

29 29

## CLOSURE OF CORONARY ARTERY FISTULA USING COVERED STENT

MOHAMMED R. ARAFAH, FRCPC, FACP, FACC

Coronary artery fistula is rare, but it is the most common congenital coronary artery anomaly with hemodynamic significance. It usually causes no symptoms in young patients but may be associated with symptoms and complications in older patients. Surgery has been the traditional treatment. In this report, a 36-year-old male who had a coronary artery fistula from the right coronary artery to the pulmonary artery was successfully treated by percutaneous transcatheter technique.

### Introduction

CONGENITAL CORONARY ARTERY FISTULA (CAF) occurs in approximately 1 in 50,000 congenital heart disease patients and 1 in 500 coronary angiography patients.<sup>1</sup> While often asymptomatic in children, CAF may be associated with significant complications.<sup>2</sup>

Many are small and found incidentally during coronary arteriography, whereas others are identified as the cause of a continuous murmur, myocardial ischemia and angina, acute myocardial infarction, sudden death, coronary steal, congestive heart failure, endocarditis, stroke, arrhythmias, coronary aneurysm formation (rupture, emboli), or superior vena cava syndrome. Some of the symptoms or complications are related to the amount of blood loss into the shunt and how much stress is placed on the left ventricle to compensate. Fistulas from the right coronary artery are more common than from the left, and over 90 percent of the fistulas drain into the venous circulation. Most fistulas are single communications, but multiple fistulas have been identified.

From the Department of Medicine, College of Medicine & King Khalid University Hospital, Riyadh, Kingdom of Saudi Arabia

Address reprint request and correspondence to Dr. Mohammed R. Arafah, Department of Medicine (38) College of Medicine & King Khalid University Hospital, P.O. Box 7805 Riyadh - 11427 Tel 467 1161, Fax: Kingdom of Saudi Arabia

### Case report

A 36 year old male presented with a history of anginal chest pain to the cardiology clinic . The patient has no established cardiac risk factors. Clinical assessment revealed no continuous murmur. The electrocardiogram was normal. The echocardiogram did not show abnormal flow . Thallium scintigraphy was suggested but patient preferred to do coronary angiography which revealed a large CAF between proximal right coronary artery and pulmonary artery . Flow appeared significantly faster through the fistulous track than through the distal run off of the RCA (Figures. 1, 2).

After taking all the necessary measurement that revealed a diameter up to 5 mm at the take-off of the fistula. The proximal RCA segment diameter was up to 5 mm proximal to the fistula and 2.2 mm just distally. A 19 mm coronary stent graft was deployed across the take-off of the fistula using 4 mm balloon catheter in aT fashion. However, flow through the fistula remained unaltered. A 6mm by 20mm bypass speedy balloon used to dilated the proximal end of the coronary stent graft that resulted in a complete obliteration of flow across the fistula (Figure.3). Repeat right coronary injection 15 minutes later, revealed persistent complete improved flow to the distal RCA run-off. The procedure was uncomplicated.





**Figure 1:** RCA with LAO Projection showing a large fistula between Proximal Segment and Pulmonary Artery.

### Discussion

Patients with small, clinically silent CAF diagnosed incidentally with echocardiography who have normal electrocardiogram and chest radiograph may be followed conservatively with up to 23% spontaneous closure rate. However, significant CAF has been associated with morbidity and mortality due to "coronary steal" leading to myocardial ischemia and angina, myocardial infarction, congestive heart failure, bacterial endocarditis, fistula rupture and even death, especially in the adult

population.<sup>2</sup> The pathophysiologic mechanism of CAF is myocardial stealing or reduction in myocardial blood flow distal to the site of the CAF connection. The mechanism is related to the diastolic pressure gradient and runoff from the coronary vasculature to a low-pressure receiving cavity. If the fistula is large, the intracoronary diastolic perfusion pressure diminishes progressively.

The coronary vessel attempts to compensate by progressive enlargement of the ostia and feeding artery. Eventually, myocardium beyond the site of



