SURGICAL MANAGEMENT OF GIANT CORONARY ARTERY ANEURYSMS WITH ASSOCIATED FISTULA

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INTRODUCTION

Giant coronary artery aneurysms with fistulas are rare and associated with risk of rupture.1 Fistulas with large left-to-right shunting can be complicated by congestive heart failure, aneurysms, endocarditis, or embolization with myocardial infarction. Because of these significant complications, surgery or intervention with transcatheter closure is recommended in symptomatic patients.

From July 1963 to 2007, Dr. Howell performed 30,000 cardiac or vascular operations at The Methodist Hospital. Among these, three patients who had giant coronary artery aneurysms with fistulas underwent surgical correction. Surgical strategies for correction included aneurysm resection and fistula closure, coronary reconstruction, coronary artery bypass, primary ligation, and hybrid therapy involving aneurysm ligation and transcatheter embolization.

CASE #1

The first patient in this series was a 44-year-old male with a three-month history of progressive fatigue and weakness. On physical examination, we found an enlarged heart with a continuous grade III/VI murmur over the mid sternum, and chest X-ray showed cardiac enlargement with prominent pulmonary vascular markings. Subsequent coronary angiography showed a large aneurysm arising from the proximal right coronary artery (RCA) wich a fismlous communication to the right acrium. The RCA itself had a high origin from the aorta (Figure 1). A 2.5:1 left-to-right shunt at the aerial level was calculated by oximetry.

The fistulous connection from the aneurysm was seen to enter the junction of the superior vena cava and right atrium on the atrium's posterior wall (Figure 2).

Operative management with cardiopulmonary bypass ensued. The fisrula connecting the aneurysm of the right coronary anery and the right atrium was dissected from the surface of the right ventricle. The aneurysm was then opened, displaying the orifice of the fistula and the orifice of the proximal and distal segments of the RCA (Figure 3A). The fistula orifice was obliterated with a continuous suture (Figure 3B), and the normal coronary artery was mobilized and then anastomosed ɷ the orifice of the proximal RCA at its origin from the root of the ascending aorta (Figure 3C). Postoperative angiograms demonstrated obliteration of the fistula with a normal looking right coronary artery (Figure 4).

CASE #2

The second patient was a 72-year-old female presenting with a cough and symptoms suggestive of bronchitis. On physical examination, a

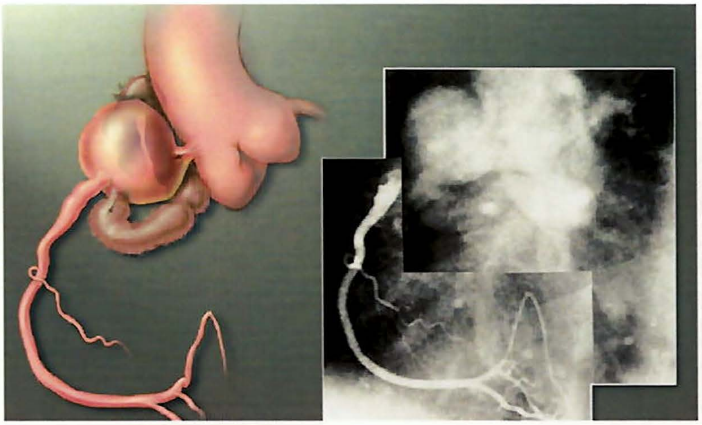


Figure 1. A large aneurysm arises from the proximal right coronary artery (RCA) with a fistulous communication to the right atrium.

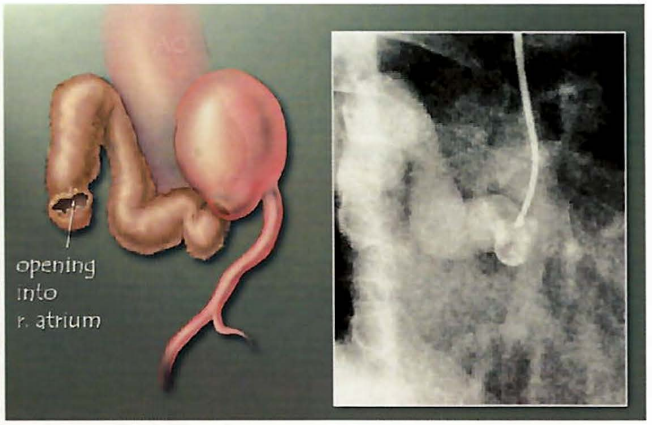


Figure 2. The fistulous connection enters the junction of the superior vena cava and right atrium on the atrium's posterior wall.

