EDITORIAL COMMENT

Reducing the Risk of Emergency Bypass Surgery for Failed Percutaneous Coronary Interventions*

John A. Bittl, MD, FACC
Ocala, Florida

In this issue of the Journal, Yang et al. (1) from the Mayo Clinic report the changing incidence and outcomes of emergency coronary artery bypass surgery for failed percutaneous coronary interventions (PCIs). The good news is that the rate of emergency bypass surgery declined dramatically, falling from 2.9% in the pre-stent era (1979 to 1994) to 0.7% in the early-stent era (1995 to 1998) and showing a further decrease to 0.3% in the current-stent era (1999 to 2003). The bad news is that the in-hospital mortality for emergency bypass surgery remained constant and high at 10% to 14%.

A description of what went wrong in each case could identify areas for improvement. The Mayo group analyzed their database and found that patients sent for emergency bypass surgery had a higher incidence of prior revascularization, reduced ejection fractions, and more complex coronary anatomy than those with uneventful PCIs. After the introduction of stents, fewer patients with abrupt closure and dissections required emergency bypass surgery than in the pre-stent era. The database analysis generated helpful broad clinical observations but could not define the root cause of PCI failures that continued to occur after the availability of stents. A dutiful fellow-in-training could have reviewed charts, interviewed the laboratory staff, and pored through narratives to identify whether catastrophes such as vessel perforation, balloon non-deflation, or other types of device failure played a role; but the additional information might have been too heterogeneous for a database analysis.

Additional insights into reasons for emergency bypass surgery in the current era have come from investigators at the Cleveland Clinic (2). Like the Mayo Clinic group, Seshadri et al. (2) reported a dramatic 10-fold reduction in referrals for emergency bypass surgery between 1992 and 2002 and also decried a persistent high mortality rate of 10% to 14%.

Cardiac tamponade accounted for emergency bypass surgery in 20% of cases. Unfortunately, such events have been difficult to predict (3). Additional improvements have been needed to enhance the safety of PCI.

Platelet glycoprotein (GP) IIb/IIIa inhibitors have been commonly theorized as reducing the need for emergency bypass surgery, but there is little direct proof for this hypothesis. The Cleveland Clinic group (2) identified stenting as independently associated with the decreased need for emergency bypass surgery, whereas the use of GP IIb/IIIa inhibitors was not. Several randomized trials of GP IIb/IIIa inhibitors (4–7) have failed to show a significant reduction in emergency bypass surgery, as strictly defined in the current report (1) and in the guidelines for bypass surgery (8). (“Emergency” bypass surgery is performed within hours to avoid significant morbidity and mortality, “salvage” bypass surgery is performed under cardiopulmonary resuscitation, “urgent” bypass surgery is performed during the same hospitalization, and “elective” bypass surgery is performed after hospital discharge.)

Reducing the need for emergency bypass surgery further might require a change in practice. Some PCI settings exist where potent antiplatelet agents are conventionally used but probably should be avoided. For example, during the aggressive recanalization of chronic total occlusions, up to 4% of patients have had cardiac tamponade and up to 18% have had vessel perforation (9). Using a reversible anticoagulant (e.g., unfractionated heparin) and avoiding clopidogrel pre-treatment or GP IIb/IIIa inhibitors might reduce the consequences of “wire exit” or perforation in this setting.

The declining routine use of atherectomy, cutting balloon atherotomy, or laser angioplasty might also reduce the risk of mechanical complications. The Mayo Clinic group (10) reported that the use of atheroablative devices was the most common cause of coronary perforation in their interventional program. A meta-analysis (11) of 16 randomized trials of atherectomy, cutting balloon atherotomy, or laser angioplasty versus balloon angioplasty in 9,222 patients showed an increased risk of major adverse cardiac events at 30 days (5.1% vs. 3.3%; odds ratio [OR] 1.54, 95% confidence interval [CI] 1.25 to 1.89) but no reduction in emergency bypass surgery (1.1% vs. 0.9%; OR 1.18, 95% CI 0.75 to 1.78) or angiographic restenosis (38.9% vs. 37.4%; OR 1.06; 95% CI 0.97 to 1.17).

When extraordinary mechanical complications occur during PCI, a panoply of innovative percutaneous treatments now exists to avert the need for emergency bypass surgery. Free coronary perforations can be classified as progressively recanalization of chronic total occlusions, up to 4% of patients have had cardiac tamponade and up to 18% have had vessel perforation (9). Using a reversible anticoagulant (e.g., unfractionated heparin) and avoiding clopidogrel pre-treatment or GP IIb/IIIa inhibitors might reduce the consequences of “wire exit” or perforation in this setting.

The declining routine use of atherectomy, cutting balloon atherotomy, or laser angioplasty might also reduce the risk of mechanical complications. The Mayo Clinic group (10) reported that the use of atheroablative devices was the most common cause of coronary perforation in their interventional program. A meta-analysis (11) of 16 randomized trials of atherectomy, cutting balloon atherotomy, or laser angioplasty versus balloon angioplasty in 9,222 patients showed an increased risk of major adverse cardiac events at 30 days (5.1% vs. 3.3%; odds ratio [OR] 1.54, 95% confidence interval [CI] 1.25 to 1.89) but no reduction in emergency bypass surgery (1.1% vs. 0.9%; OR 1.18, 95% CI 0.75 to 1.78) or angiographic restenosis (38.9% vs. 37.4%; OR 1.06; 95% CI 0.97 to 1.17).