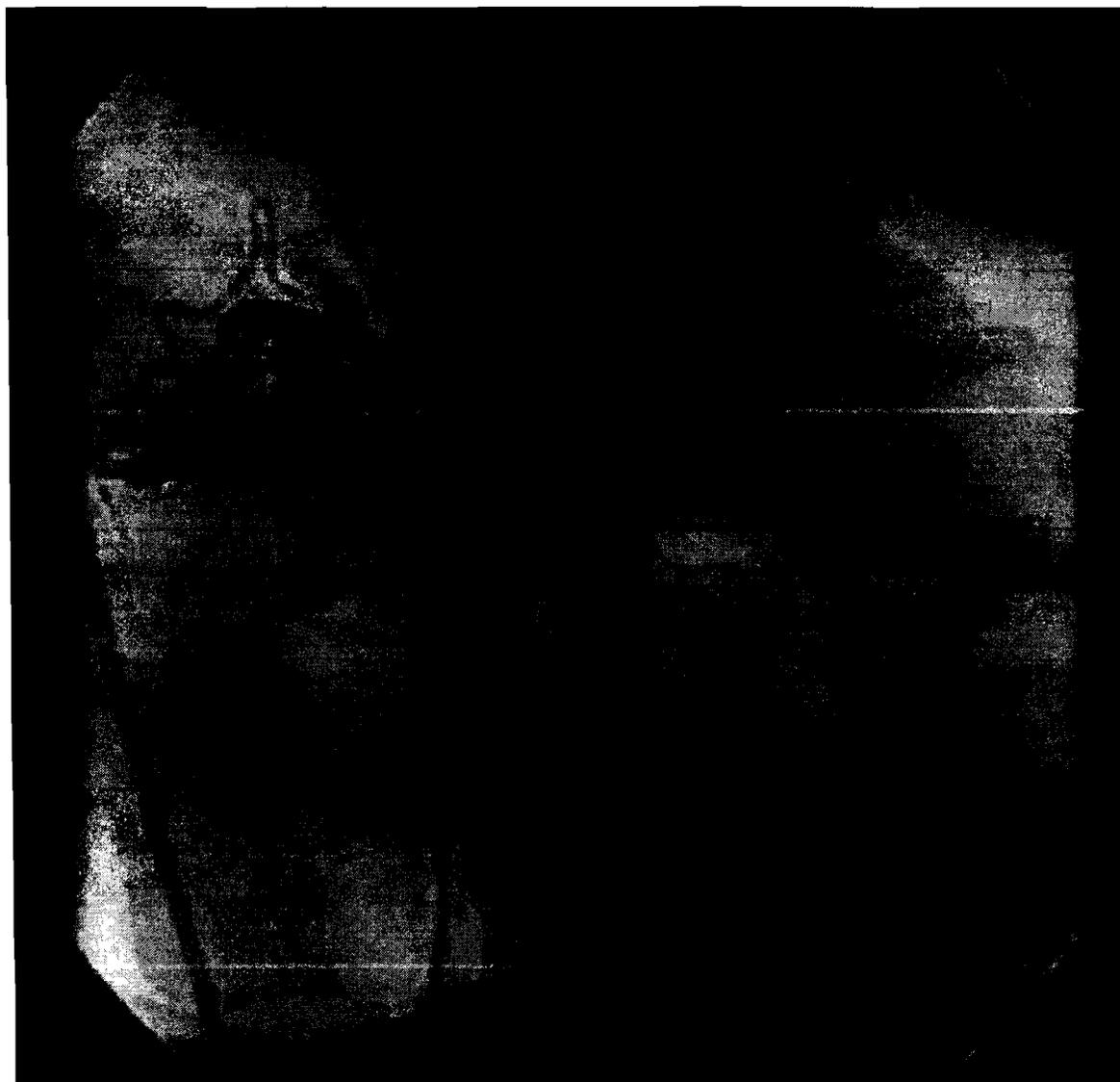


Figure 2. Right Coronary Artery in RHO Project showed the Fistula Communication.

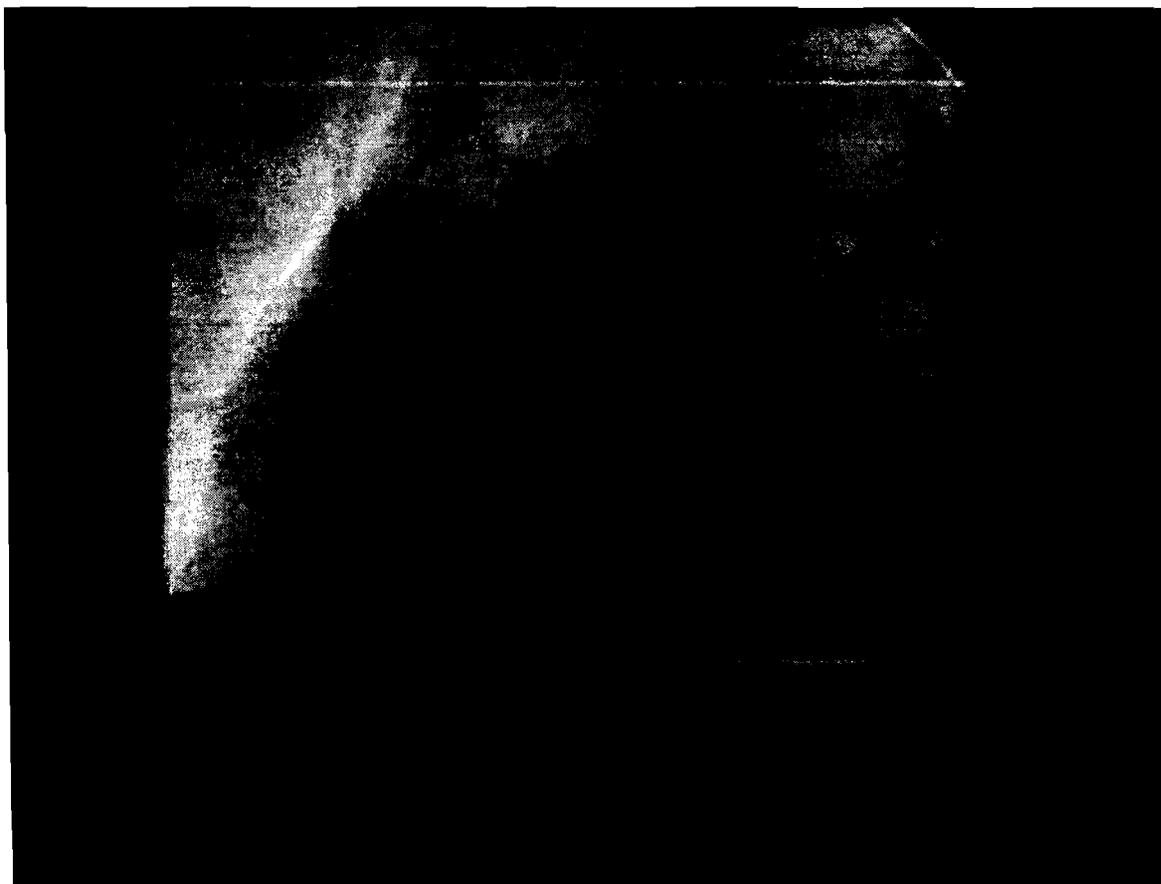
the fistula's origin is at risk for ischemia, which is most frequently evident in association with increased myocardial oxygen demand during exercise or activity. With time, the coronary artery leading to the fistulous tract dilates progressively, which, in turn, may progress to frank aneurysm formation, intimal ulceration, medial degeneration, intimal rupture, atherosclerotic deposition, calcification, side-branch obstruction, mural thrombosis, and, rarely, rupture.

