Neonatal Jatene Operation for Transposition of Great Arteries with Intact Ventricular Septum

-Two Cases Report-

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=국문초록=

심실중격결손이 동반되지 않은 신생아 대혈관전위증에서의 Jatene 술식

-수술치험 2례-

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신생아에서 심실중격결손을 동반하지 않은 대혈관전위증(Transposition of the great arteries with intact ventricular septum)의 해부학적교정은 저체중등의 외과적 위험인자에도 불구하고 심방내 교정보다 생리적이다는 점에서 선호되고있고 조기수술성적이 향상되었다고는 하나 아직도 국내사망율은 높은 편이다.

저자들은 최근 3.5Kg(생후 19일), 3.6Kg(생후 16일)된 신생아에서 Jatene operation 2례를 치험하였기에 보고하는 바이다. **(Korean J Thoracic Cardiovas Surg 1994;27:386-9)**

Key words : 1. Transposition of great vessels

CASE 1.

A 10-day-old male neonate weighing 3.5Kg was admitted with cyanosis, constipation and tachypnea. Upon physical examination, the respiratory rate was 76 and the pulse rate 188. The liver's edge was palpable one finger-breath below the right costal margin. A grade I-II/IV systolic murmur was heard at the left upper sternal border. Blood examination showed a red cell count of $397 \times 10^4/\mu$L, a hemoglobin value of 13.9g/dl and a white cell count of $25.3 \times 10^3/\mu$L. Arterial oxygen tension and saturation were 33.3mmHg and 65.5% respectively.

The chest roentgenogram demonstrated an egg-shaped cardiomegaly as well as a mild increase in the pulmonary vasculature(Fig. 1). The electrocardiogram showed sinus rhythm with right axis deviation and right ventricular hypertrophy. Echocardiogram and cardiac catheterization were performed and the diagnosis of d-transposition of the great arteries with intact ventricular septum(TGA/IVS) and patent ductus ateriosus(PDA) was established(Fig. 2). Balloon atrial septostomy was performed during the catheterization study and continuous intravenous infusion of Prostaglandin E_1(10ng/Kg/Min) and dopamine(3mcg/Kg/Min) was started. The patient's condition was stabilized at the arterial oxygen saturation of 80%. On the 9 hospital day, echographic reevaluation revealed LV/RV pressure ratio 83%, and LV free wall thickness 3.2mm.

The elective Jatene operation was performed on the 10th

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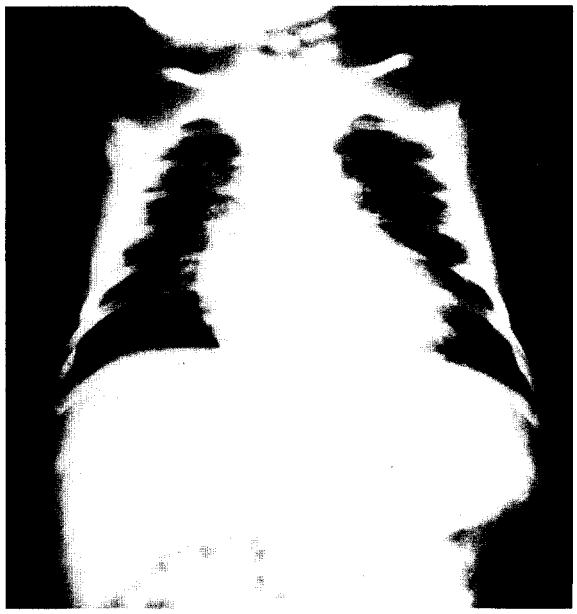

Fig 1. (Case 1.) Preoperative chest roentgenogram showing a enlarged egg-shape heart and mild degree of pulmonary congestion.

