

Otaigbe BE
Tabansi PN
Agbedeyi GO

Pattern of congenital heart defects in children with Down syndrome at the University of Port Harcourt Teaching Hospital, Port Harcourt

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Agbedeyi GO (✉)
Otaigbe BE, Tabansi PN
Department of Paediatrics,
University of Port Harcourt
Teaching Hospital,
Port Harcourt, Rivers State,
Nigeria.
E-mail: tagbedeyi@yahoo.com
Tel : +2348033908601

Abstract Down syndrome (DS) is the most common chromosomal abnormality in man and congenital heart defects (CHD) the most life threatening of its manifestations. The cardiac anomalies and early pulmonary hypertension are associated with high morbidity and mortality. It is thus important to diagnose and intervene early to improve the quality of life. Few studies have been done on Down syndrome patients in Nigeria.

Objective: The objective was to find out the incidence and types of congenital heart defects in Down syndrome patients seen in the Paediatric cardiology unit of this tertiary institution.

Method: A prospective study of Down Syndrome patients seen at the Paediatric Cardiology clinic of the University of Port Harcourt Teaching Hospital over a three year period was carried out. Data of age, sex, birth order, mother's age,

indication for surgery, clinical and echocardiographic findings and outcome was analysed. **Result:** Of the 31 patients who had echocardiography done, all had cardiac defects (100%). Patent ductus arteriosus, occurring solitarily or in combinations was the commonest cardiac defect seen followed by ventricular septal defects. Interestingly, over 60 % of the patients had multiple cardiac defects with VSD/PDA, VSD/ASD accounting for 50%.

Conclusion: The incidence of multiple cardiac defects in more than 60% of DS patients seen underscores the need for early diagnosis and intervention. Routine extensive cardiac evaluation in the first few weeks of life is advocated.

Key word: Down syndrome, congenital heart defects, Port Harcourt, Nigeria.

Introduction

Down Syndrome (also known as Trisomy 21) is the commonest chromosomal abnormality¹ with affected individuals presenting with multiple malformations and mental retardation arising from the presence of an extra chromosome 21.² There are three types of Down Syndrome (DS) – non-familial or non-disjunction (95%), unbalanced translocation (3-4%) and mosaicism (1-2%).^{2,3} The birth prevalence of DS is 9.6 per 10,000 live births⁴ and the incidence varies from 1:650 to 700.^{3,5} The clinical features of Down syndrome can be variable with the presence of two or more suggesting a possible diagnosis and the need for chromosomal studies.⁶ Chromosomal analysis of peripheral blood lymphocytes gives a diagnosis of DS.^{7,8} Affected children present with varying phenotypical features, commonly prominent epicanthic folds, flat nasal bridge, small mouth, hypotonia, single transverse palmar crease, clinodactyly, Sandal gap etc.² Congenital heart disease is a common fea-

ture as 40-60% of DS children also have been found to have congenital heart defects.^{2,4,7,9} It is important to make a diagnosis of congenital heart disease in the first six weeks of life^{9,10} as heart disease is a major factor that determines the outcome of DS children.^{3,8} It is therefore recommended that physicians have a high level of clinical suspicion for congenital heart disease in neonates with Down Syndrome.¹⁰ The commonest heart defects seen in DS are atrio-ventricular canal defects, ventricular septal defects, patent ductus arteriosus, atrial septal defects and less commonly tetralogy of Fallot, coarctation of the aorta and pulmonary stenosis,^{3,4,7,9} all of which may occur in isolation or in various combinations. Down syndrome children with congenital heart defects develop irreversible pulmonary vascular disease earlier than other non-DS patients with heart defects.⁹ Initially, following the diagnosis of heart disease DS patients were not given the option of corrective surgery either by health personnel or parents as their life expectancy was low and death from Eisenmenger's syndrome

was common.⁹ Over the years this attitude has changed and more children now have early surgery before they are six months old.¹¹ The outcome of surgery has also greatly improved.^{11,12}

In Nigeria, a recent study done that involved Down syndrome patients found that they constituted 78.3% of all syndrome complexes seen and that the commonest heart defects were ventricular septal defects and atrioventricular canal defects.¹³

This study was undertaken in Port Harcourt to ascertain the incidence and types of congenital heart defects seen amongst Down syndrome patients at the Paediatric Cardiology clinic.