Acquired CAF may occur as a complication of congenital heart disease or bypass surgery, coronary

angioplasty, stent placement or heart biopsy.<sup>1</sup> After the initial report of successful surgical repair in 1947, surgery has been the traditional approach<sup>(6)</sup> until the last few years, when various interventional techniques using coils, stents, balloons and umbrella devices have been increasingly used with very encouraging results.<sup>5</sup>

Surgical ligation, necessitating cardiopulmonary bypass in a significant number of cases, has yielded very good results, but is not devoid of complications, such as transient arrhythmias and ischemic changes, stroke and even death due to





**Figure 3.** RCA in LAO Projection after Fistula Closure

myocardial infarction.<sup>5</sup> Various interventional occlusion techniques have been increasingly utilized in recent years as alternatives to surgery in an attempt to avoid sternotomy and cardiopulmonary bypass and to minimize morbidity and hospital stay. Transcatheter embolization has been associated with uncommon complications, such as transient ischemic electrocardiographic changes and arrhythmias, device embolization and myocardial infarction,<sup>4</sup> as well as 1 reported procedural death due to device recoil into the left main coronary artery.<sup>5</sup>

We report a successful closure of a large symptomatic CAF between right coronary artery and pulmonary artery using a covered stent with a balloon according to the vessel size. The advantage of this approach is to avoid embolization of the coil with its consequences.

Recanalization after complete occlusion of a coronary artery fistula has only been reported after

surgical but not after interventional closure. We present a case of coronary artery fistula recanalization after angiographically documented complete transcatheter occlusion with Gianturco coils. The fistula was successfully managed by transcatheter implantation of a Nit-Occlud system, originally designed for interventional closure of patent ductus arteriosus.<sup>9</sup>

#### References

1. Okubo M, Nykanen D, Benson LN. Outcomes of transcatheter embolization in the treatment of coronary artery fistulas. *Cathet Cardiovasc Interv* 2001;52:510-517.
2. Liberthson RR, Sagar K, Berkoben JP, et al. Congenital coronary arteriovenous fistula. Report of 13 patients, review of the literature and delineation of management. *Circulation* 1979;59:849-854.
3. Sherwood MC, Rockenmacher S, Colan SD, et al. Prognostic significance of clinically silent coronary artery fistulas. *Am J Cardiol* 1999;83:407-411.
4. Armsby LR, Keane JF, Sherwood MC, et al. Management



- of coronary artery fistulae. Patient selection and results of transcatheter closure. *J Am Coll Cardiol* 2002;39:1026–1032.
5. Dorros G, Thota V, Ramireddy K, et al. Catheter-based techniques for closure of coronary fistulae. *Cathet Cardiovasc Interv* 1999;46:143–150.
  6. Mavroudis C, Backer CL, Rocchini AP, et al. Coronary artery fistulas in infants and children: A surgical review and discussion of coil embolization. *Ann Thorac Surg* 1997;63:1235–1242.
  7. Perry SB, Rome J, Keane JF, et al. Transcatheter closure of coronary artery fistulas. *J Am Coll Cardiol* 1992;20:205–209.
  8. Wang NK, Hsieh LY, Shen CT, et al. Coronary arteriovenous fistula in pediatric patients: A 17-year institutional experience. *J Formos Med Assoc* 2002;101:177–182 **Transcatheter Embolization of Recanalized Coronary Artery Fistula with Nit-Occlud Device**
  9. Sotiria C, Apostolopoulou, MD, Pipina Bonou, MD, Spyridon Rammos, MD, PhD Transcatheter Embolization of Recanalized Coronary Artery *J INVAS CARDIOL* 2004;16:215–217

