

# Technique and results with side-to-side anastomoses

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The technique that we have used exclusively for multiple vein graft procedures during the past 5 years consists of an end-to-side anastomosis of the vein to a coronary branch, coiling the vein around the heart with a side-to-side anastomosis at each target coronary, and ending with the aortic anastomosis. This has been referred to as the "snake graft."

The end of the vein is cut in an S-shaped manner and sutures are usually placed on opposite sides of the resulting oval, rather than at the tip and the throat. All coronary anastomoses are done with 6-0 Prolene by tying at one end of the coronary incision, doing all of one side and half the other with one needle, and the remaining quarter with the other. For multiple grafting on the diaphragmatic surface, the vein is incised transversely. It is important that this be less than one third the circumference of the vein.

The myocardium is protected by clamping the aorta, pouring cold solution in the pericardium, and temporarily filling the left ventricle with cold solution through the apical vent. After each coronary anastomosis, the ventricular cavity is refilled. This expands the heart to its maximum diastolic dimensions and permits an

accurate estimate of the length of vein segments, which is critical.

Usually a direct route is chosen from one anastomosis to the next. An exception is the route from the anterior descending to a diagonal branch from the anterior approach. Here a gentle curve is permitted to prevent angulation at the diagonal.

The proximal segment is critical. Marking sutures are placed near the anterior descending and on the aorta. A suture is placed where we want the vein to go before going on bypass and collapsing the chambers. The vein is later cut according to this measurement.

The aortic anastomosis is done by removing a triangular button of aortic wall with the apex toward the patient's left. The end of the vein is cut transversely and a longitudinal incision is made for about 10 mm. The anastomosis is done with 5-0 Prolene placed in halves.

Routing the graft is important. In general, we have avoided going along the left side of the heart. A graft to the left marginal or even a wide diagonal is routed across the diaphragmatic surface of the heart and around the acute margin. The posterior descending artery is preferred to the distal right coronary artery.

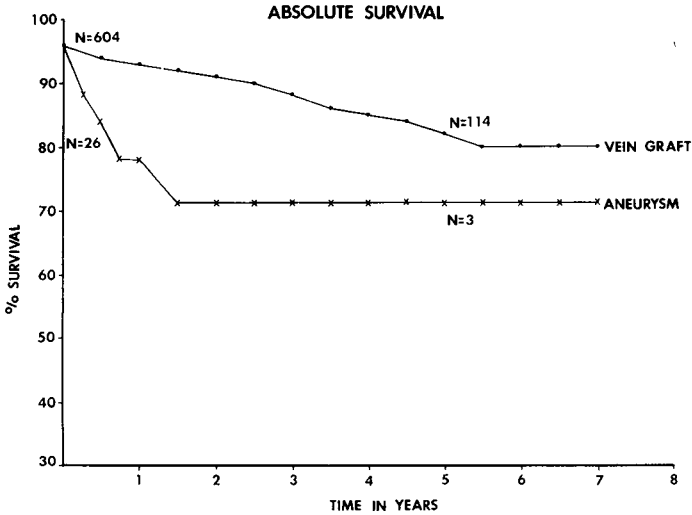
The results have been satisfactory. The operative mortality in the vein graft series was 3.9% (23/591). There was a steady decline from 6% (9/147) during 1970-1972, to 0.7% (1/149) in 1976 and early 1977. The mortality among aneurysm patients was 3.7% (1/27). Earlier the mortality was higher among patients with poor ventricular function, but recently it was 0 among the 14 with ejection fraction below 0.30, and 1 of the 139 with it above 0.30.

The average number of grafts per patient has increased from 1.8 in the early period to 2.5 in 1975, 2.8 in 1976, and 3.4 in 1977. The quadruple was the most common procedure in 1977.

We feel that follow-up arteriography is important and have obtained it on 95.7% of the 515 patients who survived surgery and completed the third postoperative month by mid-1977. The patency of the side-to-side anastomoses has varied from 93% to 97% during the years. It was 96% (592/619) for the whole series. Patency of the distal ends of the snakes was between 84% and 90% and averaged 88% (312/356) in the whole series. The patency of end-to-side anastomoses of the Y grafts done prior to April 1972 was 87% (179/206). Earlier the patency for single grafts was 88%. It has climbed recently since single grafts have only been done in patients with very large runoff beds, and is now 93% (75/81) for the whole series. Individual grafts to a diagonal branch in addition to a snake have done poorly in a small series (4 of 7). The all important proximal segment patency has ranged from 95% to 98% over the years, and averaged 96% (341/356).

As the number of grafts per patient increased steadily and the patency remains relatively constant, the average number of patent grafts per patient has increased steadily. It was 1.6 from 1970 to 1972, 2.1 from 1972 to 1974, 2.3 in 1975, 2.7 in 1976, and 3.2 in early 1977. This is the most important of the indices for comparative purposes.

Reoperation from 1970 to 1972 after mammary pedicle implants resulted in an operative mortality of 4 of the 6. Since then, none of 12 have



**Figure.** Side-to-side anastomosis.

been lost. Fifteen of the 17 grafts were patent. One patient was lost during reoperation of the 10 who previously had vein graft surgery. All of the nine grafts that have come to postoperative arteriography were patent.

The results were less satisfactory in women during the early years, but in 1976 and early 1977 an average of 2.7 grafts was attempted on 21 women and 3.1 on 128 men. For unexplainable reasons the patency was 97% in the women and 93% in the men, an average of 2.8 patent grafts per patient in each group.

Perioperative infarctions sufficiently severe to change the QRS complex have consistently been less than 2% over the years.

The mortality among the 244 early vein graft patients comparable to the

mammary pedicle series has been 1.6%/yr, and it can be compared to 7.4%/yr among the 157 single mammary pedicle implant patients ( $p < 0.005$ ). The coronary deaths in the vein graft series were at the rate of 0.7%/yr.

The *Figure* includes all operations attempted since 1970 and shows an annual mortality of 2.7% among the vein graft patients. This is clearly better than that for the aneurysms. The annual mortality would be 1.8%/yr if noncardiac deaths were eliminated.

We would not recommend this technique for teams unfamiliar with coronary surgery, but believe that it has given better results than we could expect with any other technique so far proposed.