Pediatr Cardiol 15:308–310, 1994

Pediatric Cardiology

Case Reports

Embolization of a Coronary Fistula with a Controlled Delivery Platinum Coil in a 2-Year-Old

D. De Wolf,[1] M. Terriere,[2] P. De Wilde,[3] and J. F. Reidy[4]

Departments of [1]Pediatrics, [2]Radiology, and [3]Cardiology, Academic Hospital of the Free University of Brussels, Belgium; and [4]Department of Radiology, Guy's Hospital, London, UK

SUMMARY. **Congenital coronary artery disorders are rare. Elective closure is proposed in view of the morbidity reported later in life. Excellent results have been reported with surgery, and recently catheter occlusions have been successful. We report the case of a 2-year-old girl whose coronary artery fistula was occluded with a special controlled delivery coil system.**

KEY WORDS: **Coronary fistula — Catheter closure — Coil embolization**

Congenital coronary artery fistula (CAVFs) are rare, accounting for 0.2–0.4% of congenital cardiac defects [11, 13, 17]. Severe complications can occur [4, 5, 8, 11, 19], and although spontaneous closure has been described [7, 9] most authors favor elective closure of the fistula [1, 2, 19]. Surgery has been the accepted treatment and is associated with low mortality and some morbidity [1–3, 6, 11, 19]. A few cases of successful transcatheter embolization have been reported [13, 15–17]. We report a successful embolization procedure using a new embolization device—a controlled delivery coil—that we believe represents a more controlled and safer embolization technique.

Case Report

A 2-year-old girl presented with an asymptomatic murmur. A superficial continuous murmur grade 4/6 (maximum over the right precordial space) was heard, and prominent left precordial pulsations were present. The peripheral pulses were bounding. The electrocardiogram (ECG) was normal. Echocardiographic evaluation with color Doppler showed a large artery arising from the left coronary system and draining into the right ventricle near the tricuspid annulus. Cardiac catheterization with selective left coronary angiograms showed a large fistulous artery coursing over the posterior and inferior surfaces of the heart before draining into the right ventricle (maximum diameter 4 mm; origin left coronary artery 6.4 mm). The normal coronary branches were poorly visualized, but one small myocardial branch arose distally just before the site of the fistula. The pulmonary/systemic flow ratio was 1.8:1.0.

Intervention was proposed. A 5F catheter was positioned in the proximal left coronary artery and a Tracker 18 catheter (Target Therapeutics, San Jose, CA) was passed coaxially so its tip was just proximal to the site of the fistula. A mechanically detachable coil (MDC) was used to effect the embolization. This specially manufactured device (Target Therapeutics) consists of a platinum coil 0.015 inches in diameter and 5 cm long with an unrestrained diameter of 3 mm. The device has an attaching/detaching mechanism so the coil can be pushed out by an introducer wire but still pulled back into the catheter (Fig. 1). Only when the junction of the coil and the introducer wire are outside the tip of the tracker catheter is the coil detached. A check angiogram confirmed the good position of the MDC and showed that the small myocardial branch was unaffected. Only then was it considered safe to detach the MDC. After 24 h the continuous murmur had disappeared and the color Doppler echocardiogram showed no evidence of a residual fistula. The ECG and cardiac enzymes remained normal. The patient was discharged home 24 h after the procedure.

Discussion

Congenital coronary artery fistula are the most common hemodynamically significant congenital arterial anomalies. They usually occur in isolation and are rare [11, 13, 17]. CAVFs seldom produce symptoms during the first two decades of life, although exceptions have been reported [10]. However, later in life there is a risk of heart failure developing owing to chronic left ventricular volume overload. Myocardial ischemia may be caused by

Address offprint requests to: Dr. Daniël De Wolf, Kindercardiologie, A.Z.-Kinderen VUB, Laarbeeklaan 101, B-1090 Brussels, Belgium.