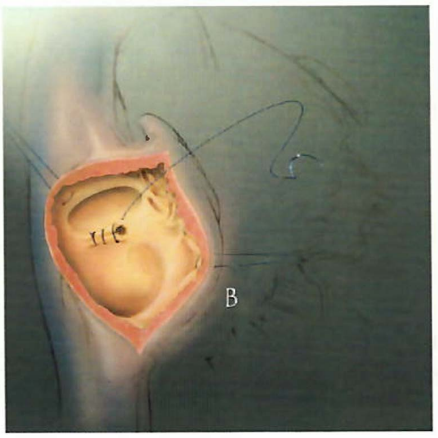


Figure 3A. After dissecting the fistula from the right atrium, the aneurysm is opened to reveal the orifices of the fistula and the proximal and distal segments of the RCA.

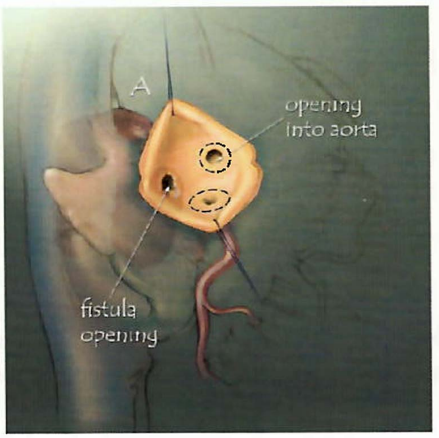


Figure 3B. The fistula exit into the atrium is closed with a continuous Prolene suture to facilitate visualization.

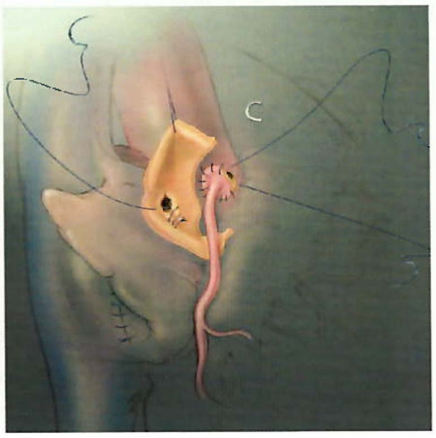
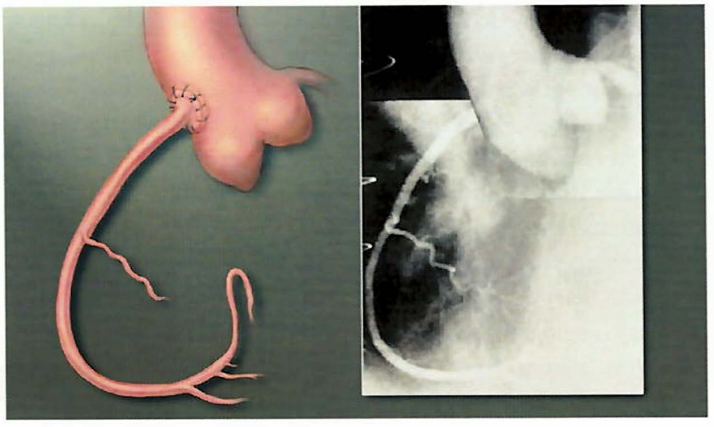


Figure 3C. The fistula orifice is closed with a continuous suture, and the normal coronary artery is connected to the orifice of the proximal RCA at its origin from the root of the ascending aorta.