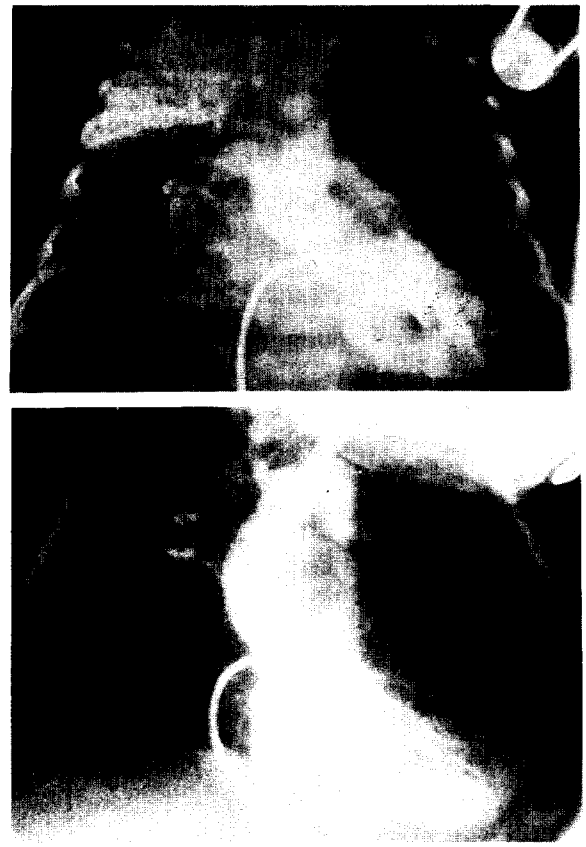

Fig 2. (Case 1.) Preoperative angiogram showing the aorta originating from the right ventricle (top) and the main pulmonary artery from the left ventricle (bottom).

hospotal day. Median sternotomy was done and pericardium was harvested to use as patches for coronary donor site. The aorta was carefully dissected, and pulmonary artery to the level of the 1st branching of the artery. Cardiopulmonary bypass was started with routine arterial and double venous cannulation and body temperature was lowered to 25℃ by rectal temperature. During this core cooling period, PDA was dissected and divided. After aortic clamping the cold crystalloid K^+ cardioplegic solution was infused via aortic root and cardiac arrest was achieved. The aorta was severed at about 5 mm above the top of the aortic valve commissures under continuous perfusion and intermittent infusion of chloropromazine (1 mg/15 min). The left and right coronaries were mobilized, with a portion of the aortic wall, which extends from the aortic incision line superiorly to the sinus of Valsalva and inferiorly to the coronary ostium. Then, the pulmonary artery was transsected just proximal to the bifurcation and the distal pulmonary segment was transferred to a position anterior to the distal aorta (LeCompte). The left and right coronary arteries and surrounding aortic wall were anastomosed with the proximal pulmonary artery wall with continuous 7-0 prolene suture. The proximal neoaorta was then sewn end-to-end to the distal aorta with 6-0 monofilament absorbable suture (PDS). The coronary donor site were repaired with autologous pericardium and the distal pulmonary artery was sewn to the proximal neopulmonary artery with continuous 6-0 PDS. The atrial communication and right atrial incision were closed.

Rewarming was carried out on bypass up to 35℃ rectal temperature. After release of the aortic clamp, the heart resumed beats spontaneously. Finally the patient was completely rewarmed and bypass was discontinued when the systolic radial arterial pressure was 45 mmHg. During the procedure additional cardioplegic solution was infused retrogradely via coronary sinus with 30-min-interval. Total bypass time was taken 142 min and aortic clamping time was 125 min.

The infant was successfully weaned from the mechanical ventilation on the third postoperative day and the sub-

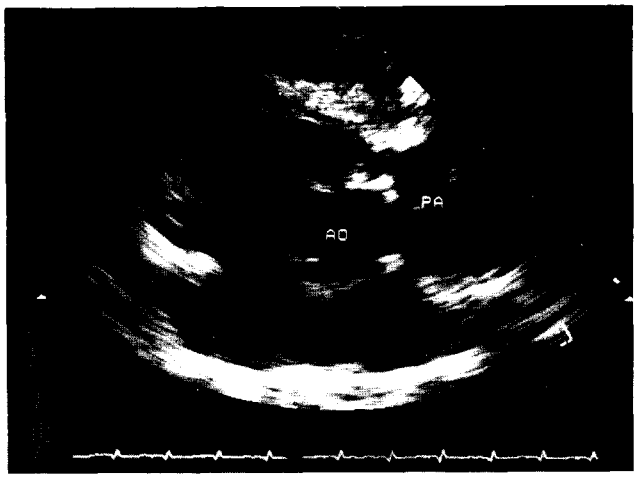

Fig 3. (Case 1.) Postoperative echocardiogram (short axis view at the the great artery level) showing that the aorta is located in the right side of the main pulmonary artery.

