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Bilateral Partioning of Systemic Venous Chamber in Conjuction with Atriopulmonary Anastomoses (Fontan-Kreutzer)

- A new technique -

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〈국문초록〉

체정맥환류 이상을 동반한 복잡심기형 환자에 있어 체정맥심방 양분을 이용한 Fontan씨 술식 치험
- 새로운 수술방법 -

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Fontan씨 술식이 적응증이 되는 복잡심기형에 있어 체정맥 환류이상은 수술을 어렵게 할 뿐 아니라 수술사망율을 높이는 중요한 요인중의 하나이다. 본 서울대학교 병원 흉부외과에서는 상대정맥이 좌 우에 모두 있고 하대정맥이 우측 심방으로 들어오며, 또 좌측간정맥이 좌측심방으로 들어오는, 폐동맥협착증을 동반한 단심방 및 단심실 환아를 경험 하였다. 이 예에 대한 치료에 있어, 저자등은 좌측 상대정맥과 좌측간정맥으로 들어온 정맥혈은 좌측 폐동맥으로, 우측 상대정맥 및 하대정맥으로 들어온 정맥혈은 우측폐동맥으로 가게 하고 폐동맥을 통해 들어온 피는 단일심으로 가게하는 변형 Fontan씨 술식을 시행하였다. 이는 구조적으로는 특이하나, 혈액순환 생리상 체순환과 폐순환을 완전히 분리시켜 주는 완전교정술이며, 기존의 술식에 비해 수술이 용이하고 폐정맥 환류 장애가 생기지 않을 수 있는 장점이 있다고 사료된다.

-Abstract-

A technique applicated for physiologic correction of complex congenital cardiac disease suitable for Fontan procedcere in which drainage of left superior vena cava and hepatocardiac vein to left atrium combined is described. We made one systemic venous baffle from left hepatocardiac vein to left superior vena cava and another systemic venous baffle from right inferior vena cava to the right superior vena cava with rigid prosthetic material(0.5mm thickness PTFE patch). And then we anastomosed directly between the right sided atrial appendage and right pulmonary artery, and left-sided atrial wall beneath the appendage and left pulmonary artery.

We believe that this procedure is superior to the method using intratrial tube graft to divert the left hepatocardiac venous blood to right atrium, and applicable for physiologic correction of any complex congenital cardiac disease suitable for Fontan-type procedure in which anomalies of systemic venous drainage combined.

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After the introduction of Fontan procedure for physiclogic correction of tricuspid atresia in 1971[1], the procedure has since been modified and extended to other more complex lesions[2-8]. But till now, the coexistence of anomalies of systemic venous connection poses both technical difficulties at repair and an increased operative mortality. In this report, we describe a new operation in which bilateral systemic venous baffles and bilateral atriopulmonary anastomoses was created in a patient with presently physiologically-uncorrectable cardiac anomalies, including bilateral superior venae cavae, right inferior vena cava and large left hepatocardiac vein in association with single ventricle variety.

Case

A 12-year-old boy was admitted to the Seoul National University Children's Hospital for surgical repair of cyanotic congenital heart disease. He was severely cyanotic, but well-developed. A grade 2/6 ejection murmur was noted at the base of the heart. A Chest X-ray film showed slightly decreased pulmonary vasculature. Electrocardiography demonstrated a normal sinus rhythm and right axis deviation. Echocardiography disclosed physiologically single ventricle with ventricular D-loop and right ventricular main chamber associated with large single atrioventricular valve. And it showed right and left superior vena cava (SVC), inferior vena cava(IVC) and left hepatocardiac vein drained to an left-sided atrium with no discernible atrial septum. By cardiac catheterization and angiography, a catheter from IVC could be passed into the left hepatocardiac vein through atrium, and also into the left SVC due to due to devoid of atrial septum and roof of coronary sinus-(Fig. 1).

The systemic oxygen saturation was 67%. Pulmonary arteriography revealed valvular and subvalvular stenosis and mean pulmonary artery pressure was 13mmHg. The right and left pulmon-

