

# Update in Cardiac Surgery

*Highlights from the 31st Annual American College of Cardiology Cardiovascular Conference at Snowmass January 17-21, 2000, Snowmass, Colo.*

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The 31st Annual American College of Cardiology Cardiovascular Conference was a broad review of evolving clinical cardiology. Over the years, a consistent theme of meetings has been progress in revascularization and valvular surgery. This year was no exception, with the surgical review focusing on 3 evolving techniques:

- Use of the radial conduit.
- A new percutaneous means of venous arterialization.
- Off-pump bypass and revascularization in patients who have diabetes mellitus.

## Radial Artery Conduits

Hendrick B. Barner, MD (Washington University School of Medicine, St Louis), reviewed the current experience with a long-used revascularization conduit, the radial artery, which was considered an alternative to the saphenous vein almost since the initiation of direct bypass surgery. The experience with this conduit was poor during the early 1970s, with 5-year patency rates reported as low as 50%. During the 1990s, use of the radial artery was reintroduced because of several advantages

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## Main Points

- The radial artery can have advantages over other choices as a revascularization conduit.
- Use of percutaneous in situ coronary venous arterialization may substantially improve myocardial blood flow.
- Recent technical developments have boosted advantages for off-pump coronary bypass surgery.
- At the present time, in patients with diabetes, bypass surgery is more likely to provide better revascularization and outcomes than is angioplasty.

over other conduits: it can be harvested simultaneously with other conduits and to lengths greater than 20 cm; hand ischemia is reported to be very rare; 2 arteries can be harvested; and wound healing is excellent, especially compared with double internal thoracic artery harvesting.<sup>1,2</sup> Based on the Allen test, the radial artery can be harvested in about 95% of patients who have coronary heart disease. One downside is that 5% to 10% of patients report a sensory disturbance over the dorsum of the hand, although this is generally not of great functional significance. In addition, the media of the radial artery is thicker than other arterial conduits, which increases harvest spasm. Most surgeons use topical and intraluminal papaverine to reduce spasm; diltiazem, amlodipine, nitrates,

and milrinone may also be effective.

The radial artery can be used in combination with any other conduit (commonly, the left internal thoracic artery and saphenous veins). Nine studies have published patency rates for the radial artery conduit, ranging from 78% to 100% at a follow-up of 1 week to 66 months. Only 2 studies have reported follow-up to 5 years. The patency rates in these 2 studies were 83% and 87%, far better rates than the average for saphenous vein conduits but perhaps not as good as the rates for internal thoracic arteries. In these 2 studies, the patient survival rates were 92% and 97%, with associated 90% freedom from angina. The radial artery appears to be more sensitive to competitive flow than is the internal thoracic artery, with declining patency

when coronary stenosis is less than 80%. Although no randomized studies to date have compared the use of alternative conduits with use of the internal thoracic artery, use of the radial artery appears to be a reasonable choice.

### PICVA

Stephen N. Oesterle, MD (Harvard Medical School, Boston), reported early experimental results with a new percutaneous revascularization technique termed "percutaneous in situ coronary venous arterialization" (PICVA). The technique involves creation of a coronary arteriovenous fistula proximal to a high-grade coronary stenosis that is unsuitable for percutaneous or surgical bypass, combined with isolation of the venous segment by proximal and distal intraluminal occlusion. This allows arterialized blood to flow retrograde through the isolated venous segment, perfusing the ischemic myocardial region. At the same time, isolation of the venous segment prevents the creation of a systemic arteriovenous fistula that would produce arterial "steal."

Although not yet tested clinically, early experimental results are promising. A mid-left anterior descending coronary occlusion was created in a swine model, and the PICVA revascularization technique was performed on the isolated anterior interventricular vein in half of the swine. Within 2 hours of arterial occlusion, 83% of the control animals had died, but 83% of the revascularized animals survived 1 week. Troponin I levels were significantly higher in the surviving control animals, compared with those undergoing the PICVA procedure. Dr Oesterle concluded that technical progress with this approach has been sufficient to warrant testing in humans who are

