

## EDITORIALS

## Intraoperative Angioplasty in the Treatment of Coronary Artery Disease

ELLIS L. JONES, MD, FACC, SPENCER B. KING, MD, FACC

Atlanta, Georgia

Since Gruentzig's original description of the use of percutaneous transluminal coronary angioplasty in selected patients, there has been intense interest in extending the indications to include many subsets of patients with coronary artery disease. One logical extension of this procedure is the use of angioplasty under direct vision in combination with coronary artery bypass surgery.

**Indications.** Whereas candidates for percutaneous coronary angioplasty usually have early symptoms of ischemia (a situation that maximizes chances of soft, easily compressible atheromatous lesions), patients for intraoperative angioplasty usually have well established multiple obstructions involving significant portions of the artery. Theoretically, intraoperative angioplasty would be the best procedure for patients with multiple segmental coronary artery lesions or with obstructions that are difficult to approach with normal bypass techniques. For anatomic locations in which the arterial obstructions are inaccessible to usual coronary bypass techniques (left anterior descending artery in the apical fat pad, distal right coronary artery at or near the interventricular-atrioventricular groove junction or proximal left anterior descending artery adjacent to septal perforators), the use of intraoperative angioplasty would have special significance.

In addition to the treatment of multiple segmental or inaccessible obstructions, intraoperative angioplasty can occasionally be used to accomplish internally what would be difficult to accomplish externally. Heavily calcified or fibrotic arteries, for example, are often difficult to enter safely for performance of either isolated or sequential bypass grafts. Surprisingly, in this situation intraoperative angioplasty has been successfully used to compress plaque of very diseased

proximal arteries that are far removed from the arteriotomy site.

Intraoperative dilations performed at our institution primarily involve the left anterior descending artery and posterior descending branch of the right coronary artery. Arterial diameter down to 1.5 mm presents no unique limitation, and obstructions in the midportion of the posterior descending branch of the right coronary artery have been dilated with satisfactory results.

Although intraoperative angioplasty appears to be a promising adjunctive procedure to the surgical treatment of coronary disease, it probably should not be employed if good sequential grafting is possible. Multiple obstructions of the proximal and midanterior descending coronary artery, which can be readily handled with sequential grafting, should be treated with this technique until long-term results of balloon angioplasty can be evaluated. Preliminary observations of percutaneous angioplasty at our institution suggest that the restenosis rate within the first 6 months is approximately 30% and therefore intraoperative angioplasty may be less satisfactory than additional grafting procedures. Stenoses located at the junction of the diagonal and anterior descending arteries probably should not be treated with intraoperative angioplasty because, as with the percutaneous approach, there is danger of compressing plaque into the diagonal branch.

**Technique.** The technique of intraoperative coronary angioplasty is simple and time to perform the procedure on average requires less than 10 minutes per obstruction dilated. Operative localization of the site for angioplasty can sometimes be difficult and is best done from a combination of the coronary arteriogram and external inspection or palpation. Obstructions in the apical fat pad or distal right coronary artery near the atrioventricular nodal artery can be identified by passing a small 1.0 mm metallic probe distal to the arteriotomy until the obstruction is encountered. This distance is carefully measured and a 2.0 or 3.0 mm balloon catheter is passed through the arteriotomy to the desired level. Regardless of which artery is dilated, the arteriotomy incision should not be placed close to the area for dilation,

From the Divisions of Cardiothoracic Surgery and Cardiology, Woodruff Medical Center, Emory University School of Medicine, Atlanta, Georgia.  
Address for reprints: Ellis L. Jones, MD, Emory University Clinic, Division of Cardiothoracic Surgery, 1365 Clifton Road Northeast, Atlanta, Georgia 30322.

because a tear may occur in the arteriotomy site after balloon inflation. The catheter is passed distally or proximally until the balloon bridges the obstruction. A hand-held saline-filled syringe is used to inflate the balloon to 4, 6, 8 and 10 atmospheres of pressure. Peak pressure at 10 atmospheres is held for 20 seconds. A total of three inflations is made over each obstruction. Once completed, the catheter is removed and the saphenous vein anastomosis is performed in the usual fashion.

This technique does not allow for fluoroscopic visualization of the passage of the angioplasty catheter. This deficiency has concerned us but has not been a problem thus far, perhaps because of the lesions selected and the direct passage of the balloon catheter. Postdilation arteriograms have not been employed to evaluate angioplasty results in the operating room because of the expense of equipment, danger of infection to the patient and the added myocardial ischemic time necessary to evaluate results. All patients having operative angioplasty, however, have been recatheterized on the 7th day after surgery just before hospital discharge.

**Clinical results.** We now have complete data on 14 consecutive patients having intraoperative angioplasty for multisegmental or difficult to approach atherosclerotic coronary lesions. All but two involved dilations of the proximal and distal left anterior descending artery. In these 14 patients, the average preoperative diameter stenosis was 50% (range 43 to 71) and the average diameter stenosis following intraoperative dilation was 26% (range 4 to 52), a mean improvement in diameter stenosis of 33%. In four patients improvement in diameter stenosis was less than 20%. It was interesting that both patients having dilation of

the right coronary system had insignificant improvement in the stenosis after dilation.

**Complications.** Potential complications of intraoperative angioplasty are essentially those of sudden vessel closure due to dissection, spasm or hemorrhage into the arterial wall. Late complications relate to recurrent stenosis. We have noted no acute complications of the procedure and follow-up has not been sufficient to comment on occurrence of late problems. Initially, one of the primary reasons for failure of intraoperative angioplasty was the use of a balloon too small for the dilation. Selection of balloon size is best made from the preoperative arteriogram because vessel diameters change significantly in the cooled anoxic heart.

**Clinical applications.** Before intraoperative angioplasty is used routinely, more extensive, carefully controlled clinical trials should first be performed. Indiscriminate use of the procedure on all types and locations of obstructive lesions will probably yield uniformly poor results. Intraoperative angioplasty can be performed very smoothly and rapidly, but in most situations probably offers no advantage over multiple grafting procedures to the artery involved. The procedure has its greatest application in the treatment of obstructions that are inaccessible with normal grafting procedures or in arteries having multiple segmental lesions when balloon dilation can be used with multiple grafting techniques.

Intraoperative angioplasty may prove to be a substantial addition to the treatment of selected patients with diffuse coronary artery disease. Its ultimate value, however, will depend on the patency rate of the dilated arterial segments. Only further observation will determine whether the procedure will endure the test of time.