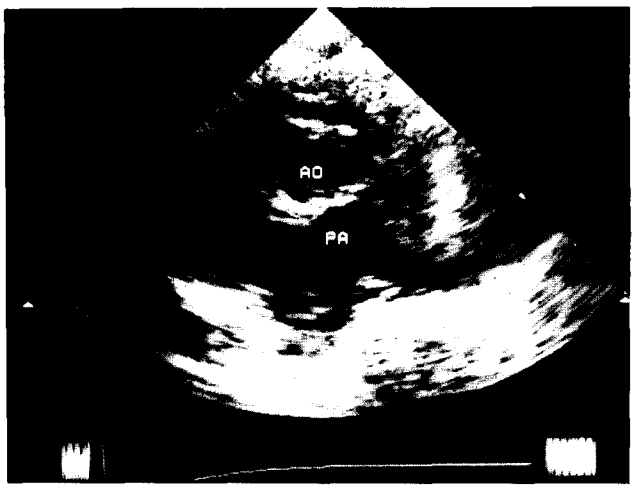

Fig 4. (Case 2.) Preoperative echocardiogram (short axis view at the great artery level) showing that the aorta is located in the right anterior portion of the main pulmonary artery.

sequent course was uneventful. Echocardiogram was performed 3 months after the operation (Fig. 3). There was a minimal systolic pressure gradient across the pulmonary valve, but otherwise normal data were obtained. The patient is excellent health, without cyanosis, arrhythmia, or heart failure, 9 months after the Jatene operation.

CASE 2.

A 15-day-old female weighing 3.6 Kg was admitted with tachypnea. Examination revealed acrocyanosis and marginally papable liver with respiratory rate of 80 breaths and pulse rates of 130 per minute. Blood pressure was 90/60 mmHg, blood examination showed a red cell count of 356 $\times 10^4/\mu L$, a hemoglobin value of 13.8 g/dl and white cell count of $21.8 \times 10^3/\mu L$. Arterial oxygen tension was 24.5 mmHg and oxygen saturation 32.6%.

The chest roentgenogram demonstrated an egg-shaped cardiomegaly and a mildly increased pulmonary vasculature. The electrocardiogram showed right ventricular hypertrophy. By echocardiogram and cardiac catheterization, the patient was diagnosed as d-transposition of the great arteries with intact ventricular septum and small patent ductus arteriosus (Fig. 4). Balloon atrial septostomy was performed during the catheterization, followed by continuous intravenous infusion of prostaglandin E_1 and dopamine. Angiogram could not be done due to severe respiratory distress (Fig. 6).

The patient's condition was worsened and emergency operation performed on the next day. The operation was carried out as same manners of case 1. Total bypass time was 130 min and the aortic clamping time 110 min. The postoperative blood pressure was easily maintained around 80/40 mmHg. There was no evidence of low-out failure throughout the immediate postoperative period but the patient died of suddenly developed massive hematemesis on the 31th postoperative day.

DISCUSSION

Transposition of the great arteries (TGA) denotes a congenital cardiac condition in which atrioventricular connection is concordant and ventriculoarterial connection is discordant {S.D.D.}, among which approximately 75 per cent have an intact ventricular septum.

The concept of "switching" the aorta and pulmonary artery to repair transposition of the great arteries (TGA) has great intuitive appeal since it not only provides correction of the physiologic defect by directing systemic venous blood to the lungs and pulmonary venous blood to the body, but also "recreates" normal anatomy by making the left and right ventricles become the pumping chambers for

the systemic and pulmonary circulations, respectively. Jatene reported his initial experience with the arterial switch operation including coronary transfer for TGA with ventricular septal defect at the 1975 Henry Ford Symposium[1].

Through the 1950s there were surgical attempts to correct TGA either at the atrial or great arterial levels. The first successful operation of TGA at the atrial level was reported by refashioning the walls of the right atrium and the atrial septum. After then, numerous modifications were suggested by many, including Bernard, Schumaker and Mustard[2, 3]. But somewhat disappointing results of the atrial swich operation for TGA and large ventricular septal defect (VSD) continued to be a stimulus for the development of an arterial switch operation, particularly since the right (systemic) ventricle failed late postoperatively[4]. After several unsuccessful attempts of arterial switch operation, Jatene and colleagues in Brazil reported the first successful case in infant with TGA and VSD in 1975). However, most infants with intact ventricular septum (TGA/IVS) did not survive after arterial switching because of the low pressure left ventricle's not being prepared for sustaining systemic pressure. Abe in 1977 and Mauck in 1978 reported a successful arterial switch operation in infants with TGA/IVS. At present, two different approaches are generally undertaken for the TGA/IVS patients. A first method is preparing the left ventricle by performing pulmonary artery banding, and the arterial switch procedure is then performed several months later[5]. A second approach is performing the arterial switch operation during the neonatal period when the left ventricle is still prepared by the high pulmonary resistance, which exists in the intrauterine circulation[6].

Currently, in situations properly prepared for the arterial switch operation in neonates, the early or hospital mortality is about 2 to 5%[7]. But in Korea, neonatal arterial switch operation seems to have a high mortality[8]. We believe that the advancement in surgical techniques and perioperative care and an accurate application of Jatene operation to the neonate will improve the surgical results.

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