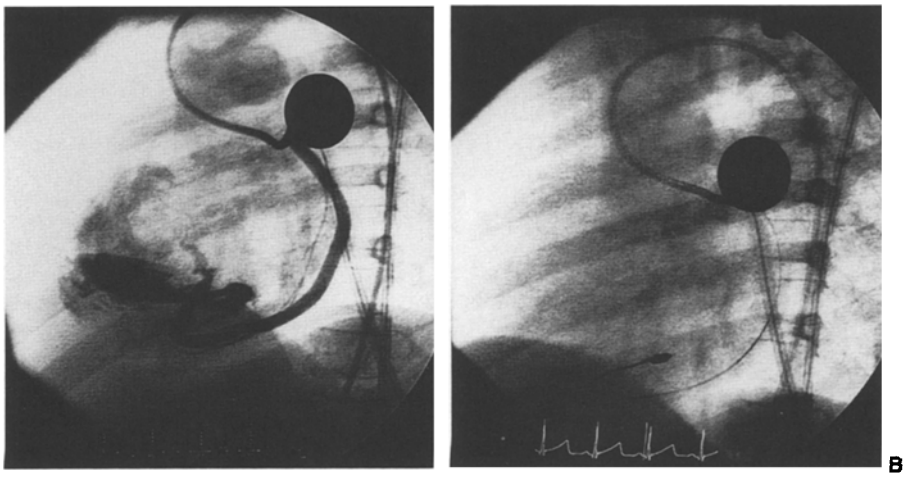

Fig. 1. (A) Selective angiography of left coronary artery with a large feeding artery leading to a fistula into the right ventricle. A distal coronary branch is visible. (B) Controlled delivery coil positioned distal to the coronary branch and still attached and retrievable.

thrombosis or a steal effect from an already compromised coronary area. Rupture and endocarditis have been reported [4, 5, 8, 11, 19].

The diagnosis can be made on clinical grounds and confirmed by color Doppler echocardiography. Catheterization can determine the exact localization of the fistula and the branching of the coronary arteries [10, 12, 18, 20]. Spontaneous closure has been reported in young children with relatively small fistula to the right ventricle, but it is unusual and not predictable [7, 9]. For these reasons surgery has been advocated for all symptomatic coronary artery fistula [1, 2, 19]. Most authors favor elective surgery for asymptomatic coronary artery fistula at the time of diagnosis or before adulthood, as intervention at a later age increases the operative risks and may be too late to prevent the complications [1–3, 6, 11, 19]. A conservative approach for small fistula seems a reasonable option, as there is a small chance of spontaneous closure and complications are probably less likely. For our patient, intervention was chosen in view of the large fistula with a significant shunt. Surgery has been performed for CAVFs, and the mortality is low (0–4%). However, most cases require median sternotomy and cardiac bypass—with a 2-week hospitalization and the associated morbidity (3.6% infarction) [1–3, 11, 19].

Cases of therapeutic embolization of CAVFs have been reported [13, 16, 17], with most of the embolizations performed using detachable balloons or steel coils. Balloon embolization is reversible and effects immediate occlusion, but there is always the risk of early deflation or inadvertent embolization to other sites. Moreover, large nontapered special delivery catheters are needed (minimum 7–8F), which poses a particular problem in young children. Coaxial embolization techniques and platinum coils (0.018 inch) have enabled coil embolization to be more selective and controlled, but when there is a high-flow fistula occlusion may not be effected even with multiple coils. A further problem is that once a coil has been passed through the tip of the delivery catheter the process is irreversible.

Controlled delivery coils (CDC/MDC), together with electrolytically detached coils, represent a major technical advance and are the first coils that can be withdrawn if positioning is not satisfactory. The flexibility of the platinum wire means that a small ball of platinum wire is produced at the delivery point, allowing more precise, effective occlusion. In our case the use of a CDC allowed the coil to be positioned with the potential to reposition or remove it in the event of a clinical, electrocardiographic, or angiographic problem.