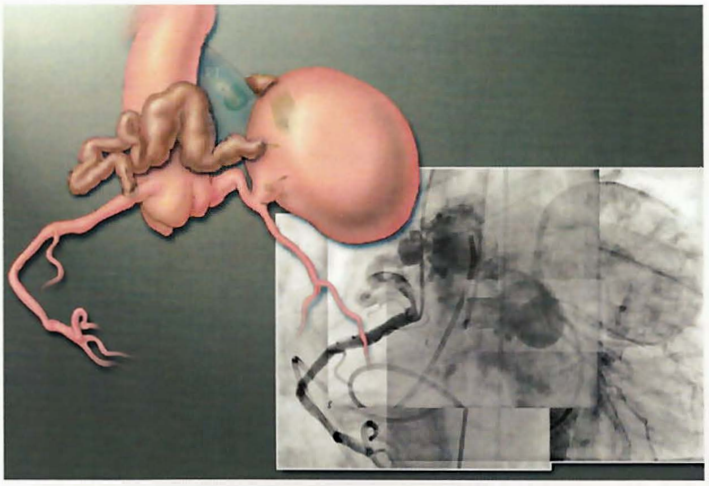
Figure 4. The right coronary artery appears normal in a postoperative angiogram following obliteration of the fistula.



continuous murmur was heard ac che lefc sternal border consiscenc with an arterial venous fistula. A mediascinal mass was seen on chest X-ray, and a CT scan suggested a coronary artery aneurysm. Subsequent coronary arteriography revealed two coronary artery aneurysms, each with a fistula. The most prominent aneurysm arose from the proximal left anterior descending artery (LAD) and expanded into a large 8 cm aneurysmal chamber. This then emptied into a smaller chamber and subsequently into the proximal pulmonary artery. The smaller aneurysm arose from the proximal RCA and drained into the LAD coronary artery aneurysm (Figures 5 and 6). Oximetry did not show an oxygen step-up in any right-sided chambers.

Afcer careful dissection and exploration of the aneurysms, the patient was placed on cardiopulmonary bypass with cardioplegic arrest. The origin of the fistula from the RCA was ligated with 2-0 silk suture. A thrombus was removed from the large aneurysm originating from the proximal LAD artery. Since the origin of this aneurysm could easily be identified, the opening was dosed with two layers of 5-0 Prolene silk (Figure 7). Ir was then oversewn with 4-0 pledgeted Prolene suture. The aneurysm and fistulous tract from the RCA emptying into the left coronary artery aneurysm was obliterated with interrupted Prolene suture (Figure 7).

A communication leaving the LAD coronary artery aneurysm was probed and found to enter the proximal main pulmonary artery. The pulmonary artery was opened, and the communication was dosed from within the pulmonary artery (Figure 8). After excess aneurysm tissue was removed and the arterial wall dosed, cardiopulmonary bypass was terminated. Postoperative angiography revealed normal-appearing coronary arteries with no evidence of residual fistula (Figure 9).



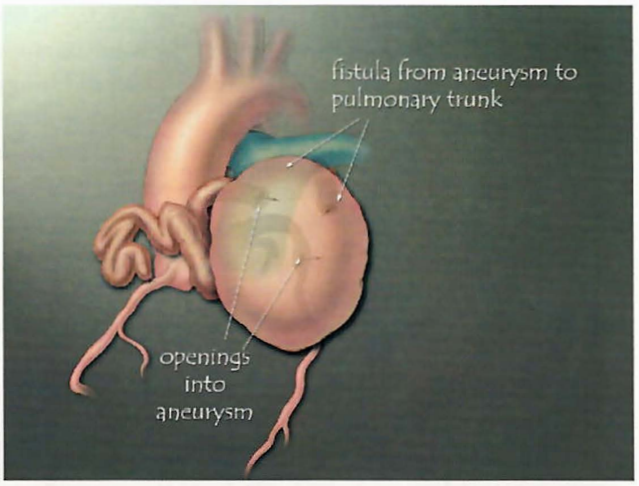


Figure 5 and 6. A coronary arteriography reveals two coronary artery aneurysms, each with a fistula. The most prominent aneurysm arises from the proximal left anterior descending artery (LAD) and expands into an 8 cm aneurysmal chamber that ultimately empties into the proximal pulmonary artery. The smaller aneurysm originates from the proximal RCA and drains into the LAD coronary artery aneurysm.