When extraordinary mechanical complications occur during PCI, a panoply of innovative percutaneous treatments now exists to avert the need for emergency bypass surgery. Free coronary perforations can be classified as progressively recanalization of chronic total occlusions, up to 4% of patients have had cardiac tamponade and up to 18% have had vessel perforation (9). Using a reversible anticoagulant (e.g., unfractionated heparin) and avoiding clopidogrel pre-treatment or GP IIb/IIIa inhibitors might reduce the consequences of “wire exit” or perforation in this setting.

The declining routine use of atherectomy, cutting balloon atherotomy, or laser angioplasty might also reduce the risk of mechanical complications. The Mayo Clinic group (10) reported that the use of atheroablative devices was the most common cause of coronary perforation in their interventional program. A meta-analysis (11) of 16 randomized trials of atherectomy, cutting balloon atherotomy, or laser angioplasty versus balloon angioplasty in 9,222 patients showed an increased risk of major adverse cardiac events at 30 days (5.1% vs. 3.3%; odds ratio [OR] 1.54, 95% confidence interval [CI] 1.25 to 1.89) but no reduction in emergency bypass surgery (1.1% vs. 0.9%; OR 1.18, 95% CI 0.75 to 1.78) or angiographic restenosis (38.9% vs. 37.4%; OR 1.06; 95% CI 0.97 to 1.17).

When extraordinary mechanical complications occur during PCI, a panoply of innovative percutaneous treatments now exists to avert the need for emergency bypass surgery. Free coronary perforations can be classified as progressively recanalization of chronic total occlusions, up to 4% of patients have had cardiac tamponade and up to 18% have had vessel perforation (9). Using a reversible anticoagulant (e.g., unfractionated heparin) and avoiding clopidogrel pre-treatment or GP IIb/IIIa inhibitors might reduce the consequences of “wire exit” or perforation in this setting.

The declining routine use of atherectomy, cutting balloon atherotomy, or laser angioplasty might also reduce the risk of mechanical complications. The Mayo Clinic group (10) reported that the use of atheroablative devices was the most common cause of coronary perforation in their interventional program. A meta-analysis (11) of 16 randomized trials of atherectomy, cutting balloon atherotomy, or laser angioplasty versus balloon angioplasty in 9,222 patients showed an increased risk of major adverse cardiac events at 30 days (5.1% vs. 3.3%; odds ratio [OR] 1.54, 95% confidence interval [CI] 1.25 to 1.89) but no reduction in emergency bypass surgery (1.1% vs. 0.9%; OR 1.18, 95% CI 0.75 to 1.78) or angiographic restenosis (38.9% vs. 37.4%; OR 1.06; 95% CI 0.97 to 1.17).
use of rotational atherectomy for proximal calcification. The use of improved guide-catheter support along with "buddy wire" (15), “buddy balloon” (16), or proximal stent-paving might overcome proximal tortuosity that prevents stenting of spiral dissections. Undilatable lesions might respond to the (selective) use of cutting balloon atherotomy (17), rotational atherectomy (18), or excimer laser angioplasty (19). No-reflow—a problem that should never be referred for emergency bypass surgery—is reduced dramatically in saphenous vein grafts with distal protection devices (20,21) and can be arbitrated with pharmacologic agents such as verapamil or adenosine. Stent closure in coronary bifurcations can be almost completely eliminated by using simultaneous “kissing” balloons and provisional sidebranch stenting (22).

The innovative methods for handling PCI misadventures and low rates of emergency bypass surgery might engender the hubris that on-site surgical facilities are not necessary. Although direct PCI for acute myocardial infarction might be justified in experienced centers without on-site surgery because thrombolytic therapy for acute myocardial infarction is so inferior (23–25), this does not justify elective or urgent PCI without surgical back-up. Emergency referrals in most centers will likely be higher than at a premier interventional center like the Mayo Clinic. The case-fatality rate would also be higher if transfer to a “cold” off-site surgical team for emergency bypass surgery is made over the phone without the possibility of on-site assessment. Such a logistic challenge could reverse the favorable trend in lower in-laboratory deaths from 0.4% to 0.2% at the Mayo Clinic from 1979 to 2003 (1).

After all stopgap measures are exhausted and referral for emergency bypass surgery becomes certain, the hard work really begins for the interventional cardiologist. The concept of a “hand off” is a myth. Instead, the interventional cardiologist becomes a critical member of the operating-room team to manage antithrombotic therapy, oversee the expeditious retrieval of device fragments, and hold discussions with the patient’s family. The postoperative period is marked by a high incidence of myocardial infarction, congestive heart failure, and complex arrhythmias (1); therefore, full-time cardiology care is required. Respiratory failure, probably representing a component of multisystem organ failure, is a common cause of death after emergency bypass surgery (1); thus, early consultation with critical-care specialists is recommended.

In closing, stents have reduced the need for emergency bypass surgery for the simple reason that they are a mechanical solution to a mechanical problem. Pharmacology has arguably played an adjunctive role. The report from the Mayo Clinic (1) presents sobering statistics about persistently high mortality after emergency bypass surgery for failed PCI. This report does not inculpate emergency bypass surgery, which is lifesaving for the majority of those who need it, but has established an important benchmark for interventional practice and should stimulate the exploration of further enhancements of PCI technique and safety.

Reprint requests and correspondence: Dr. John A. Bittl, Ocala Heart Institute, Interventional Cardiology, 13013 Highway 475, Ocala, Florida 34480-8503. E-mail: jabittl@aol.com.

REFERENCES


