passed using the combined technique described above. The postoperative course was uncomplicated, and the patient was adequately palliated, taking all of his nourishment by mouth.

**DISCUSSION**

These cases are indicative of the short time left to patients with this disease, once it is discovered. Palliation is justified only if it is immediate and uncomplicated. The advantages of simultaneous endoscopy and laparotomy are illustrated in these patients. In the first case, passage of the tube into proper position, impacted in the tumor, and its secure placement were facilitated by direct visualization, pushing from above. In a second case, endoscopic dilatation made it possible to pass the tube safely. In both cases a secure position was maintained by fixation of the tube to the abdominal wall. In the authors’ opinion, it is not wise to make a rigid distinction between intubation techniques, i.e., push vs pull. Emphasis should be placed upon the combined technique of endoscopy with laparotomy which adds to the safety of the procedure and reduces the likelihood of complications from improper placement or tube migration.

**REFERENCES**


**Spontaneous Graft Closure in Anomalous Origin of the Left Coronary Artery**

*Courtney L. Anthony, Jr., M.D.; Hugh A. McAllister, Jr., M.D.; and Melvin D. Cheitlin, M.D.*

Several reports of successful correction of anomalous origin of the left coronary artery from the pulmonary artery utilizing a graft to the ascending aorta have demonstrated the feasibility of this procedure. The patient described in this report developed prolonged occlusion of the saphenous vein graft with a fatal outcome. This was a result of intimal fibrous hyperplasia identical to that seen in adults following the placement of the saphenous vein bypass graft for treatment of atherosclerotic coronary disease.

A anomalous origin of the left coronary artery from the pulmonary artery is associated with a generally unfavorable prognosis, although survival past infancy related to the presence of adequate intercoronary anastomosis may occur. The high risk of sudden death even in asymptomatic patients has prompted general agreement favoring surgical intervention in spite of an apparently satisfactory clinical course.

Although ligation of the anomalous orifice has been carried out in patients having adequate intercoronary anastomoses with good clinical results, recent reports have favored graft anastomosis of the left coronary artery to the aorta, presumably reducing subsequent risks from atherosclerotic coronary disease and apparently providing a better perfusing pressure. Two cases of graft closure, one early and one late, have been described. These patients demonstrated retrograde filling of the left coronary artery from the right, and it has been postulated that occlusion of the graft should result in the same hemodynamics as simple ligation of the anomalous orifice. This report of a recent patient in whom delayed graft closure resulted in a fatal outcome indicates that this conclusion may not be correct.

**Case Report**

A nine-year-old girl was healthy until 2½ years of age, when she developed congestive heart failure with subsequent good response to administration of digitalis. She remained asymptomatic, and physical examination at nine years of age revealed mild cardiomegaly and a grade 3/6 short systolic murmur along the left sternal border with radiation to the left infraclavicular area. An electrocardiogram showed left axis deviation (−45°) and left ventricular hypertrophy. Small Q waves were present in leads I, aVL, and V6. There were similar findings on a vectorcardiogram, as well as clockwise inscription of the distal limb in the horizontal plane. The chest x-ray film demonstrated slight left ventricular enlargement. Cardiac catheterization revealed normal pressures and no evidence of shunting by oximetry. Hydrogen appearance

**Figure 1A.** Aortic root cineangiocardiogram, early phase with filling of dilated right coronary artery.

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time in the main pulmonary artery was rapid. Cineangiocardio-
graphy demonstrated a large right coronary artery which
arose normally. The left coronary artery filled by way of
multiple intercoronary anastomoses, the largest of which
involved the conal branches of the right coronary artery with
retrograde flow from the left coronary artery into the main
pulmonary artery (Fig 1).

At surgery a segment of autologous saphenous vein was
anastomosed end-to-side to the anterior aspect of the ascend-
ing aorta and end-to-side to the midportion of the left
anterior descending coronary artery. The anomalous con-
nection between the left coronary artery and the pulmonary
artery was ligated. The postoperative course was uncompli-
cated, and there were no further cardiovascular symptoms.

Five months following surgery, cardiac catheterization dis-
closed normal hemodynamics and a normal hydrogen-
appearance time in the main pulmonary artery. Cineangio-
cardiograms showed the graft to be patent with good perfu-
sion of both the circumflex and anterior descending branches
of the left coronary artery (Fig 2). Five months later, the

![Figure 1B](image1.png)

**Figure 1B.** Late frame showing multiple intercoronary com-
munications and delayed filling of left coronary artery system.

