นิพนธ์ต้นฉบับ

Cardiac malformations in Down's syndrome, Chulalongkorn Hospital

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Sixty five children with Down's syndrome and congenital heart disease were seen at the Pediatric cardiac unit, Department of Pediatrics, Chulalongkorn hospital; during January 1988 - December 1992. The diagnosis of congenital heart disease was base on the history, physical examination, chest radiography, electrocardiography and echocardiographic data. The most common lesion was ventricular septal defect (40.0%), followed by atrioventricular canal defect (24.6%), secundum atrial septal defect (13.8%), isolated patent ductus arteriosus (10.8%), and primary pulmonary artery hypertension without cardiac defect (7.6%). Cyanotic cardiac lesion was found only in 2 cases. Sixty percent of the cardiac patients with left to right shunt had evidence of pulmonary artery hypertension by clinical and echocardiographic data and 65.7% of them were below 1 year of age. This data indicated that children with Down's syndrome developed pulmonary artery hypertension in the early stages of life which would influence the long term prognosis.

Key words : *Down's syndrome, Cardiac malformation.*

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ความพิการของหัวใจแต่กำเนิดในผู้ป่วยกลุ่มอาการดาวน์พบได้บ่อย โดยพบได้ถึงร้อยละ 40-60 ของผู้ป่วยทั้งหมด ผู้รายงานได้ทำการศึกษาถึงชนิดของโรคหัวใจพิการแต่กำเนิดที่พบในผู้ป่วยกลุ่มอาการดาวน์ที่เข้ามารับการรักษาในหน่วยโรคหัวใจเด็ก ภาควิชากุมารเวชศาสตร์ คณะแพทยศาสตร์ โรงพยาบาลจุฬาลงกรณ์ ระหว่างวันที่ 1 มกราคม 2531 ถึง 31 ธันวาคม 2535 มีผู้ป่วยเข้ามารับการรักษาจำนวน 65 ราย การวินิจฉัยชนิดของหัวใจพิการแต่กำเนิดอาศัยการตรวจร่างกายและการตรวจด้วยคลื่นเสียงสะท้อนความถี่สูง พบว่า Ventricular septal defect พบได้บ่อยที่สุด โดยพบได้ถึงร้อยละ 40 ของผู้ป่วยทั้งหมด ที่พบบ่อยรองลงมาได้แก่ Atrioventricular canal defect (24.6%), secundum atrial septal defect (13.8%), isolate patent ductus arteriosus (10.8%), primary pulmonary hypertension (7.6%) สำหรับโรคหัวใจแต่กำเนิดชนิดเขียวพบเพียง 2 รายเท่านั้น ภาวะความดันเลือดในปอดสูงผิดปกติพบได้ถึงร้อยละ 60 ของผู้ป่วยที่มีความพิการของหัวใจแต่กำเนิดชนิด left to right shunt โดยร้อยละ 65.7 ของผู้ป่วยเหล่านี้มีอายุน้อยกว่า 1 ปี ดังนั้นภาวะความดันเลือดในปอดสูงผิดปกติจึงพบได้บ่อยและเกิดขึ้นได้เร็วกว่าปกติในผู้ป่วยกลุ่มอาการดาวน์และภาวะนี้จะมีผลต่อการพยากรณ์โรคในผู้ป่วยเหล่านี้ด้วย

Down's syndrome is the most common chromosomal aberration with mental retardation. The association of cardiovascular disease is well recognised, with the reported incidence of 40-60%. [1-5] It has long been known that atrioventricular canal defect is the most frequent cardiac anomaly. [6-8] However, ventricular septal defect have also been found to be the most common cardiac lesion in some studies. [3,9] The varying results of these studies may be due to the different groups of patients selected and method of studies. The development of pulmonary artery hypertension and pulmonary vascular disease is significantly higher in children with Down's syndrome than in normal children with cardiac anomalies. [9-11] We reviewed retrospectively the records of cardiac malformations and the occurence of pulmonary hypertension present in children with Down's syndrome at the department of Pediatrics, Chulalongkorn hospital.

Material and methods

The study consisted of all children referred to the Pediatric cardiac clinic, Chulalongkorn hospital during January 1988- December 1992. Down's syndrome was diagnosed by clinical and/or chromosomal study. A detailed history and physical examination of the cardiovascular system, chest radiography, electrocardiography and echocardiography were done in all patients. The type of cardiac malformations were categorised by using the New England Regional Infant Cardiac Programe (NERICP). [12] Pulmonary artery hypertension was diagnosed clinically, and confirmed by the abnormality in the ratio of acceleration time to ejection time of the pulmonary artery flow velocity obtained from Doppler echocardiography. [13]

Result

During the study period, there were 65 patients with Down's syndrome and cardiac malformations. The age ranged from 5 days to 12 years old. There were seventeen patients aged less than 1 month; 28 patients were between 1 month to 1 year old; 13 patients were between 1 to 4 years old and 7 patients were older than 4 years old. Male to female ratio was approximately 3:2 (39:26). Diagnosis of Down's syndrome was confirmed in 48 patients (73.8%) by chromosomal study. Five patients had additional extracardiac anomolies.

