management similarities. Conversely, STEMI is often considered separately because of important differences in early hospital care. One difference is in the recommendations regarding PCI. Immediate PCI (within 90 minutes of the patient's arrival in the emergency department) is recommended for those with STEMI.⁸ PCI may be delayed for those with NSTEMI or unstable angina.

PERCUTANEOUS CORONARY INTERVENTION

PCI is also commonly known as *coronary angioplasty* (or simply *angioplasty*), *percutaneous transluminal coronary angioplasty* (PTCA), or *balloon angioplasty*. PCI encompass a variety of procedures used to treat patients with ACS. PCI done in emergency circumstances, most often for patients with STEMI, is referred to as *primary PCI*. Other PCI procedures, such as those used to treat the narrowed coronary arteries of unstable angina, are referred to as *elective PCI*.

The term *balloon angioplasty* is often used to describe PCI; while balloon angioplasty is still done as part of nearly all PCI, it is rarely the only procedure performed. Another procedure often done during PCI is the implantation of stents. Stents are implanted in most patients undergoing PCI because the stent gives various advantages over simple balloon dilation.⁹

Angioplasty is a technique that is used to dilate an area of arterial blockage, using a catheter with a small, inflatable, sausage-shaped balloon at its tip. Angioplasty does have some shortcomings. First, the opening created by angioplasty is not very smooth, because areas of stenosis are typically made up of both atheroma, which is soft, and plaque, which is hard. The balloon may not be able to evenly expand areas with uneven degrees of hardness.

Second, some of the areas compressed by the balloon will bounce back shortly after expansion. In addition, material within the expanded channel can proliferate after the channel is expanded, which results in gradual restenosis of the vessel.

Coronary artery stents were designed to overcome some of the shortcomings of angioplasty. A common type of stent is made of self-expanding, stainless steel mesh. It is mounted on a balloon catheter in a collapsed form. When the balloon is inflated, the stent expands and pushes against the inner wall of the coronary artery (Figure 1). In many cases, the stent is coated with an antiproliferative drug that interferes with the process of restenosis. These stents are called *drug-eluting stents*, although they are often also referred to as *coated* or *medicated stents*. Compared with angioplasty alone, stents open the diseased segment into a rounder, bigger, and smoother opening, and they reduce the chance of restenosis. However, stents cannot be used in all situations. For instance, stents are difficult to place in arteries that have extreme bends, and they cannot be used in very small vessels.

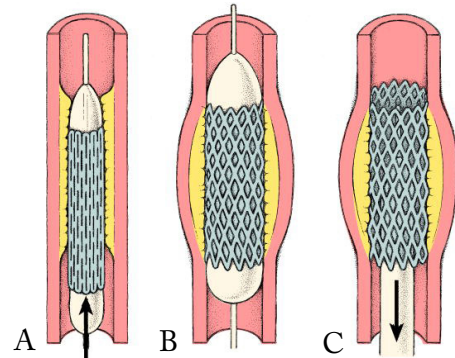


FIGURE 1. A common type of coronary stent is made from stainless steel mesh. In (A), the balloon catheter positions the stent at the site of arterial stenosis; in (B), inflation of the balloon dilates the artery and expands the stent; in (C), the balloon is collapsed and withdrawn, leaving the expanded stent in position.

DOOR-TO-BALLOON INITIATIVE

The benefit of prompt, expertly performed primary PCI for acute STEMI is well established.¹⁰ ACC/AHA guidelines recommend a door-to-balloon time of less than 90 minutes for nontransferred patients with STEMI who undergo primary PCI.¹¹ Adherence to guidelines has been correlated with improvement in patient outcomes in ACS, including reduced mortality.^{1,3,5,6} Although these guidelines have been published and widely accepted, barriers to the optimal management of patients with STEMI still exist.