![Figure 2](image2.png)

**Figure 2.** Postoperative angiocardiogram. Graft is patent
with good filling from entire left coronary artery distribution.

As patient suddenly collapsed while swimming and was dead on
arrival at a local hospital.

Abnormal postmortem findings were limited to the heart.
There was cardiomegaly (heart weight, 400 gm) with left
ventricular hypertrophy (wall thickness, 1.6 cm) and dilata-
tion. The left ventricular apex was thin (6 mm), and there
was diffuse endocardial fibroelastosis of the left ventricle. A
6.1-cm saphenous vein graft extended from the anterior
aspect of the aorta to the midportion of the left anterior
descending coronary artery. The entire vein wall was
thickened by intimal hyperplasia with almost total occlusion
from the aortic anastomosis distally for 1.9 cm (Fig 3). There
was complete thrombotic occlusion of the distal vein graft
and the left anterior descending coronary which also ex-
tended proximally to involve the initial segment of the left
circumflex artery (Fig 4). The thrombus was organized, with
early recanalization. The intimal hyperplasia was composed
mainly of acid mucopolysaccharide and myxoblasts with no
collagen detectable by Movat's stain. The right coronary
artery was patent and supplied the posterior descending
artery. Microscopic examination of the myocardium revealed
extensive fibrosis involving the left ventricular apex and
lower anterolateral free wall. No areas of acute infarction
were seen.

![Figure 3](image3.png)

**Figure 3.** Marked intimal hyperplasia in proximal vein graft
(A). Portion of aortic wall is present for comparison of rela-
tive thickness (B) (AFIP negative 73-10910; Movat's stain,
original magnification x 14).

![Figure 4](image4.png)

**Figure 4.** Intimal hyperplasia in distal vein graft (A).
Thrombus with early recanalization occluding left anterior
descending coronary artery (B) (AFIP negative 73-10909;
Movat's stain, original magnification x 13).


**Discussion**

In series reporting the use of saphenous vein bypass grafts in the treatment of atherosclerotic coronary artery disease, the rate of graft occlusion within the first postoperative year has been reported as 10 percent to 22 percent.\(^1\) These early occlusions usually resulted from the technical problems related to the small caliber of the coronary artery or to distal atherosclerotic disease with poor runoff. Thus, the unaltered structure of the coronary arterial wall in the child would seem to indicate a favorable prognosis for long-term graft patency.

Two cases of late graft occlusion have now been reported,\(^1\) and in the present case the process involved intimal fibrous hyperplasia identical to that seen in adults.\(^1\) The etiology of this change is unclear but has been thought to be a response of the vein when subjected to arterial pressure.\(^1\) Other factors, such as trauma to the vein segment in removing and preparing it for use as a graft, may also be important. Whatever the explanation, the vein of the child is obviously not immune. The value of alternative techniques, such as the use of prosthetic graft material or anastomosis of the internal mammary artery to the left coronary artery, remains to be determined.

Of greater concern is the fact that occlusion of the graft did not result in the same coronary flow as would have been present had only ligation of the anomalous orifice been performed; rather, there was extensive occlusion of the left anterior descending and circumflex arteries. In most cases reported in which mention was made of the manner in which the distal end of the graft was anastomosed to the left coronary artery,\(^3,4,6,11,15,16\) the anastomosis was made to the main left coronary artery proximal to the bifurcation into the circumflex and anterior descending branches. Thus, both branches were perfused in a physiologic antegrade direction. If an end-to-side anastomosis to the midportion of the left anterior descending artery is performed, flow through the graft must divide into two streams directed totally opposite to each other. It is possible that this flow pattern may result in intimal damage in the artery which could lead to thrombosis. Occlusion of the left anterior descending artery at this point would result in severe compromise of flow to both the distribution of that vessel and also of the circumflex artery, particularly if the intercoronary collateral vessels have regressed. In addition, recent reports have shown extension of the intimal proliferative process across the distal anastomosis into the coronary artery, providing another mechanism by which occlusion of this vessel could occur.\(^1\) Thus, the preferred site for anastomosis would appear to be as far proximal on the main left coronary artery as is technically feasible.\(^1\) Even after successful surgery and reconstruction of a two coronary-artery system, the long-term prognosis for the patient with anomalous origin of the left coronary artery from the pulmonary artery must remain guarded. Careful follow-up of such patients is indicated.

**References**


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