Cardiac anomalies in these children were devided into 6 groups : atrioventricular canal defect, ventricular septal defect, secundum atrial septal defect, isolated patent ductus arteriosus, pulmonary hypertension without cardiac lesion and cyanotic cardiac lesions (Table 1). Ventricular septal defect was the most common type of cardiac malformation (40.0%), 38.5% were inlet type ventricular septal defect. The second most common cardiac lesion was atrioventricular canal defect (24.6%). The secundum atrial septal defect was presented in 13.8%, isolated patent ductus arteriosus in 10.8% and cyanotic cardiac lesions in 3.1%. Two patients with cyanotic cardiac lesion had pulmonary atresia with ventricular septal defect and tricuspid atresia with pulmonary stenosis.

Table 1. Type and incidence of cardiac malformations in Down's syndrome.

Diagnosis	Number of patients		Total	%
	without PH	with PH		
Ventricular septaldefect	10	16	26	40.0
Atrioventricular canal defect	4	12	16	24.6
Secundum atrial septal defect	5	4	9	13.8
Isolated patent ductus arteriosus	4	3	7	10.8
Primary pulmonary hypertension	-	5	5	7.6
Cyanotic cardiac lesions	2	-	2	3.1
Total	**25**	**40**	**65**	**100.0**

PH = Pulnomary artery hypertension.

Evidence of pulmonary artery hypertension by clinical and abnormal pulmonary artery flow velocity was found in 5 patients without cardiac lesion and in 35 (60.3%) patients with left to right cardiac lesions. With increasing age, the clinical and echocardiographic evidence of pulmonary artery hypertension increased. Fifty five percent of the patients below 1 year of age had evidence of pulmonary artery hypertension. (Table 2)

Table 2. Age distribution of patients with clinical and echocardiographic evidence of pulmonary artery hypertension (PH).

Age	Without PH	With PH	Total
< 1 month	7	7	14
1 month - 1 year	10	14	24
1-4 years	4	9	13
> 4 years	2	5	7
Total	**23 (39.7%)**	**35 (60.3%)**	**58**

21 patients developed pneumonia and 8 patients developed congestive heart failure during the study period. Digitalis and vasodilators such as prazosin and angiotensin converting enzyme inhibitors were used to treat the patients who had clinical evidence of congestive of heart failure and pulmonary hypertension. One patient with atrioventricular septal defect developed cyanosis from pulmonary vascular obstructive disease. Corrective surgery was done in 3 patients with isolated patent ductus arteriosus and one patient with ventricular septal defect. The overall mortality rate was 12.3%.

Discussion

The incidence of cardiac malformations in patients with Down's syndrome vary greatly with the nature of the studies, ranging from 36.3 to 62.0%. [1-5,10] In our study, the most common cardiac malformation is ventricular septal defect followed by atrioventricular canal defect. This is in contrast to other studies in which atrioventricular canal defect is more common than ventricular septal defect (Table 3). Our data is similar to the data from Malaysia which was reported by Hoe TS and Chan KC. Racial factors may contribute to the difference in the type of cardiac malformation in Down's syndrome patients.

Table 3. Type of common cardiac malformations in patients with Down's syndrome from different centres.

Type of defect	Rowe/Uchida [1]	Greenwood [12]	Park [8]	Hoe/Chan [3]	This study
AVC	36%	48.7%	45.6%	11.8%	24.6%
VSD	33%	28.7%	33.2%	52.9%	40.0%
ASD 2 ^{0}	9%	2.6%	8.4%	-	13.8%
PDA	10%	6.9%	4.7%	17.6%	10.8%

AVC = Atrioventricular canal defect, VSD = Ventricular septal defect

ASD 2 ^{0} = Secundum atrial septal defect, PDA = Patent ductus arteriosus

Pulnomary hypertension is more common and occurs early in children with Down's syndrome and heart disease, [9-11,14] particularly in those with a large left to right shunt, [10] and may develop in patients who have little or no congenital cardiac malformations. [15-17] The development of severe pulmonary vascular disease have been noted to occur in children with Down's syndrome who are less than one years old. [18] As in our study, evidence of pulmonary artery hypertension is found in 60.3% of the patients with left to right shunt and in 55% of the patients who were less than one year old. Several hypotheses have been made to explain the development of significant pulmonary hypertension in these children; such as chronic upper airway obstruction due to tonsillar and adenoid hypertrophy, laryngomalacia, obstructive sleep apnoea, enlarged tongue, and mid facial hypoplasia. These mechanisms result in alveolar hypoventilation, hypoxaemia and hypercapnia which causes elevation of pulmonary artery resistance. In addition, lung parenchymal disease, diminished numbers of alveoli and decrease alveolar area, the loss of capillary surface area also results in the development of pulmonary artery hypertension. [19-20] The development of pulmonary artery hypertension is significant and affect the long term prognosis of these children.

Children with Down's syndrome and congenital heart disease can be successfully treated early in life. Therefore an early routine cardiac evaluation is essential. In the light of changing sociolegal environment, our future concerns should be toward prevention, early recognition, and improved management.

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