Successful balloon aortic valvotomy in a child with a pulmonary hypertensive duct and aortic valve stenosis

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SUMMARY  A ten year old boy with pulmonary hypertension and a ductus arteriosus had severe aortic valve stenosis relieved by balloon aortic valvotomy. Subsequent aortic regurgitation was mild. This procedure avoided open heart operation, which would have been hazardous in this patient.

Percutaneous transluminal balloon valvotomy for pulmonary valve stenosis has become an established procedure and its use in many patients has avoided open heart surgery. There are more problems and greater risks when the technique is used to relieve aortic valve stenosis.

We report the effectiveness of balloon aortic valvotomy in a child in whom the risk of open heart surgery was considerable.

Case report

This ten year old boy was first noted to have a murmur in the neonatal period. When he was three years old investigation showed a ductus arteriosus and pressure in the systemic circulation was equivalent to that in the pulmonary artery. His condition was considered to be inoperable. Reinvestigation when he was eight confirmed the presence of the ductus arteriosus. Mean pulmonary artery pressure was 63 mm Hg, the systemic mean pressure was 60 mm Hg and did not fall (65 mm Hg) when 100% oxygen was given. The pulmonary vascular resistance (total) was calculated from an assumed oxygen consumption to be 21.7 units.

He was referred to the National Heart Hospital to be considered for heart and lung transplantation. Examination suggested that there was also a complicating left sided lesion because there were small carotid pulses and an intense systolic ejection murmur at the left sternal edge. For this reason reinvestigation was performed and specific attention was paid to the left outflow tract. This showed severe valvar aortic stenosis with a peak aortic gradient of 101 mm Hg (mean gradient 60 mm Hg and valve area 0.3 cm²) and a domed, thickened and mobile valve on angiography (fig a). The left ventricular filling pressure was normal (12 mm Hg) and the pulmonary arteriolar resistance was 22.1 units with a ratio of 0.7 between the pulmonary artery resistance and the systemic resistance (cardiac output was measured by thermodilution). Oxygen saturation of blood in the ascending aorta was 85% and in a femoral artery it was 75%.

Symptoms of hypoxia developed earlier than expected in this boy, and we wondered whether the aortic valve disease had accelerated the development of pulmonary vascular disease. There was, therefore, a case for relieving the obstruction even though the pulmonary vascular resistance was unlikely to fall. The obvious difficulties of cardiopulmonary bypass with temporary closure of the duct and the hazard of severe pulmonary vascular disease in the postoperative period made open valvotomy a formidable undertaking.

On 5 March 1985, percutaneous balloon valvotomy was performed under general anaesthesia. Before valvotomy the aortic gradient was 92 mm Hg (66 mm Hg mean). A Gensini catheter and 260 cm guide wire were introduced percutaneously into the femoral artery and advanced to the left ventricular apex. A 1.8 cm balloon was advanced over the wire until two thirds of the balloon was below the aortic
valve plane. The balloon was rapidly inflated twice with dilute contrast to a maximum pressure of 3.5 bar (350 kPa). “Waisting” of the balloon (fig b) and its subsequent disappearance were noted on the first occasion. Subsequent gradient measurement across the aortic valve indicated successful relief of the stenosis (peak and mean gradients 10 mm Hg) and aortography showed mild aortic regurgitation with an aortic pressure of 130/80 mm Hg.

Recovery from the procedure was uneventful, and the systolic thrill disappeared clinically; the murmur was short with a late click and soft immediate diastolic component. The signs of pulmonary hypertension remained. At an outpatient follow up five months later, the boy’s mother reported that he was less breathless and not cyanosed. Aortic regurgitation had not increased, echocardiography indicated a considerable reduction of the left ventricular hypertrophy, and Doppler studies suggested only a “trace” of aortic regurgitation.

Discussion

The prognosis of patients with pulmonary hypertension and ductus arteriosus without other lesions is relatively good because symptoms appear late, usually in adolescence, and cases may survive until the fifth or even sixth decades provided cerebral abscess and rupture or thrombosis of pulmonary arteries do not occur. This boy with severe aortic valve stenosis became disabled earlier and he was unlikely to survive beyond 20 years. We were able to relieve the aortic valve stenosis by balloon valvotomy; this avoided exposing him to the considerable risk of open heart operation.

Balloon valvotomy can cause severe or catastrophic aortic regurgitation and may fail in patients with dysplastic valves. Open aortic valvotomy is safer and more likely to achieve a better haemodynamic result. In special circumstances, however, in which the risks of surgery are unusually high, as in this patient with irreversible pulmonary hypertension, we recommend balloon valvotomy. We hope that there will be improvement in this boy’s condition that will delay the need for heart and lung transplantation. We still prefer open aortic valvotomy for usual cases of aortic valve stenosis.

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References

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