Conclusion

When intervention is thought to be indicated for the management of CAVFs, embolization should be the treatment of choice. Improvement in embolization techniques allows even large fistula in young children to be occluded satisfactory. We believe that controlled delivery coils represent a technical advance that will facilitate more effective and controlled occlusion.

References

1. Blanche C, Chaux A (1990) Long-term results of surgery for coronary artery fistulas. *Int Surg 75*:238–239
2. Bogers AJ, Quaegebeur JM, Huysmans HA (1987) Early and late results of surgical treatment of congenital coronary artery fistula. *Thorax 42*:369–373
3. Bonnefoy L, Bonnet H, Scanu P, et al (1990) Infarctus myocardique tardif après fermeture d'une fistule coronarocardiaque. *Ann Cardiol Angiol 39*:457–459
4. Cason BA, Gordon HJ (1992) Coronary steal caused by a

coronary artery fistula. *J Cardiothorac Vasc Anesthesiol 6*: 65–67
5. Doi YL, Takata J, Hamashige N, et al (1987) Congenital coronary arteriovenous fistula associated with dilated cardiomyopathy. *Chest 91*:464–466
6. Efller DB, Sheldon WC, Turner JJ, Groves LK (1967) Coronary arteriovenous fistulas: diagnosis and surgical management: report of fifteen cases. *Surgery 61*:41–50
7. Griffiths SP, Ellis K, Hordof AJ, et al (1983) Spontaneous complete closure of a congenital coronary artery fistula *J Am Coll Cardiol 2*:1169–1173
8. Haberman JH, Howard JL, Johnson ES (1963) Rupture of the coronary sinus with hemopericardium. *Circulation 28*: 1143–1144
9. Hackett D, Hallidie-Smith KA (1984) Spontaneous closure of coronary artery fistula. *Br Heart J 52*:477–479
10. Kimball TR, Daniels SR, Meyer RA, et al (1989) Color flow mapping in the diagnosis of coronary artery fistula in the neonate: benefits and limitations. *Am Heart J 117*:968–971
11. McNamara JJ, Gross RE (1969) Congenital coronary artery fistula. *Surgery 65*:59–69
12. Nishiguchi T, Matsuoka Y, Sennari E, et al (1990) Congenital coronary artery fistula: diagnosis by two-dimensional Doppler echocardiography. *Am Heart J 120*:1244–1248
13. Perry SB, Rome J, Kaene JF, Bain DS, Lock JE (1992) Transcatheter closure of coronary artery fistulas. *J Am Coll Cardiol 20*:205–209
14. Reidy JF, Sowton E, Ross DN (1983) Transcatheter occlusion of coronary to bronchial anastomosis by detachable balloon combined with coronary angioplasty at the same procedure. *Br Heart J 49*:284–287
15. Reidy JF, Jones ODH, Tynan MJ, Baker EJ, Joseph MC (1985) Embolization procedures in congenital heart disease. *Br Heart J 54*:184–192
16. Reidy JF, Tynan MJ, Qureshi SA (1990) Embolization of a complex coronary arterio-venous fistula in a 6 year old child: the need for specialized embolization techniques. *Br Heart J 63*:246–248
17. Reidy JF, Anjos RT, Qureshi SA, Baker EJ, Tynan MJ (1991) Transcatheter embolization in the treatment of coronary artery fistulas. *J Am Coll Cardiol 18*:187–192
18. Shakudo M, Yoshikawa J, Yoshida K, Yamaura Y (1989) Non-invasive diagnosis of coronary artery fistula by Doppler color flow mapping. *J Am Coll Cardiol 13*:1572–1577
19. Wellens F, Deuvaert F, Leclerc JL, Primo G (1984) Coronary artery fistula: an absolute surgical indication. *Acta Chir Belg 84*:339–344
20. Wen MS, Lin FC, Yeh SJ, Wu DL (1991) Doppler color flow imaging in coronary artery fistula. *Am Heart J 122*:1180–1184