Resecting and Grafting of Coronary Artery Aneurysm

By Paul A. Ebert, M.D., Robert H. Peter, M.D., J. Caulie Gunnells, M.D., and David C. Sabiston, Jr., M.D.

SUMMARY
A 31-year-old patient with symptoms suggesting acute myocardial infarction and subsequently found to have a large aneurysm of the circumflex branch of the left coronary artery is presented. This is thought to represent the first patient treated by resection and grafting of a coronary artery aneurysm by use of an interposed saphenous vein graft. The aneurysm was filled with friable blood clots, emphasizing the hazard of future embolizations. The etiology and indications for surgical resection are discussed.

Additional Indexing Words:
Saphenous vein autograft

Isolated aneurysms of the coronary artery are extremely rare, and many times the etiology is uncertain.1 Aneurysmal dilatation of the coronary artery associated with a fistula between an intracardiac chamber is not uncommon and, in these instances, the aneurysm is thought to be related to the high flow through the fistula. Multiple aneurysmal dilatations of the coronary arteries are seen in patients with advanced arteriosclerotic coronary artery disease, but the clinical significance has been questioned.2,3 In 1966 Björk4 reported a patient with an intramural coronary aneurysm who had reverse flow during systole due to bulging of the thin-walled chamber into the left ventricular cavity. No communication with an intracardiac chamber was seen, and the narrow neck between the side of the coronary artery and the aneurysm was successfully closed at surgery. The present report describes the clinical history and surgical correction of a patient having two episodes compatible with myocardial infarction which were thought to have resulted from peripheral coronary embolization from an aneurysm located in the left circumflex coronary artery.

Case Report
M. S.: This 31-year-old white female housewife was admitted to the Duke University Medical Center on December 7, 1969 with a history of two episodes of severe chest pain occurring within the past 5 months. The patient had been in good health without any known cardiac abnormalities until August 25, 1969, when she developed a feeling of fullness in her left chest which progressed to sharp pain down the left arm. She was hospitalized for 4 weeks, with the initial 7 days on the coronary care unit. The pain gradually subsided. Mild cardiomegaly was observed on chest X-ray, and the electrocardiogram was compatible with a myocardial infarction. She was given digoxin (0.25 mg/day), and 14 days after discharge she developed another episode of severe anterior chest pain requiring an additional 3 weeks of hospitalization. For the following 2 months she remained at home on markedly limited activity. She had several episodes of mild chest pain associated with vomiting. The pain was primarily in the left chest, occasionally radiating into the left arm, and was made worse by lying on her left side. She was referred to this medical center for evaluation. On physical examination the pulse was 68 beats/min and regular; blood pressure was 100/75 mm Hg. Cardiac examination showed a point of maximal impulse in the left mid-clavicular line. Heart sounds were distant. A soft S4 was audible. No

From the Departments of Surgery and Medicine, Duke University Medical Center, Durham, North Carolina 27706.

Received August 11, 1970; revision accepted for publication December 17, 1970.
murmurs or rubs were heard. The remainder of the examination was not remarkable. Hemoglobin was 13.1. Electolytes and urinalysis were normal. Electrocardiogram showed a normal sinus rhythm with low voltage and nonspecific ST and T-wave changes in limb leads and V₆. Chest X-ray and cardiac series showed the left side of the heart to be rather straight. There was a question of some fullness in the pulmonary outflow region. The heart size was within normal limits, and no definite chamber enlargement or abnormal calcifications were identified. Because of the unusual history and the question of previous myocardial infarction, cardiac catheterization was performed, which showed normal pressures and oxygen saturations in all four chambers. Cardiac index was 2.5 liters/min, with an arterial-venous oxygen difference of 4.2 volumes/100 ml. Coronary arteriograms were performed, and the left coronary artery injection showed aneurysmal formation beginning 1 cm distal to the origin of the circumflex coronary artery. This aneurysm measured approximately 10 times the diameter of a normal coronary artery. Beyond the aneurysmal chamber was a fusiform dilatation of the circumflex coronary as seen for approximately 1 cm (fig. 1). The remainder of the coronaries appeared normal. The left ventricle contracted well.

On December 18, 1969, the patient underwent resection and grafting of the coronary artery aneurysm. A left anterior thoracotomy incision was made and the chest entered through the fourth intercostal space. Total cardiopulmonary bypass was accomplished by cannulation of the left femoral artery for arterial return, and venous catheters were placed in the left common femoral vein and in the outflow tract of the right ventricle. The left ventricle was decompressed through an apical vent. A large aneurysm measuring approximately 8 cm in length and 5 cm in diameter was located in the atrioventricular
The numerous small fresh clots of blood are shown adherent to the rough irregular surface of the aneurysm. The proximal opening into the aneurysm was a discrete mildly dilated vessel of good quality and normal appearing intima. The distal branches were of normal size. LV = left ventricle.

Figure 2
Operative photograph showing the anterolateral wall of the left ventricle. The normal anterior descending coronary artery (LAD) can be compared with the aneurysm of the circumflex shown by the arrows. The pulmonary artery (PA) and left atrial appendage (LA) are labeled.

groove in the course of the circumflex coronary artery (fig. 2). The aneurysm began approximately 1 cm distal to the bifurcation of the left main coronary. The proximal part of the circumflex coronary artery was occluded, and the aneurysm was transected at the bifurcation of the circumflex artery into the marginal and atrioventricular branches. The aneurysm was removed from the atrioventricular groove by sharp dissection. On opening, the aneurysm was filled with soft, friable freshly clotted blood, which was loosely adherent to the wall (fig. 3). A reversed segment of autogenous saphenous vein was interposed between the ends of the circumflex coronary artery and anastomosed with continuous 7-0 Tevdek sutures (fig. 4). The clamps were removed and cardiopulmonary bypass discontinued without difficulty. The patient required small amounts of cardiotonic agents during the first 48 hr after operation, but proceeded to make an

