

Emergency Open-Heart Surgery in Infancy Using Hypothermia and Inflow Occlusion*

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The use of extracorporeal circulation in open-heart surgery has led to successful correction of congenital anomalies in children. The connection of this device to the body of an infant may be impossible due to some technical difficulties such as the cannulation of the large vessels, the volume capacity of the oxygenator, and the body weight of the infant. In such cases a combination of hypothermia and inflow occlusion permits a lifesaving surgical procedure.

Case Report

T. Y. (Case number: 363025). A 10 month-old male infant was brought to the hospital by his parents because of cyanosis which had been present since his birth. The cyanosis was augmented while crying.

Physical examination revealed the following Body weight: 7.800 gr, height: 71 cm, pulse: 128/min, blood pressure: 130/90 mmHg, and the respiration rate: 48/min. Cyanosis and respiratory difficulties

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were present. On auscultation of the heart, a mild systolic murmur was heard on the left third intercostal space along the sternum. The liver was palpable 4 cm. below the costal margin.

Blood examinations revealed the following: Hb: 17.21 gr %, white cells: 15000, and hematocrit: 66 %. An ECG showed right axis deviation and right ventricular hypertrophy. A direct postero-anterior chest x-ray demonstrated a global enlargement of the cardiac silhouette (Fig. 1). Catheterization and angiography was performed on the 3rd of January, 1973 (T. T) through the right saphenous vein which proved a severe pulmonary valvular stenosis and patent foramen ovale (Figs. 2, and 3). Pressures recorded during catheterization were: right atrium: 5 mm Hg., left atrium: 7 mm Hg., pulmonary artery: 5 mm Hg., and right ventricle: 120 mm Hg.

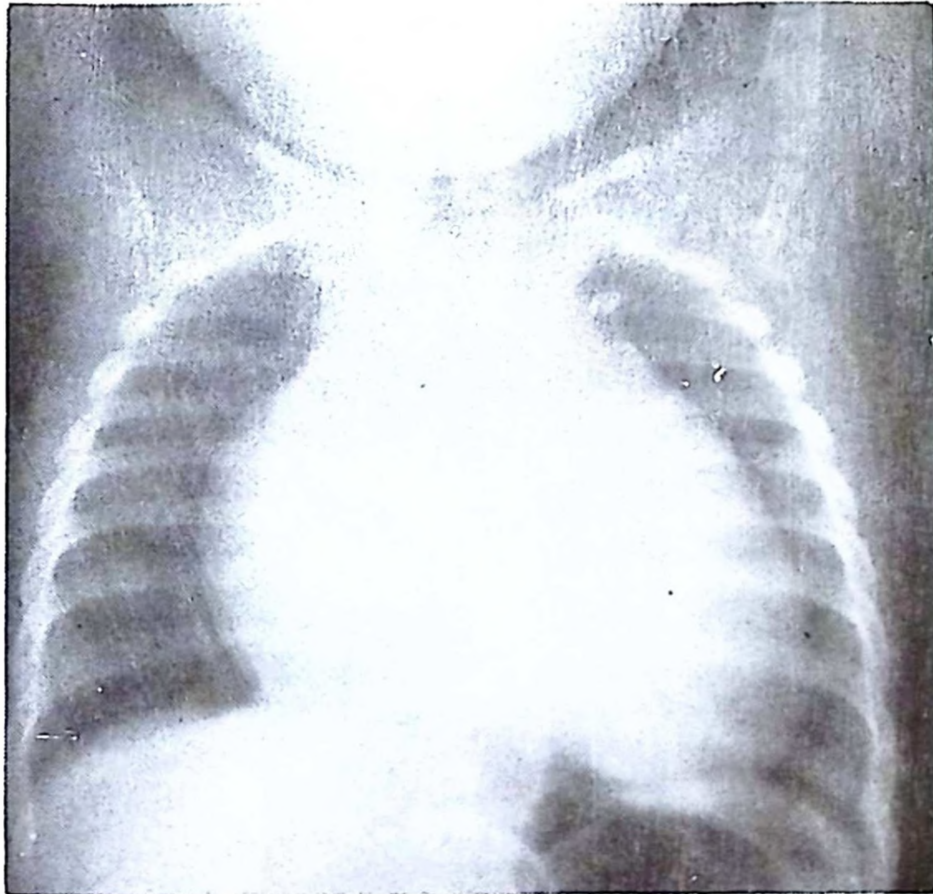


Figure 1

Pre-operative chest x-ray of the infant showing global enlargement of the heart.

On the 5th of January, 1973 the infant was taken to the operating room (A.A.). Under general anesthesia surface hypothermia was induced to 32°C. A median sternotomy was performed. The heart was severely cyanotic. Upon gross examination, anomalies of the large vessels were absent. A mild systolic thrill was palpable on the pulmonary artery.



Figure 2

Angiography performed when the catheter tip is in the right ventricle displaying pulmonary stenosis.



Figure 3

Angiography. Left lateral view.

The vena cava superior and inferior were prepared and tourniquets were placed around them. Traction sutures were inserted on the pulmonary artery. A pulmonary arteriotomy was performed after the occlusion of the vena cava. The orifice of the valve was 2 mm and the cusps were thick in structure. Under direct vision, stenosis was relieved by scalpel and scissors through the commissures and dilatator which was applied until an opening of 1 cm was obtained at a distance of 1 mm to the annulus. A Satinsky clamp was placed on the pulmonary artery after the loosening of the cava tourniquets. The pulmonary arteriotomy was sutured. The duration of the inflow occlusion was 3.5 minutes. The color of the heart and the patient immediately became pink.