Method

This was a prospective study carried out at the Paediatric Cardiology clinic of the University of Port Harcourt Teaching Hospital (UPTH) on all patients who presented with features of Down Syndrome between January 2009 and February 2012. Patients seen in the clinic are usually referred from the Paediatric outpatient clinic if they present with a murmur, failure to thrive, recurrent chest infection or heart failure. In addition for Down patients, the indication included dysmorphic features. The following information was obtained from children with features of Down syndrome - name, age, sex, clinical features, birth weight, birth order, mothers' and fathers' ages, indication for referral to Cardiology unit, echocardiography findings and outcome. Echocardiography was done by the Consultant Paediatric Cardiologist using the Sonosite Micromaxx machine. Data was analysed using Epi Info six.

Results

A total number of two hundred and fifty - three patients with congenital heart disease were seen over the study period, of which thirty- eight (15%) had features of Down syndrome. However only 31 patients had echo done and these alone were analysed. This gave an incidence of 12%. There were 17 females and 14 males with a male-female ratio of 1:1. Their ages ranged from 0.5 months to 130 months.

Four of the children had low birth weight (13%), 12 (39%) had normal birth weights and 15 (48%) of them were born at health centres or maternity homes where their birth weights were not recorded. With respect to order of birth, 23.8% were first born, 20.4 % second born, 19% third born, 30.6% fourth born and only one each were 6th and seventh children respectively. Their mothers' ages ranged from 25 to 42 years. The mean of their ages was 34years. 61.9% of the mothers were aged between 26 and 35 years and 30% were above 35years

of age.

Table 1: Age ranges of mothers.

Age (years)	Number	%
21-25	3	4.8
26-30	8	28.6
31-35	10	33.3
> 35	10	33.3

The age of the fathers ranged from 33 to 53 years. The mean age for the fathers was 44 years.

All the patients had dysmorphic features, only 12 (39%) had a single transverse palmar crease (9 females and 3 males). 13 (42%) of the patients were referred because of failure to thrive and recurrent chest infections. 90.2 % were referred because murmurs were heard.

Of the 38 patients only 31 had echocardiography done because of financial constraints.

Table 2 shows the common cardiac defects found in these patients.

Table 2: Heart defects seen in Down syndrome patients

Cardiac defect	Number	%
Solitary VSD	3	10
Solitary ASD	2	6
Solitary PDA	4	13
AVCD	3	10
VSD/PDA	5	16
VSD/ASD	5	16
TOF/ASD	2	6
TGA/VSD	1	3
PS	1	3
AVCD/PDA	2	6
TOF	1	3
DORV	1	3
ASD/VSD/PDA	1	3

Key: TGA - Transposition of the Great Arteries AVCD – Atrio-ventricular Canal Defect PS – Pulmonary stenosis

Isolated cardiac defects were seen in nine (29%), PS, TOF and DORV in one (3%) patient each, while multiple cardiac defects (ASD/PDA, ASD/VSD, VSD/PDA, ASD/VSD/PDA, TOF/ASD, TOF/PDA, AVCD, AVCD/PDA, TOF/ASD) were seen in 19 (61%) of patients.

Only five of the patients (16%) have had cardiac surgery and all in India. Six (19%) have died, one in India before undergoing surgery, one from severe pulmonary

hypertension after surgery, one due to complications of surgery for achalasia of the oesophagus, two from intractable heart failure in UPTH and two at home with immediate cause unknown. 20 (65%) are on follow-up and being managed medically while awaiting surgery.

Discussion

The incidence of cardiac defects in Down syndrome patients seen in this study was 100% which is seemingly high but explained by the fact that these patients were referred for cardiac evaluation because of existing symptoms and signs suggestive of a cardiac pathology. This incidence is thus understandably higher than the known 40-60% documented internationally and locally in reviews of Down patients.^{2-4,9,13}

That 60% of the children were second born and higher in birth order, differs from previous study results that DS patients were mainly the first born.³ This is probably explained by the fact that some of the mothers in this study are young and also multiparous.