Another fact that must be considered in efforts to ensure that all patients have access to optimal care is that 60 to 70% of STEMI patients present initially to

hospitals without ready access to primary PCI.¹² Data from the National Registry of Myocardial Infarction (NRM) reveals that only 4% of STEMI patients who are transferred for primary PCI achieve D2B times of less than 90 minutes.¹³ Recognizing the projected time to PCI is vital because it can affect the type of treatment selected, and AHA/ACC guidelines stress the importance of prompt reperfusion, preferably achieved with PCI if it can be initiated within 90 minutes after the patient presents to the hospital. However, if PCI cannot take place within 90 minutes (perhaps due to the need to transfer the patient to a PCI-capable facility), the guidelines recommend that pharmacological thrombolysis, unless there are contraindications, should be initiated within 30 minutes of presentation.⁸

A recent study attempts to quantify the results of the national efforts to improve D2B time.¹⁴ It found that significant improvements have been made, and it concluded that the D2B Alliance reached its goal of 75% of patients with STEMI having D2B times within 90 minutes.¹⁴ The study compares patients treated in hospitals that participated in the Alliance in both 2005 and 2008 and found that as of May 2005, 52.5% of patients had a D2B time within 90 minutes, compared to 76.4% of patients as of March 2008.¹⁴

To reach their goal, the D2B Alliance promoted the use of specific strategies and sponsored several activities for healthcare facilities. Hospitals that excel in reducing D2B time were surveyed, and the results were reported in an effort to provide insights to other institutions.¹⁵ A review of these strategies and the experiences reported by participating facilities can provide concrete areas of focus for those hospitals still struggling to meet the guidelines.

STRATEGIES TO REDUCE D2B TIME

D2B time reflects a complex clinical process involving multiple departments and disciplines. Rather than focus on a particular set of therapeutic drugs or devices, improving D2B times is dependent on improvement in systems of care. Hence, several process factors are associated with superior D2B time. These can be grouped into two broad categories: those that relate to organizational culture, and those that relate to specific procedural steps. Attention to items in both categories is important for reaching D2B time goals and for sustaining these improvements over time. Bradley et al identified eight themes as common to top-performing hospitals¹⁵:

- * An explicit goal of reducing D2B times
- * Visible senior-management support
- * Innovative, standardized protocols
- * Flexibility in implementing standardized protocols
- * Uncompromising individual clinical leaders
- * Collaborative, interdisciplinary teams

- * Data feedback to monitor progress and identify problems or successes
- * An organizational culture that fosters persistence despite challenges and setbacks

ORGANIZATIONAL CULTURE

One overarching theme that emerged as common to hospitals reporting substantial improvement and outstanding performance relates to corporate attitude.¹⁵ Identified in each of the top-performing institutions was a culture that promotes persistence and collaboration, and avoids the assignment of blame. Although these traits are inherently difficult to quantify, they are believed to play a vital role in the systems approach necessary to improve D2B time.

EXPLICIT GOALS

Organizations must set the explicit goal of reducing D2B time.¹⁵ It should be widely understood that D2B time is a quality measure for hospitals in their level of excellence in caring for patients with acute STEMI. The goal must be integrated into a shared organizational vision with staff members in every role, from front-desk clerk to physician. Such shared goals are critical for motivating and sustaining improvement efforts.

SENIOR-MANAGEMENT SUPPORT

Senior management and physicians must be visibly supportive of the effort. Tangible signs of senior-management support include appropriate resource allocation to meet goals (for example, maintaining staffing levels and purchasing additional equipment), collecting and sharing performance data, and dealing with individuals resistant to the initiative. Even something as seemingly minor as arranging for priority hospital parking for the cath lab staff members in off-hours can have effects in saving time and demonstrating the commitment of leadership to staff members.

Successful programs also need strong individual clinical leaders. These champions include physicians, nurses, and technologists who are uncompromising in their efforts to improve D2B time.

INNOVATIVE, STANDARDIZED PROTOCOLS DEVELOPED BY INTERDISCIPLINARY TEAMS

Top-performing hospitals all had a specific, focused initiative to redesign existing processes and protocols for treating patients with STEMI.¹⁵ The process was broken into manageable segments, and interdisciplinary teams stressed innovation and flexibility in developing improvements for each segment. Although protocols listed a standard set of procedures, the hospital staff was empowered to experiment with changes to the protocol to improve the process and to better reflect the reality of the particular hospital. Over time, as teams worked together to achieve a common goal, mutual respect among disciplines and departments developed. Collaboration ensured that

all disciplines and departments were committed to, and invested in, the established protocols.

