A Technic for Taking Down the Potts' Anastomosis

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The presence of a functioning aortico-pulmonary anastomosis, previously established for the palliation of an infant with tetralogy of Fallot, complicates subsequent open-heart repair. The presence of an open shunt during bypass results in decompression of the aortic blood flow into the operative field once the right heart is entered. The difficulty of reaching the shunt area through the usual open-heart incision is increased by the presence of vascular pleural adhesions from the previous surgery.

Kirklin and Devloo have reported a method for closing the shunt through the left pulmonary artery by profound hypothermia with temporary interruption of the circulation. The alternate technic reported here also employs hypothermia, but without interruption of the circulation. A description of the operative procedure and the results in three cases are described.

Operative Technic

With the patient under endotracheal anesthesia, hypothermia to 30 C. is induced by immersion in ice water. The electrocardiogram is continuously monitored as the temperature falls. The patient is placed on the operating table in a modified right lateral recumbent position, with the left chest rotated forward about 45° (fig. 1). After the back is prepared, a 10-em. incision is made to the left and parallel to the upper thoracic spine. The incision extends from the second to the fifth thoracic vertebra and lies two fingerbreadths to the left of the spinous processes. The incision is carried down through the trapeziums and rhomboid muscles. The long spinal muscle is retracted medially. Two-centimeter segments of the posterior portion of ribs 2, 3, and 4 are resected subperiosteally along with the tips of their respective transverse processes (fig. 2). Electrocoagulation is used to insure meticulous hemostasis. The intercostal vessels are ligated and divided along with the intercostal muscles. The parietal pleura, if present, can be stripped off the operative field. The shunt-site is located by palpat ing the thrill. The aorta is dissected free posteriorly in the area of the shunt, and umbilical tapes are passed around it above and below the anastomosis. Additional sharp dissection is now used to define the shunt-site more precisely. It will be noted that the anastomosis has become somewhat tubulated, much like a short broad patent ductus. The left pulmonary artery adjacent to the anastomosis is dilated. A seamless Dacron cloth band, 8 mm. wide, is passed around the shunt and the shunt is temporarily occluded by digital pressure to observe the heart action. If, after 5 minutes, the electrocardiogram and vital signs remain unaffected, the shunt is permanently closed. A mattress suture of 0 Mersilene is placed across the Dacron cloth band so that as it is tied the band is drawn up tight and the shunt is squeezed shut. The anastomosis and the cloth band are transfixed with one or two additional sutures to assure complete and permanent obliteration (fig. 3). The wound is again inspected for hemostasis. If the pleural space has been entered, all air must be evacuated. The incision is then closed in layers without drainage. A temporary dressing is applied.

The patient is now placed on his back in the usual position for an open-heart procedure. After the front of the chest is prepared, a vertical sternotomy incision is used to avoid entering the left pleural space. The previously induced hypothermia is utilized during the major portion of the intracardiac repair while the aorta is cross-clamped and the coronary flow is interrupted. It may be necessary to use the heat exchanger, placed in the venous arm of the extracorporeal circuit, to lower the body temperature another 2 to 4 C. before occluding the aorta. After the aorta is clamped, the heat exchanger is placed on the warming cycle so that by the time the intracardiac repair is completed, the patient's body temperature has been returned to normal levels.

Case Reports

Case 1

C. S. R. was a 7-year-old white girl, weighing 41 pounds, who had been cyanotic since age 6

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months. A Potts' anastomosis and a Brock valvulotomy had been performed at 3 years. The child's condition had worsened in the past year. There was a loud continuous murmur audible over the left precordium. The liver was enlarged two fingerbreadths below the right costal margin. Clubbing of the fingers and toes was present. The heart was enlarged. The chest roentgenogram showed an aneurysmally dilated left pulmonary artery which, on fluoroscopy, pulsed vigorously. An angiocardiogram demonstrated complete atresia of the proximal segment of the left pulmonary artery. The child's condition was improved with digitalis and diuretics.

On March 5, 1959, closure of the Potts' anastomosis and definitive repair of the tetralogy deformity were carried out. The orifice of the shunt was approximately 7 mm in diameter. The child made an uneventful recovery.

Comment
Because of the presence of a dense scar in the left hilum, no attempt was made to connect the left pulmonary artery to the main pulmonary artery. The right pulmonary bed seemed adequate to accept the total output of the right ventricle. In the 2 years since operation the child has continued to enjoy excellent health.

Case 2
K. L. S. was a 4-year-old white girl who had been cyanotic since shortly after birth. At age 9 months, she was first admitted to the Children's Hospital because of a respiratory infection. The child was markedly cyanotic. During this admission, a Potts' anastomosis was carried out. The child continued to be troubled by respiratory infections, and in the year prior to admission she had had two bouts of congestive heart failure in spite of adequate digitalis therapy. A harsh thrill and a loud continuous murmur were present over the left precordium. There were slight cyanosis and clubbing. Chest roentgenogram showed a markedly enlarged heart. Right ventricular hypertrophy was also present on the electrocardiogram.

On April 10, 1959, closure of the Potts' anastomosis and a definitive repair of the heart were accomplished. Eight hours postoperatively, the
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Figure 3

Demonstrates tubulation of the shunt and the method of obliteration with a Dacron cloth band and Mersilene transfixion sutures.

child developed signs of heart failure as evidenced by a rise in venous pressure and enlargement of the liver. The child died shortly thereafter.

Comment

This patient had been and probably still was in some degree of heart failure at the time of surgery from the very large left-to-right shunt. It would have been advisable to have performed a preliminary narrowing of the Potts' anastomosis to relieve the left ventricle, thus giving the myocardium a chance to recover. In this way, the heart would have been in better condition for the bigger operation of complete correction.

Case 3

D. S. A. was a 6-year-old girl who had had intense cyanosis and dyspnea since age 3 months. At age 4 years, an aortieopulmonary anastomosis was performed. Cyanosis and dyspnea returned in the year prior to admission. On July 24, 1959, closure of the Potts' anastomosis and a definitive repair were accomplished. When last seen 18 months postoperatively, the child was leading a normal life.

Discussion

Hypothermia, by reducing total body oxygen requirements, protects the patient during the short interval while the shunt is closed and until total bypass can be established.

The posterior mediastinotomy approach provides adequate exposure and obviates the need for entering the left pleural space. The Dacron cloth band and transfixion of the shunt with heavy Dacron sutures seems to be a satisfactory means of achieving permanent closure.

Summary

A technic is described for definitive repair of patients with tetralogy of Fallot whose previously constructed aortieopulmonary (Potts') anastomosis has remained functional. Hypothermia without interruption of the circulation has been used to protect the patient during the brief interval after the shunt is obliterated and until cardiopulmonary bypass is
established for the definitive intracardiac repair. The results in three children, followed up to 2 years, are reported.

References

Among the changes during the past century in what hospitals are and in what they do, the trend toward specialization is obvious. One could almost say that instead of being the place where a doctor could easily see a great many kinds of patients, the hospital has become the place where a patient can see a great many kinds of doctors.—Alan Gregg, M. D., Challenges to Contemporary Medicine. New York, Columbia University Press, 1956, p. 63.
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