

CASE REPORTS

Coronary Artery–Right Ventricular Fistula Treated Surgically

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The several varieties of "coronary arteriovenous fistula" have been detailed by Upshaw (1962). The right coronary artery is more commonly involved than the left and the right ventricle is most often the recipient chamber. Gasul and colleagues (1960) found reports of 12 successful closures of these abnormal communications and added 3 cases from their own experience. Since that time there have been reports from Abbott, Rivarola, and Logue (1961), Carmichael and Davidson (1961), Neufeld *et al.* (1961), Braudo *et al.* (1962), Cooley and Ellis (1962), Nunn *et al.* (1962), Papaioannou *et al.* (1962), Effler and Welti (1963), Haller and Little (1963), Michaud *et al.* (1963), Sabiston *et al.* (1963), and Chalnot *et al.* (1964), bringing the recorded total of successfully treated cases to about 40. There have been 3 deaths attributable to the operative intervention. We add a further case in which the diagnosis was made before operation by aortography and in which closure was accomplished without hypothermia or cardiopulmonary bypass.

Case Report

A 51-year-old company director was admitted to hospital in March 1964. For about 2 years he had been unduly breathless on exertion, such as climbing stairs. Nine months before this admission he had required inpatient treatment, at another hospital, for left ventricular failure, and he had taken digoxin and an oral diuretic since that time.

His father died of heart disease at the age of 64 years. His mother, aged 78 years, had suffered a coronary thrombosis. His own past history was free of serious disease.

His brachial blood pressure was 180/100 mm. Hg, and the regular pulse was collapsing in character. There was no oedema or neck vein distension, but there was obvious venous pulsation above the clavicle in the semi-recumbent posture. The apex beat could not be accurately located. There was no abnormal præcordial pulsation. A soft continuous murmur was audible to the left of the sternum, maximal in the sixth intercostal

space. Apart from persistent crepitations at both lung bases, other systems were normal.

The electrocardiogram, which showed left axis deviation, 25 mm. S waves in V2, and S–T depression in leads I, aVL, and V6, was considered consistent with left ventricular hypertrophy. Chest radiograph revealed some over-all cardiac enlargement and pulmonary congestive changes. Right heart catheterization revealed a left-to-right shunt at ventricular level, the pulmonary artery O₂ saturation being 72 per cent, and high and low right ventricular saturations, 77 and 69 per cent respectively, while right atrial and superior vena caval saturations were 62 per cent. Pulmonary wedge and right atrial pressures were normal; right ventricular pressure was 35/0–5 mm. Hg.

Aortography (Fig. 1) revealed an enormously dilated and tortuous right coronary artery, the end of which could not be clearly seen. Selective right coronary cineangiography also failed to demonstrate the site of entry of the fistula into the right side of the heart, but clearly showed the passage of a large bolus of contrast medium through the pulmonary artery shortly after full opacification of the right coronary artery.

Surgical closure of the abnormal communication was felt to be justified by the development of symptoms attributable to the anomaly.

At operation on April 24, 1964, the chest was opened through an antero-lateral 5th space intercostal incision. There was general ventricular enlargement, that of the left being relatively greater than that of the right. The origin of the right coronary from the aorta could not be seen; it appeared about 1.5 cm. from the aortic wall, at which point it was about 1 cm. in diameter. Its course, shape, and size are apparent from Fig. 1 and 2. The branches of the dilated coronary were of normal size (Fig. 2). On the under-surface of the heart, close to the atrio-ventricular groove, it entered a dilated "vein" about 2 cm. in diameter. The terminal portion was narrow, with epicardial thickening over it and calcification in its walls. The coronary sinus was examined and was also found to be about 2 cm. in diameter. Electrocardiograms taken from the apex and the lateral aspect of the body of the left ventricle showed no change when the vessel was occluded. The terminal portion of the artery