DATA FEEDBACK

Sharing performance data with team members is integral to improvement efforts.¹⁵ Data feedback allows teams to monitor progress and identify problems and successes. Data were used to identify where delays were occurring and motivate changes.

SPECIFIC STRATEGIES

Specific hospital strategies have been identified as important to improving D2B time. Researchers surveyed hospitals in regards to the use of 28 specific strategies and determined that six were significantly associated with a faster D2B time¹⁶:

- * Cath lab activations done by emergency medicine physicians
- * A system of activating the cath lab through a single call to a central page operator
- * A process in place to activate the cath lab while the patient is en route to the hospital
- * An expectation that cath lab staff members arrive within 20 minutes after being paged
- * An attending cardiologist always on site
- * The use of real-time data feedback by staff members in the emergency department and the cath lab

EARLY ACTIVATION OF THE CATHETERIZATION LABORATORY

Three of the six identified strategies relate to the process of activating the cath lab. These practices had a significant effect on D2B time. The intervals were shorter for a) hospitals in which emergency department (ED) physicians activated the cath lab without consulting a cardiologist, b) those in which the cath lab was activated with a single call from the ED to a central page operator, who then paged both the interventional cardiologist and the cath lab staff, and c) those that had a process in place to activate the cath lab while the patient was en route to the hospital.

An early cath lab activation by the ED prior to the patient being assessed by a cardiologist has encountered resistance in some facilities. Cardiologists are sometimes reluctant to allow ED personnel to activate cath lab physicians and staff without cardiology consultations. However, once implemented, the typical experience was that the ED did an excellent job in correctly identifying appropriate patients for immediate catheterization. This experience was reported by The Medical University of South Carolina (MUSC) in Charleston.¹⁷ A survey supported that experience in finding that hospitals that had implemented the cath lab activation by ED physicians reported only one additional false start (cath lab activation without

PCI being needed) in a six-month period.¹⁶

Hospitals that allowed cath lab activation while the patient was en route to the hospital relied on the results of ECGs performed by emergency medical services (EMS). This process requires that ambulances carry 12-lead ECG monitors capable of wireless transmission to emergency departments, which allows ED physicians to diagnose STEMI prior to the patient's arrival and to activate the cath lab so it is prepared to receive the patient. Facilities with this process in place reported significantly faster door-to-balloon times than did hospitals that waited for the patient to arrive at the ED before activating the cath lab. MUSC reports that "In Charleston, most STEMI patients who call EMS have an ECG performed in the field, which is transmitted to the hospital. For patients transported by EMS, it is frequently possible to call a 'STEMI ALERT,' our name for a single page that notifies all key personnel a STEMI patient has entered the system. The paging operator gives a single page, which activates the cath lab, interventional cardiologist and key personnel such as the CCU charge nurse and nursing supervisor prior to the patient's arrival. Initiating the process while the patient is still in the field resulted in door-to-balloon time of less than 30 minutes."¹⁷

Interestingly, it is not the mere fact of patients receiving an ECG en route to the hospital that is correlated with improved D2B time, but how the ECG data was incorporated into the entire process. In the Bradley et al study, the percentage of patients with ACS who had an ECG performed en route did not have a shorter D2B time than those that received an ECG after arrival in the ED.¹⁶ Instead, it was the way the ECG data were used by hospitals that was important. Hospitals that activated the cath lab on the basis of the ECG performed while the patient was en route and those that had other strategies to respond to transmitted ECG data reported faster D2B times.

STAFFING STRATEGIES

Two of the six recommended strategies revolve around staffing issues. D2B time was, on average, 20 minutes shorter (91 minutes vs. 111 minutes) in hospitals that expected staff to arrive in the cath lab within 20 minutes of being paged.¹⁶ Hospitals in which a cardiologist was always at the hospital reported D2B time that was, on average, eight minutes less than those that had a cardiologist on call during evenings, weekends, and holidays. Although these strategies are clearly beneficial in reducing D2B time, they may be impractical or prohibitively expensive to implement in many hospitals.