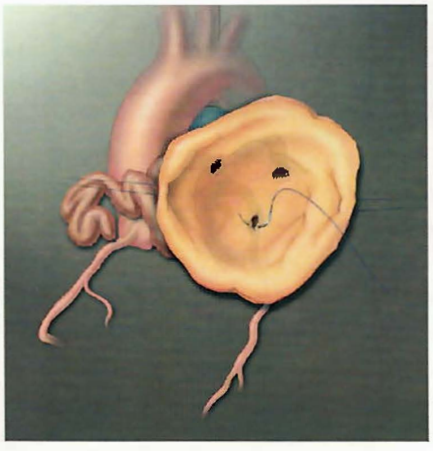


Figure 7. The origin of the fistula from the LAD is closed with two layers of 5-0 Prolene silk and oversewn with 4-0 pledgeted Prolene suture; entrance of right coronary fistula and exit of fistula from aneurysm sac to pulmonary artery is closed with interrupted suture.

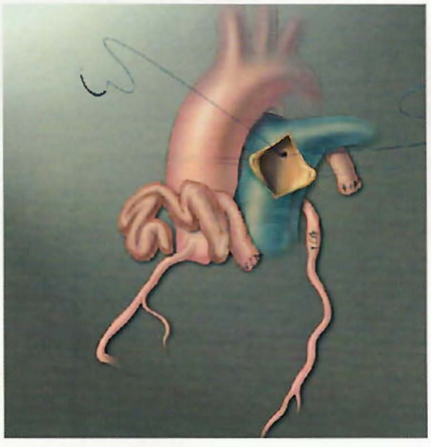


Figure 8. After identifying a communication that entered the proximal main pulmonary artery from the LAD coronary artery aneurysm, the pulmonary artery was opened and the communication closed from within the pulmonary artery.

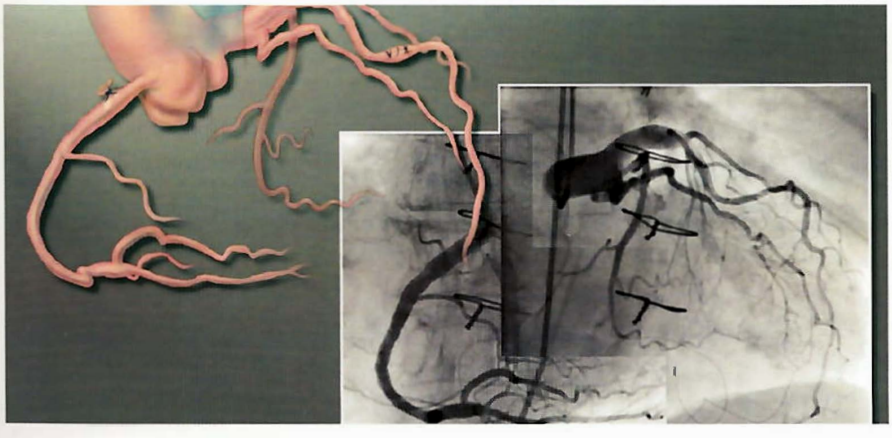


Figure 9. Postoperative angiography reveals normal-looking coronary arteries with no evidence of residual fistula.

CASE #3

The third patient was a 61-year-old male with recent onset of congestive hearc failure. A continuous murmur over the precordium was found on auscultation. Echocardiography revealed a congenital malformation with lefc-ro-right shunting into the right atrium inferiorly. A CT scan demonstrated vascular abnormalities consistent with an arterial-venous malformation, which led us to suspect high-output heart failure. During cardiac catheterization, an oxygen seep-up in the right atrium was recorded and calculated to represent a 3: I left-to-right shunt. A coronary angiogram demonstrated a long RCA aneurysm with a fistulous communication to rhe inferior right atrium (Figure 10). The posterior descending and posterolaceral coronary arteries were normal at their origin from the RCA aneurysm, as were the left main and LAD coronary arteries. The proximal circumflex artery was normal, giving off a moderate-sized first obtuse marginal branch. Distal to chis branch, however, the circumflex became aneurysmal, coursing posteriorly and emptying into the coronary sinus (Figure 10).