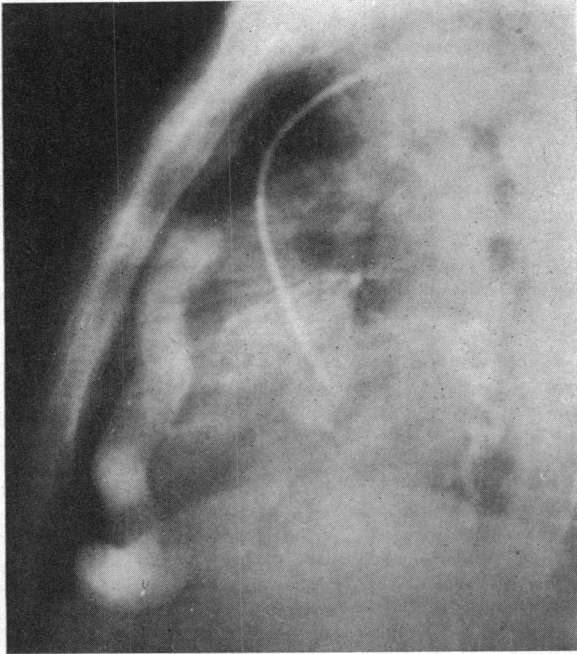


FIG. 1a.—Thoracic aortography: contrast medium in large right coronary artery.



FIG. 1b.—Composite drawing from aortograms, showing size and course of right coronary artery.

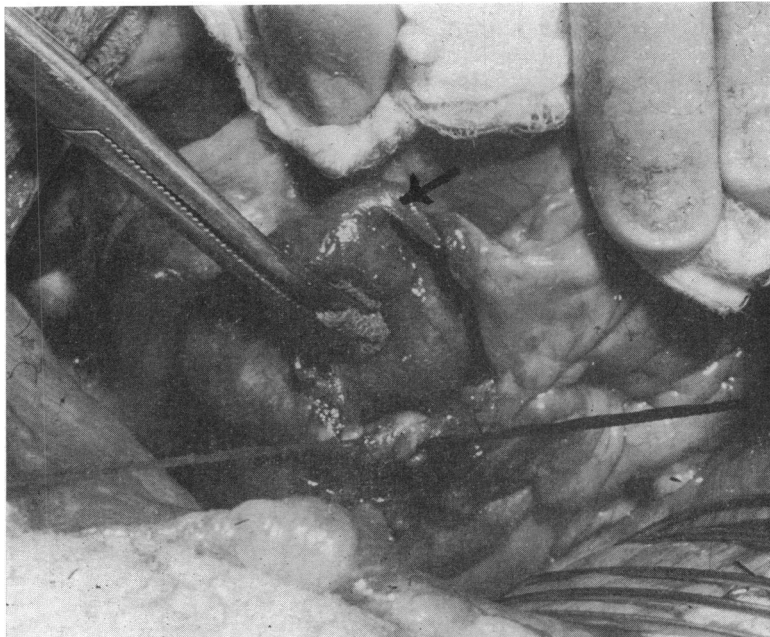


FIG. 2.—Under-surface of the heart with the apex raised, showing the tortuous dilated right coronary artery ligated at its end. Arrow shows coronary branch of normal size.

was doubly ligated at two points 1 cm. apart and then divided. After ligation of the coronary artery the heart immediately became smaller.

His post-operative course was generally satisfactory, though a serum GOT level of 102 units/ml. on the third day, falling to 46 units/ml. by the 10th day, caused some anxiety at the time. He had no ischaemic cardiac pain, and serial electrocardiograms showed only non-specific (post-pericardiectomy) S-T changes and more marked left axis deviation. The latter was attributable to paralysis of the left diaphragm. The raised transaminase levels were considered to have been due to direct myocardial trauma during dissection of the heart at operation.

Twelve months later he was well, and stated that he was no longer dyspnoeic on the sort of exertion that had provoked breathlessness before operation. He no longer needed drugs. Screening showed the left diaphragm to be still paralysed. Right heart catheterization 7 months after operation revealed normal pressures and no evidence of residual left-to-right shunt. Systemic arterial pressure (at rest) was 185/105 mm. Hg and O₂ saturation was only 84 per cent: this latter figure was very rapidly raised to 95 per cent by administration of oxygen by mask and was thought to reflect left basal hypoventilation. The resting cardiac index was 4.1 l./min. m.²

Comment

Although it was felt that no adequate explanation of his left ventricular failure had been found, suspicion of the correct diagnosis was not entertained during the patient's first stay in hospital. This may have been chiefly because only the diastolic murmur was impressive at that time, a feature perhaps explicable by partial closure of the fistula during systole where the recipient chamber is the right ventricle (Nunn *et al.*, 1962).