DATA FEEDBACK

Effective data feedback tools were also associated with shorter D2B time.¹⁶ Data collection should include such metrics as D2B time and the proportion of eligible patients receiving some form of reperfusion therapy. Data should be communicated with all providers, including staff members in the ED, cath lab, and EMS.

The D2B Alliance recognizes the importance of using real-time performance feedback to drive the quality improvement effort and to sustain gains once they are achieved. A variety of proprietary software packages are available for this purpose, and many hospitals have developed their own tools for monitoring metrics related to D2B time. For hospitals that do not have a system in place for data feedback, the D2B Alliance's collaboration with the Institute for Healthcare Improvement (IHI) has produced a Web-based tool that can display average D2B time data in a variety of formats and date ranges. The software can also capture qualitative data on features of the implementation process, such as barriers encountered, lessons learned, and successes achieved. More information can be found at <http://www.ncdr.com/WebNCDRA/Action/default.aspx>.

CONCLUSION

Hospitals that implemented a greater number of recommended strategies have been shown to have a shorter door-to-balloon time (Table 1).¹⁶

TABLE 1¹⁶. Door-to-Balloon Time According to the Number of Key Strategies Used*

Number of Key Strategies	Hospitals with the Number of Key Strategies (N = 362)	Average of Median Door-to-Balloon Time
0	137 (37.8%)	110
1	130 (35.9%)	100
2	56 (15.5%)	88
3	31 (8.6%)	88
4	8 (2.2%)	79

*Because the number of hospital using three or four strategies was small, the precision of the estimates may be limited.

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Despite the effectiveness of the strategies listed, many hospitals have not implemented such policies, and D2B times at those facilities continue to be well above the recommended 90-minute markers. For example, results from Bradley et al showed that 37.8% of hospitals surveyed had not adopted any of the recommended strategies and reported D2B times averaging 110 minutes (Table 1). Although implementation of some of the advantageous strategies would require additional resources, implementation of other strategies does not. For example, having ED physicians activate the cath lab without prior consultation of a cardiologist was strongly associated with a reduced D2B time but was used in only about 23% of hospitals during the weekdays and 27% of hospitals at night or on weekends.¹⁶ Similarly, a streamlined process of activating the cath lab through a single call was used

in only about 14% of hospitals surveyed.¹⁶

Although much progress has been made in reducing the D2B time, work still remains. Additional gains can be achieved by convincing more hospitals to adopt at least some of the proven strategies for reducing D2B time. However, the initiatives must not stop there. Other factors, such as significant delays in ED diagnosis of STEMI, which may occur when the patient does not arrive by EMS, must still be addressed.

GLOSSARY OF CARDIOVASCULAR TERMS

Acute coronary syndrome (ACS)—An umbrella term used to cover any group of clinical symptoms compatible with acute myocardial ischemia.

Acute myocardial ischemia—Chest pain due to insufficient blood supply to the heart muscle that results from coronary artery disease.

Angina—Chest pain caused by myocardial ischemia that is not severe enough to result in cellular death.

Angioplasty—A procedure used to unblock an artery clogged with plaque; also known as percutaneous transluminal coronary angioplasty (PTCA), or balloon angioplasty. Often followed by the placement of a stent in the unclogged area.

Antiproliferative drug—A medication that coats stents. Prevents the abnormal growth of tissue following stent implantation.

Arteriosclerosis—A group of diseases characterized by thickening or hardening of the arteries and loss of blood flow to the heart due to plaque; can lead to angina or myocardial infarction.

Bare-metal stent—A stent not coated with an antiproliferative drug for inhibiting restenosis.

Catheter—A tube-like instrument used to access a body cavity; in angioplasty, a catheter provides access to the artery for the delivery of a balloon or stent.

Coronary angiogram—A procedure in which fluoroscopic images of the coronary arteries are obtained after an iodinated contrast agent is injected into the arteries; used to demonstrate stenosis or occlusion.