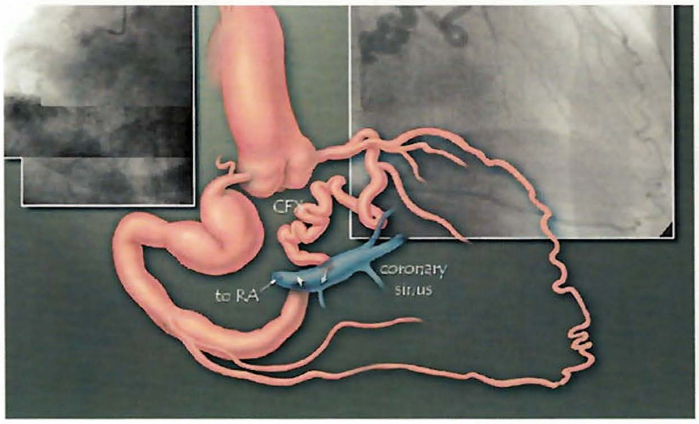


Figure 10. A coronary angiogram shows a long RCA aneurysm with a fistulous communication to the inferior right atrium. The proximal circumflex artery gives off a moderate-sized first obtuse marginal branch; it becomes aneurysmal distal to this branch, coursing posteriorly and emptying into the coronary sinus.

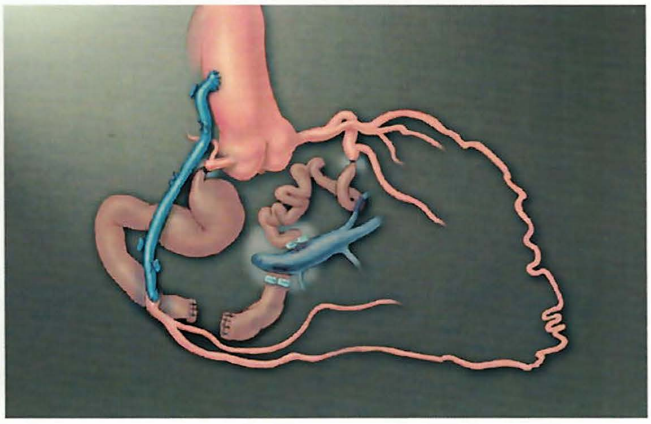


Figure 11. The large aneurysmal RCA is divided just distal to the posterolateral and AV nodal branches, and the proximal and distal ends are ligated along with the fistula connection to the right atrium. The normal posterior descending and posterolateral branches are anastomosed to the ascending aorta using an autogenous saphenous vein graft. On the posterolateral side of the heart, the origin of the remaining arteriovenous fistula is dissected free, doubly ligated, and oversewn between pledgeted sutures.

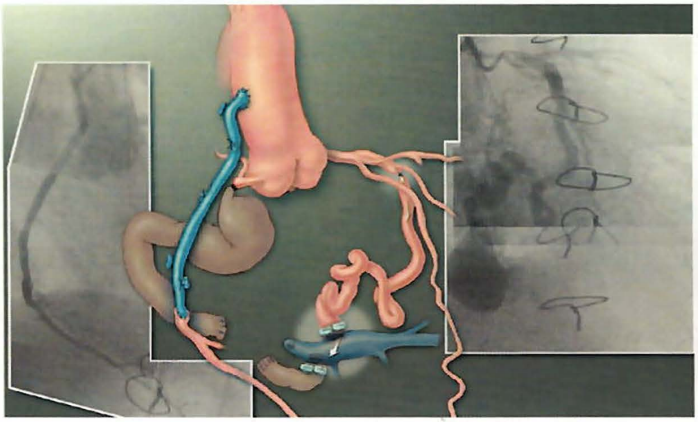


Figure 12. Coronary angiography one year after surgery shows an obliterated RCA aneurysm and fistula with a patent saphenous vein graft to the posterior descending and posterolateral coronary arteries; it also shows a persistent fistula from the distal circumflex to the coronary vein.