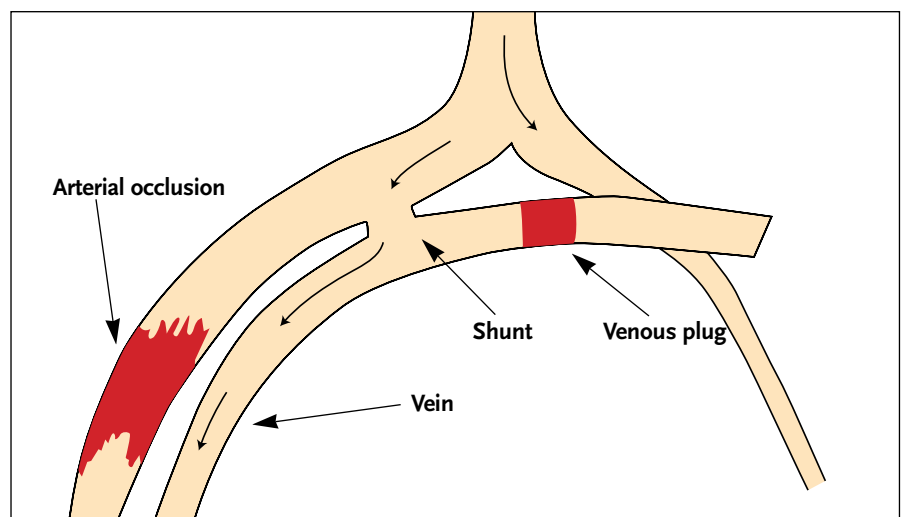
not candidates for currently available revascularization techniques. Unlike transmyocardial laser revascularization and the early results of growth factor therapy, the PICVA technique appears to substantially improve myocardial blood flow (Figure).

### OPCAB

Tirone E. David, MD (University of Toronto), and Andrew Wechsler, MD (MCP Hahnemann University, Philadelphia), described the current status of off-pump coronary artery bypass (OPCAB). Off-pump bypass surgery has been performed for almost 3 decades, but beating heart surgery through a minimal incision (minimally invasive direct coronary artery bypass [MIDCAB]) has produced a flurry of recent interest.<sup>3,4</sup> Although no randomized trials of the standard and MIDCAB techniques have been reported, many groups have experienced reduced graft patency rates with the MIDCAB technique, compared with the historical experience, which used the standard approach involving internal thoracic artery anastomosis to the left anterior descending coronary artery. Although

the minimally invasive portion of the MIDCAB technique has not lived up to expectations, the OPCAB approach has many advantages that can be more easily realized through recent technical developments. Potential advantages for OPCAB are shown in the Table. Through the use of recently developed techniques for immobilization of the coronary artery during distal anastomosis, the quality of the bypass appears to be equivalent.

An area of great current interest is the development of robotic approaches to coronary anastomosis. Another advance is the development of the sutureless anastomosis. A nitinol device has been developed that can connect the graft to the aorta within seconds without sutures. Experimental results have been excellent, and the approach has similar potential for performing distal anastomoses. Currently, OPCAB surgery can be used for many patients undergoing bypass surgery, with complete multivessel revascularization usually possible. In one practice, 86% of patients are being treated with this approach. Both Drs David and Wechsler called for the initiation of ran-



**Figure.** The percutaneous in situ coronary venous arterialization technique.

Table

**Potential Advantages of Off-Pump Coronary Artery Bypass**

- Avoidance of the cost and complications of cardiopulmonary bypass
- Less systemic inflammatory response
- Decreased heparin requirements
- Less blood loss
- Shorter operations
- Probable reduced hospital length-of-stay
- No forced period of relative hypotension
- No global myocardial ischemia
- Less postoperative atrial fibrillation
- Less cognitive impairment

domized trials to compare standard with OPCAB bypass surgery.

**Diabetic Patients**

Spencer B. King III, MD (Emory University, Atlanta), and Bernard J. Gersh, MB, ChB, DPhil (Mayo Medical School, Rochester, Minn), summarized the status of revascularization of patients with diabetes mellitus. An important finding in the Bypass Angioplasty Revascularization Investigation (BARI),<sup>5</sup> which compared the outcomes of patients randomized to bypass surgery or angioplasty, was a 5-year all-cause mortality rate of 35% in patients treated with angioplasty and

of 19% in patients undergoing bypass surgery. Interestingly, this marked difference in survival was not observed in 2 large data registries from Duke and Emory Universities, nor was it found in the Emory Angioplasty Revascularization Trial (EAST).

The explanation for a better outcome with bypass surgery in the BARI study may lie in the differences between the 2 groups in vascular biology and clinical status. Patients with diabetes appear to have both greater smooth muscle cell proliferative responses to balloon injury and more reverse arterial remodeling. Also, they do not have as much compensatory ar-

terial enlargement associated with atherosclerosis and therefore develop more diffuse disease. After angioplasty, the arteries of diabetic patients contract more, increasing restenosis. At the same time, diabetic patients tend to have more triple-vessel disease, diffuse disease, left ventricular dysfunction, and comorbidities. In these situations, bypass surgery is more likely to provide complete revascularization and better outcomes. At the present time, advanced coronary artery disease is probably better managed with bypass surgery. A second BARI trial, focusing on patients with diabetes, has been started in an attempt to resolve this issue. ■

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