Figure 3

Figure 4

The entire aneurysm was excised and a reversed segment of saphenous vein autograft interposed. There was only minimal discrepancy in the size of the autograft and the ends of the circumflex coronary artery. A continuous running suture of 7-0 Tevdek was used to complete the anastomosis.
uneventful recovery. She was discharged from the hospital 16 days after operation, and chest X-rays made 3 months after surgery showed the heart size to be smaller than on preoperative examination (fig. 5). The prominence in the area of the pulmonary outflow tract is no longer noted. A postoperative coronary arteriogram was obtained immediately prior to discharge, and the graft appeared patent with good filling of the peripheral branches of the circumflex (fig. 6). The pathological evaluation of the aneurysm left certain doubts as to its origin. There were islands of inflammatory cells about the wall and some areas of smooth muscle within the aneurysmal wall which are usually not seen in congenital aneurysms. The aneurysm was fusiform in shape and had not developed at a major bifurcation of the coronary tree. It was concluded that the aneurysm was inflammatory in origin, but the exact etiology could not be determined.

Series of posteroanterior chest roentgenograms showing the heart size at the times of acute chest pain in September and October of 1969. The December, 1969, film was taken immediately before operation and still shows some fullness in the area of the left atrium or pulmonary artery. The X-ray taken 8 months after surgery shows the heart to be slightly smaller with some concavity and less prominence along the area of the pulmonary artery.
CORONARY ARTERY ANEURYSM

Comments

Coronary artery aneurysms remain as an unusual finding, and their exact effects on the coronary circulation remain uncertain. Death has been attributed to rupture of coronary artery aneurysms, but peripheral embolization with resultant myocardial infarction has not been emphasized. In the present case, the two episodes of chest pain, weakness, and cardiac enlargement were most likely due to embolization of small thrombi to the peripheral bed of the circumflex coronary artery. There was no evidence at the time of operation of any pericardial adhesions or of previous leakage of the aneurysm or pericarditis. It is not possible to definitely exclude pericarditis as a cause of this patient's symptoms, but the absence of any gross evidence of inflammatory disease in the pericardium so soon after the acute episodes makes peripheral embolization a more likely cause.

There has been considerable discussion in the literature regarding the etiology of aneurysms of the coronary arteries. Approximately half are thought to be atherosclerotic in origin. Other possibilities such as periarteritis, syphilis, septic emboli, rheumatic fever, and subacute bacterial endocarditis are commonly mentioned. Coronary artery aneurysms can be congenital in origin, and death in childhood has been reported secondary to rupture of such aneurysms and occlusion of the distal coronary. However, the finding is unusual in reports of large series of pediatric autopsies. The majority of reported aneurysms seen in childhood have been secondary to the existence of a coronary arteriovenous fistula with shunt and are probably not true aneurysms, but aneurysmal dilatations. Scott classified aneurysms as diffuse or localized, with the diffuse aneurysms always considered congenital. Localized aneurysms could be due to arteriosclerosis or other inflammatory diseases. Embryology of the congenital lesions has been discussed by many authors. The exact causative factor is still unclear. In the present case, the wall was filled with inflammatory cells and the aneurysm was not located at an arterial bifurcation, which Forbus considers critical to the formation of congenital aneurysms of the cerebral circulation. The present patient had normal liver profile and renal arteriogram, with no clinical evidence of atherosclerosis in other vessels or history suggestive of collagen vascular disease.

With the increased number of patients with chest pain undergoing routine coronary arteriography, coronary artery aneurysms may be reported in greater frequency. In the past, these lesions have been mentioned rarely and were of uncertain clinical significance. Daoud and associates have emphasized that these lesions may not be as rare as previously reported. It is apparent in the present case that blood clots were present in the aneurysm and that cineangiography showed marked

Figure 6

Left coronary artery injection obtained 2 weeks after operation. The arrows show the extent of the saphenous vein autograft. The peripheral branches of the circumflex are well outlined.
turbulence and swirling effect within the aneurysm. Thus, the possibility of embolization to the peripheral coronary bed would seem likely. At the time of operation, resection of the aneurysm with end-to-end interposition of a saphenous vein autograft seemed to be the preferred method of treatment. The fusiform configuration and the marked irregularities of the wall made any type of plastic procedure on the aneurysm unattractive. The techniques of end-to-end anastomosis are commonly employed for other types of vascular surgery, and the dilated proximal aspect of the coronary artery was quite similar in size to the autologous vein. The encouraging aspect of the patient's postoperative course has been the reduction in heart size compared to the films taken at the time of her two previous hospitalizations for chest pain. This suggests functional improvement of the left ventricle.

A difficult aspect of preoperative evaluation was the minimal changes seen on the electrocardiogram, which were only nondiagnostic 0.01-sec Q waves in leads II, III, and aV_{F}. No murmurs or rubs were heard, and the heart size was only slightly enlarged radiographically.

This is thought to represent the first patient reported having symptoms compatible with a myocardial infarction treated by resection and grafting of a coronary artery aneurysm. Operative resection in this condition is indicated because of the possibility of rupture or embolization to the distal coronary circulation with resultant myocardial infarction.

References

Resecting and Grafting of Coronary Artery Aneurysm
PAUL A. EBERT, ROBERT H. PETER, J. CAULIE GUNNELLS and DAVID C. SABISTON, JR.

Circulation. 1971;43:593-598
doi: 10.1161/01.CIR.43.4.593

Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 1971 American Heart Association, Inc. All rights reserved.
Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circ.ahajournals.org/content/43/4/593

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Circulation can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Circulation is online at:
http://circ.ahajournals.org//subscriptions/