Two-thirds of the mothers were younger than 35 years which is similar to a Mexican study showing that the highest proportion (34%) of the DS patients were born to mothers who were aged 16-25 years.³ This is not in keeping with previous studies that claimed DS due to non-disjunction was commoner with advanced maternal age. However, in this study chromosomal analysis was not done. Another study showed there is no significant difference in the mother's age or race between those DS patients who have cardiac defects and those who do not.⁴

In this study, multiple cardiac defects were seen in 19 (61%) patients with only nine (29%) patients having isolated cardiac defects which were a solitary VSD, ASD, PDA in contrast to other studies which showed that more commonly DS patients have isolated heart defects than multiple ones.^{3,7}

The commonest cardiac defect seen was PDA which accounted for over 50% of cases and seen mainly in combination. This contrasts with most studies done worldwide in which atrio-ventricular canal defects were the commonest heart defects.^{4,5,8,9,14-15} Only two patients had complete AVCD with single A-V valve in this study, one of whom was diagnosed at one week of age and died at two weeks. Two others have transitional A-V canal defect and are being managed medically and awaiting surgery.

In Mexico and Oman, secundum atrial septal defects were the commonest heart defects seen in DS children^{3,7} while in Malaysia VSDs were found in a high of 41.1% of DS patients.¹⁶ Other heart defects that have been documented are tetralogy of Fallot as a solitary lesion or in combination with AVCDs, ASDs or PDAs^{4,7,13,17} and isolated pulmonary stenosis,¹³ hypertrophic cardio-

myopathy and hypertrophic obstructive cardiomyopathy and complex cyanotic heart defects,¹⁶ coarctation of the aorta⁴ and even a case of Pentalogy of Fallot with right aortic arch, a perimembranous non-restrictive VSD and secundum ASD.¹ In a study done amongst a highly consanguineous population of DS patients, such defects as aortic stenosis, coarctation of the aorta, transposition of the great arteries and complex congenital heart diseases were not seen.⁷ We found two cases of Pentalogy of Fallot, one of transposition of the great arteries and an isolated pulmonary stenosis among our study population.

Down Syndrome patients with congenital heart defects are known to develop pulmonary hypertension at an earlier age than non-Down Syndrome patients with heart defects – as early as 3-4 months of life.⁹ It is seen commonly in those who have AVCDs especially the complete type.^{3,9} The early development of pulmonary hypertension has been attributed to the reduced pulmonary alveolarization in DS or the increased risk of upper respiratory tract obstruction.¹⁵ As a result of these developments it is advocated that DS patients are reviewed by cardiologists on or before six weeks of life (preferably by 2 weeks) and a complete cardiac evaluation including ECG and ECHO done.^{9,10} All patients who have cardiac defects should be offered surgery by the age of four months⁹ to avoid the development of pulmonary hypertension. Surgery is also done because of the possibility of upper airway obstruction, respiratory symptoms, feeding difficulties and poor growth that are symptoms associated with congestive heart failure.¹² The younger a DS child is at surgery the more likely it is to be successful and the pulmonary hypertension reversible.¹¹ Amongst the patients studied only five (16%) had pulmonary hypertension. Other studies have given the incidence of pulmonary hypertension as 50%.³

A review of national data proved that Down syndrome patients had no increased mortality risk following surgery for common heart defects. However they did have longer hospital stays and higher rates of post-operative complications after repairs of ASDs, VSDs and tetralogy of Fallot.¹¹ Another study says 15% of DS patients who have surgery have a good outcome at one year from surgery.¹⁴ Down Syndrome patients with complete AVCDs who do not have surgery may either end up with severe cardiac disability or death.⁹ Four of the five patients who had surgery were operated before one year of age and the Pentalogy of Fallot repair was at two years of age. Aside from the two who died (both post-operatively and the other from another noncardiac surgery one year later) all other three are doing well post-operatively. The small percentage of patients with DS having surgery in our study is not only due to the cost of the surgery (which is not done in Nigeria) but also probably due to the fact that the parents are counseled and aware that the cardiac surgery does not change the phenotypic appearance and degrees of mental retardation associated with DS

Conclusion

Down Syndrome patients have a number of manifestations, the most debilitating being the cardiac defects. The incidence of multiple cardiac defects in more than

50% of DS patients underscores the need for early diagnosis and intervention to improve the quality and expectancy of life. Routine extensive cardiac evaluation in the first few weeks of life is advocated.