Later on, a truly continuous murmur became audible and its site of maximal intensity suggested a ruptured aortic sinus aneurysm rather than any form of congenital aorto-pulmonary communication. Additional possibilities included arteriovenous fistula of the heart, lung, or chest wall, and the association of ventricular septal defect with aortic incompetence. Right heart catheterization served only to confirm the presence of a left-to-right shunt and to indicate its site of entry. Aortography revealed the true state of affairs.

Surgical closure of the fistula appears to have conferred real benefit in this case, though he still has, of course, mild systemic hypertension and left diaphragmatic paralysis. The latter is thought to

have been due to stretching of the phrenic nerve at operation and may yet recover.

Summary

A coronary arteriovenous fistula, of the common right coronary-right ventricular type, was found in a 51-year-old man who presented with left ventricular failure. Surgical closure of the fistula brought relief of his dyspnoea.

We are grateful to Dr. P. H. Davison for allowing us to report details of this case.

References

- Abbott, O. A., Rivarola, C. H., and Logue, R. B. (1961). Surgical correction of coronary arteriovenous fistula. *J. thorac. cardiovasc. Surg.*, **42**, 660.
- Braudo, J. L., Javett, S. N., Zion, M. M., and Adler, D. I. (1962). Congenital coronary arteriovenous fistula. *Brit. med. J.*, **1**, 601.
- Carmichael, D. B., and Davidson, D. G. (1961). Congenital coronary arteriovenous fistula. *Amer. J. Cardiol.*, **8**, 846.
- Chalnot, P., Grosdidier, J., Cherrier, F., and Mathieu, P. (1964). Un cas de fistule coronaro-ventriculaire droite. *Ann. Chir. thorac. cardiovasc.*, **3**, 218.
- Cooley, D. A., and Ellis, P. R., Jr. (1962). Surgical considerations of coronary arterial fistula. *Amer. J. Cardiol.*, **10**, 467.
- Effer, D. B., and Welti, H. (1963). A propos d'une fistule artério-veineuse entre artère coronaire gauche et ventricule droit. *Arch. Mal. Cœur*, **56**, 164.
- Gasul, B. M., Arcilla, R. A., Fell, E. H., Lynfield, J., Bicoiff, J. P., and Luan, L. L. (1960). Congenital coronary arteriovenous fistula. *Pediatrics*, **25**, 531.
- Haller, J. A., Jr., and Little, J. A. (1963). Diagnosis and surgical correction of congenital coronary artery-coronary sinus fistula. *Circulation*, **27**, 939.
- Michaud, P., Froment, R., Viard, H., Gravier, J., and Verney, R. N. (1963). Les fistules coronaro-ventriculaires droites. A propos de 3 cas opérés. *Arch. Mal. Cœur*, **56**, 143.
- Neufeld, H. N., Lester, R. G., Adams, P., Jr., Anderson, R. C., Lillehei, C. W., and Edwards, J. E. (1961). Congenital communication of a coronary artery with a cardiac chamber or the pulmonary trunk. ('coronary artery fistula'). *Circulation*, **24**, 171.
- Nunn, D. B., Thrower, W. B., Boone, J. A., and Lipton, M. (1962). Coronary arteriovenous fistula simulating patent ductus arteriosus. *Amer. Surgn.*, **28**, 476.
- Papaioannou, A., Agorogiannis, S., Nihoyanopoulos, J., and Lazzaridis, D. (1962). Congenital coronary artery fistula. Successful preoperative diagnosis and surgical correction. *Amer. J. Cardiol.*, **10**, 588.
- Sabiston, D. C., Jr., Ross, R. S., Criley, J. M., Gaertner, R. A., Neill, C. A., and Taussig, H. B. (1963). Surgical management of congenital lesions of the coronary circulation. *Ann. Surg.*, **157**, 908.
- Upshaw, C. B. (1962). Congenital coronary arteriovenous fistula. Report of a case with an analysis of seventy-three reported cases. *Amer. Heart J.*, **63**, 399.