Coronary artery bypass graft (CABG)—An invasive medical procedure in which a section of an artery from another portion of the body is used to bypass a blockage in a coronary artery to improve blood flow to the heart.

Drug-eluting stent (DES)—A stent coated with an antiproliferative drug that inhibits restenosis.

Facilitated percutaneous coronary intervention—Using a combination of reperfusion strategies to treat STEMI. Pharmacologic reperfusion is used to reestablish flow early on and is then followed by emergency PCI.

Interventional cardiology—A medical specialty devoted to the practice of minimally-invasive cardiac procedures.

Non-ST segment elevation MI—A less-severe type of MI. It does not produce characteristic elevation in the ST segment of the ECG. The artery is only partially occluded.

Percutaneous coronary intervention (PCI)—Encompasses a variety of minimally invasive procedures used to treat patients with ACS. PCI done in emergency circumstances is referred to as primary PCI. Other PCI procedures are referred to as elective PCI. Also commonly known as coronary angioplasty (or simply angioplasty), percutaneous transluminal coronary angioplasty (PTCA), or balloon angioplasty.

Primary percutaneous coronary intervention—A PCI procedure done in emergency circumstances, most often for patients with STEMI.

Stable angina—Chest pain caused by myocardial ischemia. The pain typically occurs with activity or stress, with minimal or nonexistent symptoms at rest.

Stent—A tiny mesh cylinder that expands within a blood vessel and props open a previously clogged artery.

ST-segment elevation MI (STEMI)—A more-severe type of MI. ST-segment elevation of the ECG occurs when the large arteries that supply oxygen to the heart muscle, such as the left main or left anterior descending artery, become completely occluded.

Unstable angina—A form of ACS, in which angina symptoms occur in a random and unpredictable pattern. Symptoms may appear while the patient is at rest, without any apparent trigger. They may occur with a crescendo pattern (ie, distinctly more severe, prolonged, or frequent than previous episodes). May indicate an impending MI.

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FACTORS AFFECTING DOOR-TO-BALLOON TIME POST TEST

Expires: August 15, 2012 Approved for 1 ARRT Category A Credit.

1. **The common adage “time is muscle” refers to the fact that**
 - a. given enough time the heart muscle will strengthen itself.
 - b. the longer the heart goes without blood and oxygen, the greater the damage sustained to the heart muscle.
 - c. the only effective treatment is a small dose of thrombolytic drugs given frequently over a prolonged period of time.
 - d. the diagnosis of MI requires a prolonged period as the patient undergoes a series of ECGs over the course of three to four days.
2. **Door-to-balloon time refers to what time period?**
 - a. From when the patient first has symptoms to when that patient is scheduled for a PCI
 - b. From when the patient first sees a family doctor to when that patient sees a cardiologist for treatment
 - c. From when the patient calls 911 to when the PCI is performed
 - d. From when the patient arrives in the ED to when the PCI is performed
3. **Which of the following is NOT a subtype of acute coronary syndrome?**
 - a. Stable angina
 - b. Unstable angina
 - c. STEMI
 - d. NSTEMI
4. **Select the definition of acute myocardial ischemia:**
 - a. Chest pain due to insufficient blood supply to the heart muscle that results from coronary artery disease
 - b. A congenital heart defect in which the aortic valve is narrowed
 - c. The inability of the heart to pump out all the blood that returns to it
 - d. An inflammation of the heart lining or valves, usually caused by a bacterial infection
5. **Which of the following differentiates unstable angina to NSTEMI?**
 - a. Chest pain is more severe and more prolonged with unstable angina.
 - b. Unstable angina does not result in heart muscle damage.
 - c. Symptoms from unstable angina occur only with a trigger, such as exercise, whereas NSTEMI symptoms occur unpredictably.
 - d. Nitroglycerin will relieve the chest pain associated with unstable angina but is ineffective in treating NSTEMI.
6. **What does the ST refer to in the myocardial infarction types of STEMI and NSTEMI?**
 - a. A specific segment of the ECG
 - b. The words standard treatment
 - c. The phrase start site, transcription
 - d. The words stenosis, tricuspid
7. **What is it called when a coronary artery is completely occluded and a relatively large amount of heart muscle damage is occurring?**
 - a. Unstable angina
 - b. NSTEMI
 - c. STEMI
 - d. Non-Q wave MI
8. **Which can be used to help differentiate NSTEMI from unstable angina?**
 - a. The presence of chest pain
 - b. Creatinine levels
 - c. AP and lateral chest x-ray
 - d. Biomarkers, such as troponin
9. **Which of the following is NOT a term often used in place of PCI?**
 - a. CABG
 - b. Balloon angioplasty
 - c. Percutaneous transluminal coronary angioplasty
 - d. Angioplasty
10. **The term primary PCI refers to procedures**
 - a. that examine only one coronary artery.
 - b. used to treat coronary artery stenosis, rather than occlusion.
 - c. done in emergency circumstances, most often for patients with STEMI.
 - d. used to treat patients with unstable angina.
11. **The pharmacologic agents that interfere with the process of restenosis and often coat stents are called**
 - a. corticosteroids.
 - b. adrenergic antagonists.
 - c. interferons.
 - d. antiproliferatives.
12. **ACC/AHA guidelines recommend a D2B time for nontransferred STEMI patients of less than**
 - a. 180 minutes.
 - b. 120 minutes.
 - c. 90 minutes.
 - d. 60 minutes.
13. **All of the following are themes common in hospitals with a rapid D2B time EXCEPT**
 - a. an explicit goal of reducing D2B times.
 - b. visible senior-management support.
 - c. rigorous adherence to standardized protocols.
 - d. collaborative, interdisciplinary teams.