Conflict of interest: None

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References

- Gurbuz A, Lafci B, Ozpak B, Aslan O, Yurekli I, et al. Pentalogy of Fallot and Down's syndrome with right aortic arch anomaly. *The Internet J of Thorac and Cardiovasc Surg*, 2009; 14(1).
- American Academy of Pediatrics. Committee on Genetics. Health Supervision for Children With Down Syndrome. *Pediatrics* 2001; 107: 442-9.
- De Rubens Figueroa J, del Pozzo Magana B, Pablos Hach JL, Calderon Jimenez C, Castrejon-Urbina R. Heart Malformations in Children With Down Syndrome. *Rev Esp Cardiol* 2003; 56: 894-9.
- Freeman SB, Taft LF, Dooley KJ, Allran K, Sherman SL, et al. Population-Based Study of Congenital Heart Defects in Down Syndrome. *Am J Med Genet* 1998; 80: 213-7.
- Steeg CN. Congenital Heart Disease in Down Syndrome. *Pediatr Rev* 1993; 14: 488-94.
- Towbin JA, Greenberg F, Genetic Syndromes and Clinical Molecular Genetics. In: Garson A, Bricker JT, Fischer DJ, Neish SR (eds). *The Science and Practice of Paediatric Cardiology* 2nd edition, Maryland Williams and Wilkins 1998; 2627- 99
- Venugopalan P, Agarwal AK. Spectrum of Congenital Heart Defects Associated with Down syndrome in High Consanguineous Omani Population. *Indian Pediatrics* 2003; 40: 398-403.
- Nisli K, Oner N, Candan S, Kayserili H, Tansel T, et al. Congenital heart disease in children with Down's syndrome: Turkish experience of 13 years. *Acta Cardiol* 2008; 63: 585-9.
- Dennis J, Archer N, Ellis J, Marder L. Recognising heart disease in children with Down syndrome. *Arch Dis Child Educ Pract Ed* 2010; 95: 98-104.
- Down Syndrome Medical Interest Group. Basic Medical Surveillance Essentials for people with Down's syndrome Cardiac Disease: Congenital and Acquired Cardiac Revision. December 2007.
- Amark K, Sumergardh J. The effect of changing attitudes to Down's syndrome in the management of complete atrioventricular septal defects. *Arch Dis Child* 1999; 81: 151-4.
- Fudge JC, Li S, Jagers J, O'Brien SM, Peterson ED, et al. Congenital Heart Surgery Outcomes in Down Syndrome: Analysis of a National Clinical Database. *Pediatrics* 2010; 126: 315-
- Ekure EN, Animashaun A, Bastos M, Ezeaka VC. Congenital Heart Disease associated with Identified Syndromes and Other Extra-cardiac Congenital Malformations in Children in Lagos. *West Afr J Med* 2009; 28: 323-7.
- Ali SKM. Cardiac abnormalities of Sudanese patients with Down's syndrome and their short-term outcome. *Cardiovasc J Afr* 2009; 20: 112-5.
- Martinez-Quintana E, Rodriguez-Gonzalez F, Medina-Gil JM, Agredo-Munoz J, Nieto-Lago V. Clinical outcome in Down syndrome patients with congenital heart disease. *Circulation* 2010; 78: 245-50.
- Hae TS, Chan KC, Boo NY. Cardiovascular Malformations in Malaysian neonates with Down Syndrome. *Singapore Med J* 1990; 31: 474-6.
- Rashid AKMM, Basu B, Rahman MM. Tetralogy of Fallot in down syndrome (Trisomy 21) – An uncommon association. *Pak J Med Sci* 2009; 25: 698-700.