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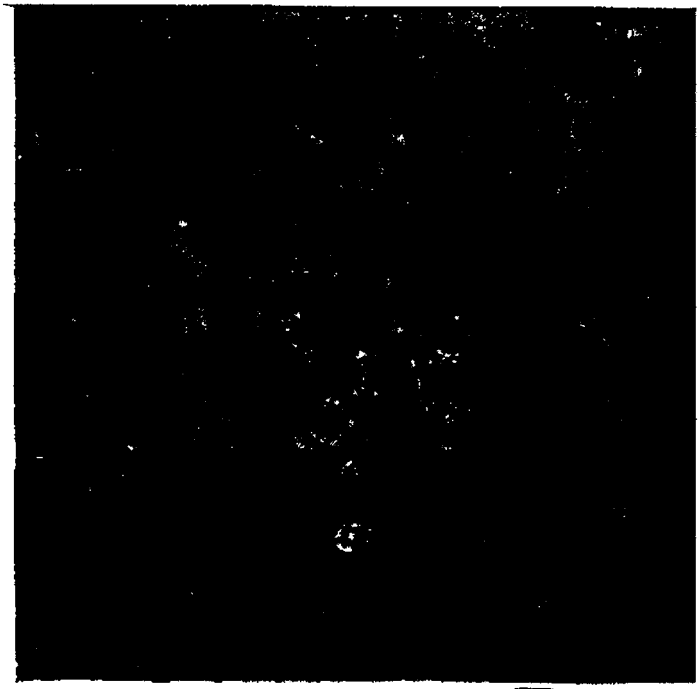
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Preliminary Communication

Pleurectomy

John Helwig, Jr., MD, Rachel Ash, MD, Sidney Friedman, MD, T. Giffin Daughtridge, MD, and Julian Johnson, MD

Pleurectomy was used to stimulate systemic-pulmonary anastomoses as a palliative treatment for patients with cyanotic congenital heart disease with pulmonary hypertension. To our knowledge, the successful application of this principle, suggested to us by Bernice Wedum, MD, has not heretofore been reported.

Patients with pulmonary hypertension associated with a right-to-left shunt within the heart have systemic hypoxia due to the combination of a decreased effective pulmonary blood flow secondary to the mechanical pulmonary-arteriolar block and the effects of the right-to-left shunt itself. As a result of pulmonary arteriolar obliterative changes, the pulmonary resistance is equal to or greater than the systemic resistance. In effect, multiple peripheral "pulmonary stenoses" exist.

For editorial comment, see page 290.

In 1949, Barrett and Daley[1] described pleurectomy as a method for increasing the pulmonary blood flow in patients with cyanotic congenital heart disease with a decreased pulmonary blood flow and *low* pulmonary-artery pressures. They demonstrated the development of large, effective bronchopulmonary anastomoses with considerable clinical improvement in these patients. Through the years, this method of palliation has been employed in patients in whom Blalock or Pott's shunts could not be performed for technical reasons and who were not amenable to open-heart corrective surgery.

Liebow and his coworkers[2] have beautifully demonstrated by injection studies the bronchopulmonary anastomoses in health and disease. (We will use the term bronchial arteries to include all systemic arteries that supply or become related to the lungs, as does Liebow.) These precapillary anastomoses are difficult to demonstrate in health but may become very large in obliterative disease of the lungs or in tetralogy of Fallot with low pulmonary-artery pressures. Heath[3] found the bronchial arteries to be enlarged also in cases of hypertensive pulmonary-vascular disease with widespread occlusion of pulmonary arteries. These systemic arteries gave rise to thin-walled branches which entered the lung parenchyma. The observations of Liebow and Heath suggested that these systemic pulmonary anastomoses were distal to the pulmonary arteriolar obstruction of these patients with pulmonary hypertension and might be stimulated to develop by pleurectomy, as has been shown to be effective in patients with pulmonary stenosis.

Therefore, the rationale of the currently proposed procedure is to bring collateral blood flow into the pulmonary circulation at the level of the precapillaries and hence to increase the amount of unsaturated blood flow past the capillary-alveolar interface.