The post-operative course of the infant was uneventful and he was discharged from the hospital 8 days after surgery. The post-operative control chest x-ray is shown in Fig. 4.

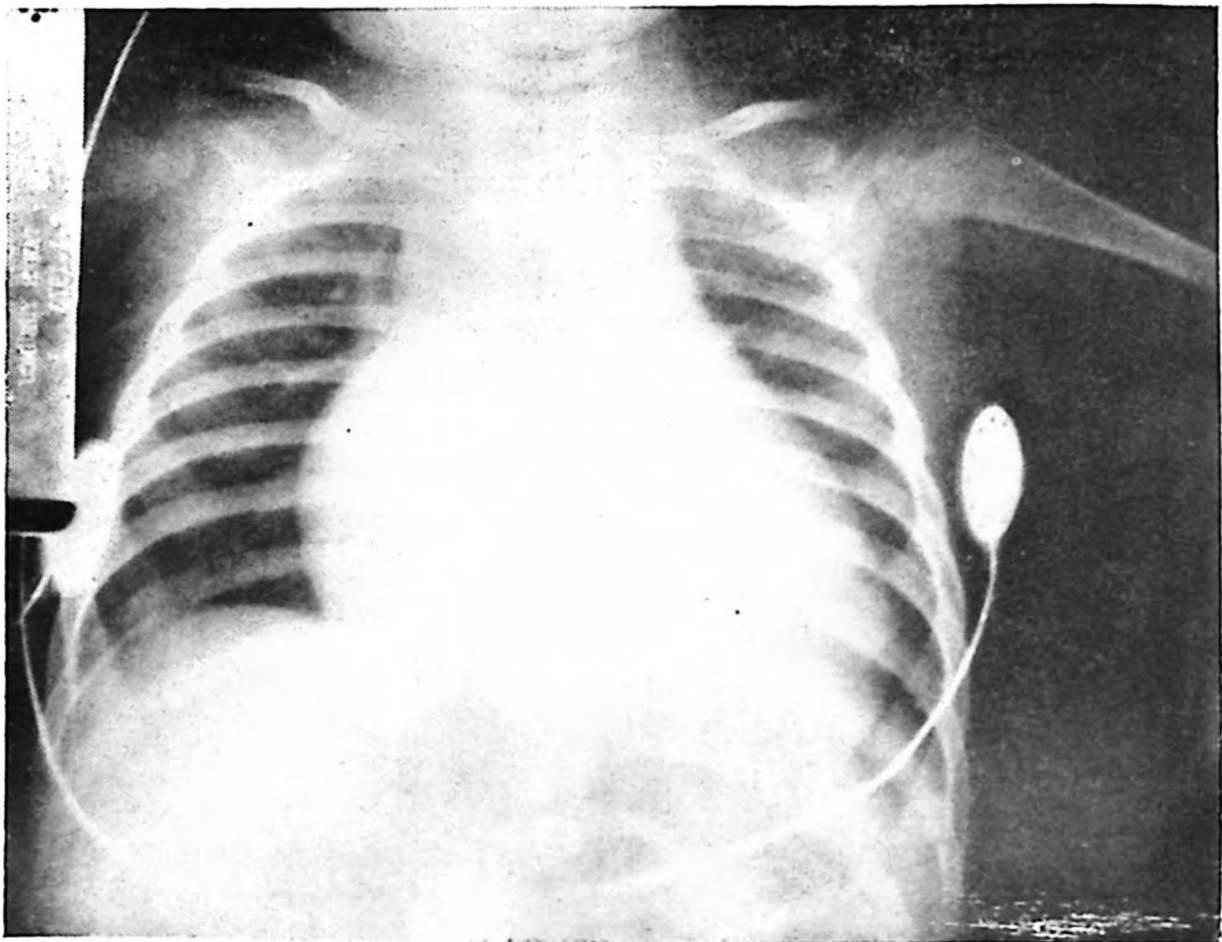


Figure 4

Post-operative chest x-ray of the patient taken in the post-operative recovery room.

Discussion

A combination of hypothermia and inflow occlusion is used in cardiac surgery during infancy when the application of cardiopulmonary

by-pass is technically difficult and in many times hazardous. Under normothermic conditions the circulation can be interrupted for 3 minutes, while under hypothermia at 32°C it can be interrupted for 6 minutes.¹ Hypothermia below 30°C is not recommended due to the possible irreversible complications, such as ventricular fibrillation. This technique is used in relieving pulmonary stenosis, closure of atrial septal defects, creation of atrial septal defects (in cases of transposition of the large vessels) and other cardiac anomalies. In cases of pulmonary stenosis and small patent foramen ovale, closure of the interatrial communication is generally not necessary because it closes spontaneously after relieving pulmonary stenosis. A persistent left superior vena cava should be suspected when the heart is not completely emptied during inflow occlusion.¹ A combination of hypothermia and inflow occlusion may also be used for children and adults in short cases instead of extracorporeal circulation.²

Summary

A case of severe pulmonary stenosis in a 10-month old infant that was treated by inflow occlusion and hypothermia is presented. The importance of this technique in infantile cardiac surgery as a life-saving measure is emphasized.

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