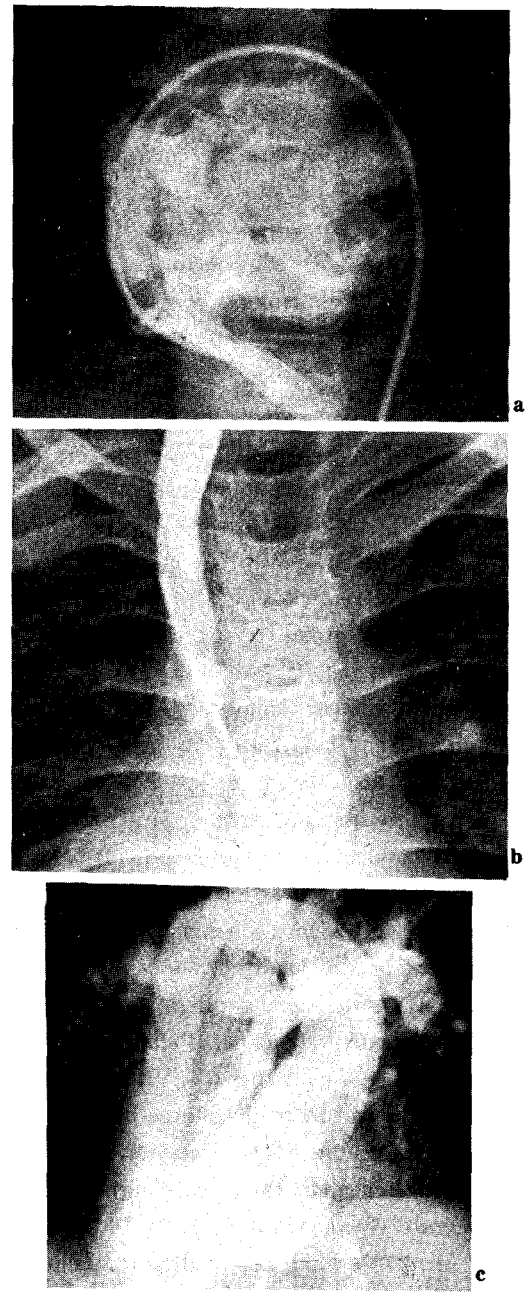

Fig. 1. Preoperative angiocardiograms
a) Anteroposterior view shows opacification of atrium and inferior vena cava. The catheter is introduced to heart via left hepatocardiac vein.
b) Anteroposterior view of showing right superior vena cava.
c) Anteroposterior view of showing relation of great arteries. Both pulmonary arteries are confluent and good-sized

operation consisting of end-to-side anastomosis between the SVC with azygos or hemiazygos continuation and the confluent pulmonary artery and division or lagation of the pulmonary artery truck--to such complex lesions[11].

But, as cited by himself, because that operation is virtually an extension of Glenn's idea, undesirable late sequele related to Glenn's operation may take place in the tufure and, in addition, arterial oxygen desaturation inevitably persists due to drainage of the hepatocardiac venous and coronary sinus blood into the functional left atrium. The idea for our approach was derived from two basic knowledges.

The first is that the basic concept for the Fontan procedure is not greatly different from the Glenn's, i.e., not pumping but flooding of the systemic venous blood to pulmonary circulation. And the second is that systemic venous baffle rather than pulmonary venous baffle can be constructed easy and useful to avoid systemic and pulmonary venous obstuction[12].

Based on the above idea, we made one systemic venous baffle from left hepatocardiac vein to the left SVC and another systemic venous baffle from the right IVC to the right SVC with rigid prosthetic material (0.5 mm thickness PTFE patch) under tension. Above procedure could be done with only single right atriotomy incision 1 cm away from and paralled to the AV groove which extended from the base of the right atrial appendage to the right atrium-IVC junction. It could be done without difficulty and without the risk of obstructing neither the pulmonary venous drainage nor single AV valve orifice.

The next step was to make systemic venous to pulmonary artery continuity. To achieving this, several techniques, for example, a direct anastomosis between the roof of the atrium or the atrial appendage and the pulmonary artery, or cavopulmonary anastomosis at either or both atrial side, could be used according to the surgical facility. We used a direct end-to-side anastomosis between right-sided atrial appendage and right pulmonary artery and another anastomosis between the roof of the left-sided atrium and the left pulmonary artery. By the above procedure we have suggested to save the sinus rhythm and atrial contraction, and so to earn some additional, but not cirtical, hemodynamic advantages[13].

From the above our experience, we hopefully suggested that the coexistence of anomalies of systemic venous connection could poses neither technical difficalties at repair nor increased operative mortality from now. Any cases of anomalous systemic venous drainage can be managed with partitioning of atrium with bilateral systemic venous baffles and then to make systemic venous pulmonary continuity. There will be reduced risk of obstruction to systemic or pulmonary venous drainage.

In addition, there will be natural potency for growth of any chamber or orifice because of no use of prosthetic material except small portion of each venous chambers.

We believe that this procedure is applicable for physiological correction of any complex congenital cardiac disease suitable for Fontan procedure, if in which anomalies of systemic venous drainage combined.

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