14. Which of the following is an effective tool used to pinpoint where delays are occurring and motivate change?
- Data feedback
 - GPS tracking of on-call staff members
 - Analysis of payroll data
 - Appointment of a D2B czar who tracks employee participation and issues formal reprimands for deviations from protocols
15. Three of the six specific strategies to reduce the D2B time relate to
- the accessibility of cardiologists.
 - the process of activating the cath lab.
 - quickly obtaining laboratory and radiographic results.
 - the location of the cath lab.
16. What barrier has been identified in having the ED physicians activate the cath lab without consulting a cardiologist?
- ED physicians are unwilling to make the diagnosis of STEMI.
 - Cardiologists are uncomfortable allowing ED physicians to activate cath lab physicians and staff members without having the diagnosis confirmed by a cardiologist.
 - The number of false starts has risen dramatically in facilities where ED physicians activate the cath lab.
 - ED physicians are too busy to navigate the complex process involved in activating the cath lab.
17. What is necessary to allow cath lab activation while the patient is en route to the hospital?
- A cardiologist must travel with the EMS.
 - EMS staff members must also be registered nurses.
 - The ambulance must be equipped with a 12-lead ECG monitor capable of wireless transmission to the ED.
 - The patient insurance coverage must be verified while still in the ambulance, prior to activating the cath lab.
18. All of the following are included in the six strategies known to be effective to reduce the D2B time EXCEPT
- a system of activating the cath lab through a single call to a central page operator.
 - an expectation that cath lab staff members arrive within 20 minutes after being paged.
 - keeping an attending cardiologist always on site.
 - having elective catheterization cases rescheduled.
19. In the 2006 Bradley et al survey, what percentage of hospitals used four or more of the key strategies?
- 75.2%
 - 41.5%
 - 15.5%
 - 2.2%
20. In the 2006 Bradley et al survey, what percentage of hospitals reported a D2B time that met or exceeded ACC/AHA guidelines?
- 68%
 - 41%
 - 26%
 - 9%



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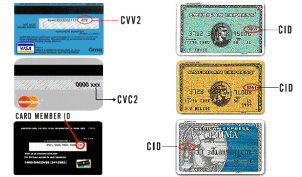
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1. a b c d	6. a b c d	11. a b c d	16. a b c d
2. a b c d	7. a b c d	12. a b c d	17. a b c d
3. a b c d	8. a b c d	13. a b c d	18. a b c d
4. a b c d	9. a b c d	14. a b c d	19. a b c d
5. a b c d	10. a b c d	15. a b c d	20. a b c d