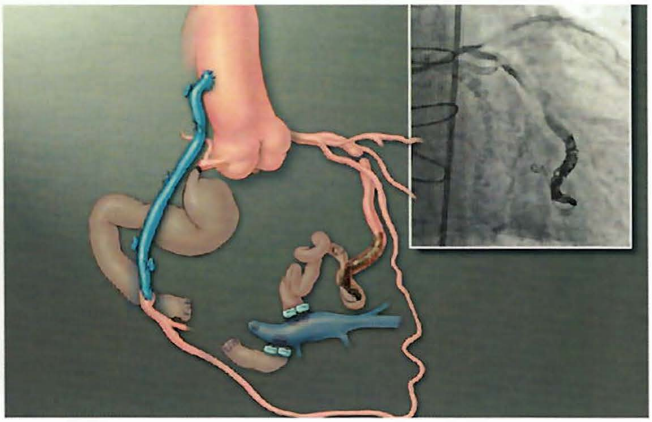


Figure 13. The persistent fistula is treated with coil embolization.

Surgical correction was instituted through a standard median sternotomy incision. The large right coronary aneurysm arose near the origin of the RCA and continued as such to that artery's crux area. At this point, a normal posterior descending and posterolateral artery branched from the main aneurysmal artery. The fistulous portion then emptied into the coronary sinus just distal to the crux area. Cardiopulmonary bypass was then instituted. The large aneurysmal RCA was divided just distal co the posterolateral and AV nodal branches (Figure 11). The proximal and distal ends were ligaced, as was the fistula connection to rhe right atrium. The normal posterior descending and posterolateral branches were then anascomosed to the ascending aorta using an autogenous saphenous vein graft (Figure 11).

We then focused on the posterolaceral side of the heart, where the remaining arteriovenous fistula was identified - originating just distal to the OMl branch of the circumflex artery and emptying into the coronary sinus. The fistula origin was dissected free, doubly ligated, and oversewn between pledgeted sutures (Figure 11).

Coronary angiography one year following the surgery revealed obliteration of the RCA aneurysm and fistula with a patent saphenous vein graft to the posterior descending and posterolareral coronary arteries and normal cardiac function without regional wall abnormalities (Figure 12). Mildly increased cardiac output and index, consistent with a persistent high output scare, was noted at the time of cardiac cathecerization. Coronary angiography revealed a persistent fistula from the distal circumflex co the coronary vein {Figure 12). The decision was made to coil embolize the persistent fistula. This was accomplished successfully (Figure 13). One month later, the pacient remained asymptomacic.

DISCUSSION

Coronary artery fisculas are usually congenital and are recognized in 0.2% of routine coronary arteriograms.2 Levine et al.3 reported that 50% of the vessels originated from the right coronary artery, 42% from the left coronary artery, and 5% from both vessels. Drainage occurred into the right atrium in 41% of paciems, into the pulmonary artery in 17%, into che coronary sinus in 7%, into che left acrium in 5%, into the left ventricle in 3%, and into the superior vena cava in 1%. Giant coronary artery aneurysms associated wich fisculas are even rarer and carry a risk of rupture. Therefore, surgical intervention should be considered.1

The diagnosis is usually made by the presence of a continuous precordial murmur or a paracardiac mass seen on chest X-ray or CT examination. Younger patients may be asymptomatic, whereas older patients may have symptoms of dyspnea, angina, and fatigue or even overt congestive heart failure, especially in large left-to-right shunts. The diagnosis may be confirmed by cardiac catheterizacion with coronary angiograms, CT angiograms, and/or echocardiography.

Surgical intervention in patients with giant coronary artery aneurysms and associated fistulas consists of closing the fistula site of the coronary artery and closing the distal opening at the receiving chamber or artery. Closure of the distal opening without interruption of the proximal origin can lead to rupture of the aneurysm. It is recommended that the aneurysm or fiscula *be* entered and examined for residual bleeding. Lack of bleeding implies that no residual fistula exists. These operations ideally are performed with the assistance of cardiopulmonary bypass to facilitate closure of the distal openings under direct visualization.

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