Report of a Case

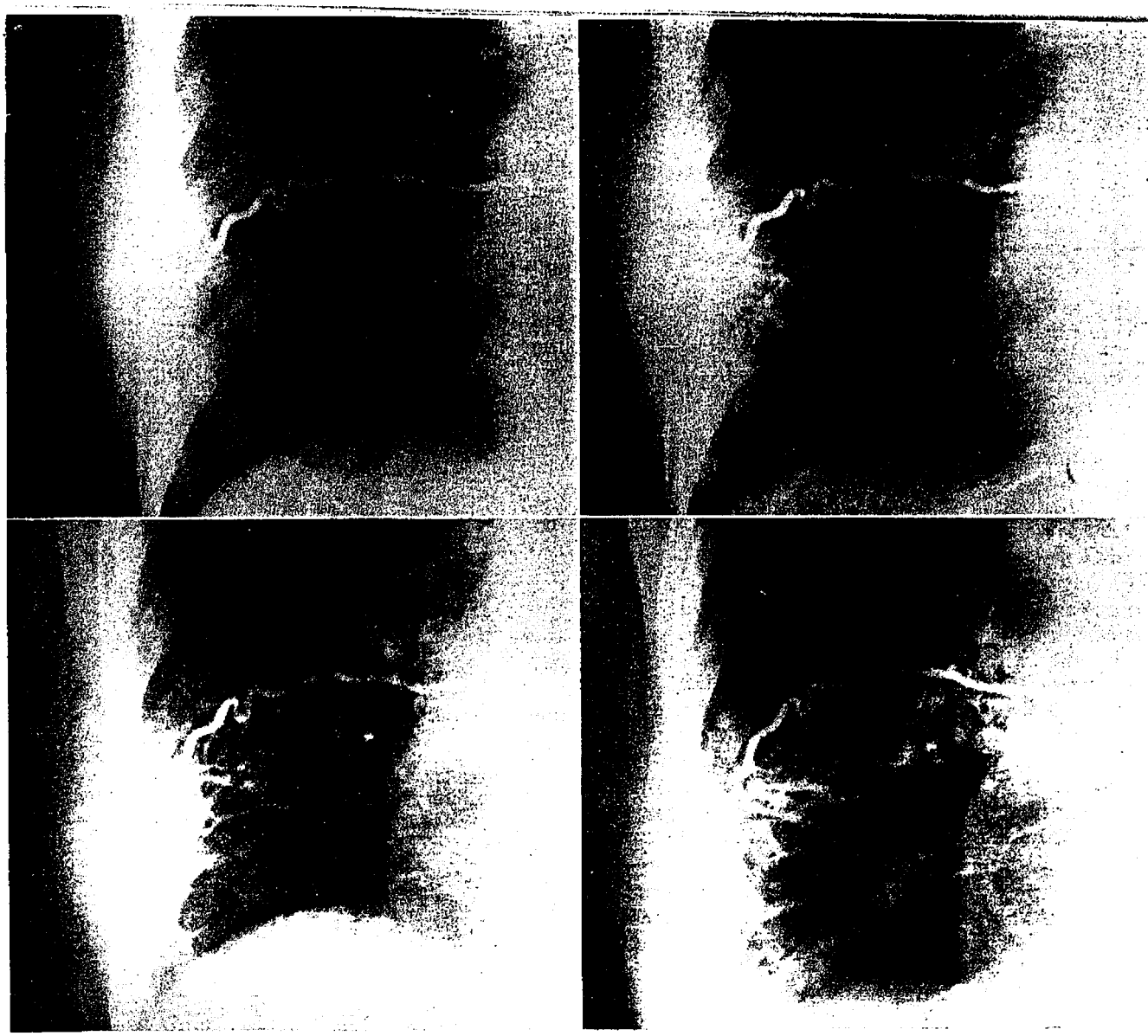
A girl, born on Jan 13, 1947, was admitted to the Children's Hospital of Philadelphia in 1948 and a diagnosis of pseudotruncus arteriosus was made. The first Pott's operation done at the Children's Hospital was performed, and the anastomosis was made 4 mm in diameter. Immediately postoperatively she was pink and did extremely well. The marked improvement in clinical status was to portend the progressive development of pulmonary hypertension, probably the result of too large a systemic-pulmonary anastomosis. Because of increasing dyspnea and cyanosis, she was admitted to the Hospital of the University of Pennsylvania in September 1964 at which time right and retrograde left cardiac catheterizations were performed. The diagnosis of pseudotruncus arteriosus was confirmed by hemodynamic and cineangiocardiographic studies. The pulmonary artery was intubated by way of the Pott's anastomosis in a retrograde fashion, and both the aortic and pulmonary-artery pressures were found to be 110/70 mm Hg. The hemoglobin level was 18.4 gm/100 cc and the hematocrit reading, 60%. Both the patient and her mother were most anxious that something be done. Pleurectomy on the right side was performed on Sept 28, 1964, and the surface of the lung was sprinkled with powdered asbestos. The patient had an uneventful postoperative course with a progressive increase in exercise tolerance. In March 1965 she was readmitted to the University of Pennsylvania Hospital for reevaluation. At this time, the patient could

1. Preoperative chest x-ray film, Sept 21, 1964. Postoperative chest x-ray film, March 8, 1965, was unchanged except for pleural thickening on right side.



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2. Selective right middle intercostal film-changer arteriography demonstrates rapid filling of pulmonary veins ½ second after injection (*upper left*), 1½ seconds after injection (*upper right*), 2½ seconds after injection (*lower left*), and 4 seconds after injection (*lower right*).

climb one flight of stairs without dyspnea, whereas, prior to surgery, a climb of only four steps caused significant dyspnea. On physical examination, she was considerably less cyanotic and the hemoglobin level was 16.2 gm/100 cc and the hematocrit reading was 56%. The chest x-ray film (Fig 1) and electrocardiogram were essentially unchanged. Her arterial oxygen pressure (Po_2) was 42 mm Hg (78% saturation) compared to a preoperative Po_2 of 33 mm Hg (64% saturation). Selective retrograde intercostal film-changer arteriography demonstrated significant collateral blood flow from the intercostal and bronchial arteries to the lung with early opacification of the right pulmonary veins (Fig 2). Considering that the postoperative study was done only 5½ months following pleurectomy, the degree of collateral circulation was remarkable.

Comment

The clinical course and the angiographic demonstration of significant induced collateral circulation to the right lung of the patient with cyanotic congenital heart disease and pulmonary hypertension, strongly suggest that pleurectomy was of real palliative benefit. The angiograms demonstrate conclusively that blood now flows from the systemic circulation through the pulmonary parenchyma into the pulmonary veins. Although preoperative intercostal arteriograms were not obtained, the fact that no significant adhesions between the parietal and visceral pleura were found at surgery excludes the possibility that all the collaterals were due to preexisting bronchial collaterals alone. The marked change in systemic oxygen saturation strongly suggests that this collateral blood flow undergoes oxygenation at the alveolar level.

On the basis of the observations made on this patient, we believe a cautious further trial of this procedure is indicated.

This study was supported in part by Public Health Service grant HE-06352 and by the John A. Hartford Foundation.

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