Down's Syndrome with Congenital Heart Disease: Analysis of Cases Over Two Years in a Non-Invasive Laboratory of a Tertiary Hospital

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Abstract:

Background: *Trisomy 21 or Down's Syndrome is the most frequent chromosomal aberration affecting live birth infants with an incidence of 1 in 660 live births. This syndrome is often associated with congenital cardiac lesions, Incidence of which is 40-60 percent. This study was conducted to see the frequency of Down's syndrome cases and pattern of heart diseases they have in one of the busy non-invasive pediatric cardiac laboratory of the country.*

Methods: *It was a retrospective study conducted in the non-invasive pediatric cardiac laboratory and pediatric cardiac outpatient clinic of a tertiary hospital over a period of two years (November 2007 to October 2009). The entire patients who had Down's Syndrome and had Doppler echocardiography were included in the study.*

Results: *Out of total six thousand and fifty echocardiography, Down's Syndrome case was 205 (3.38%). Out of 205 cases, 185 cases were followed up in pediatric cardiac out patient clinic. Twenty cases had not reported in the out patient clinic. Seventeen of those patients had normal cardiac anatomy in Doppler echocardiography. Male were 43.90% and female were 56.09% amongst study group. Most of the patients are young infant (47.32%). Only 2.44% are in more than 10 years age group. Murmur was audible in 86.49% cases in study group and developmental delay was present in 100% of the cases. Doppler Echocardiography was found as most sensitive and specific investigation for detecting congenital heart disease. A-V canal defect was the commonest association (15.60%). Congenital heart disease was not detected in 8.29% cases. Surgical treatment was advised in 52.19% cases, Device closure was advised in 16.59% cases, medical management was advised in 21.46% cases.*

Conclusion: *Down's syndrome is a very common chromosomal anomaly in our country. Incidence of this syndrome is increasing as number of working women, late marriage and elderly mother increasing. So, multidisciplinary approach for managing this disease should be adopted immediately.*

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Introduction:

Down's Syndrome, also called Trisomy 21, is the commonest genetic pattern of malformation in human being[1]. Most of the textbooks and authors quote the incidence of this malformation as one in 700 to 800 live births. Down's syndrome was first described by John Langdon Haydon Down with characteristic physical features and problems and so known as Down's syndrome.[1] Children with Down's syndrome are at much higher risk of congenital heart disease.[2] The incidence of congenital heart disease (CHD) in general population is 0.8 percent whereas the incidence of CHD in children with Down's syndrome is between 40-60 percent.[3] The aim of this study was to find out the pattern of congenital heart disease among the Down's syndrome cases who were analyzed over a period of two years. Among 6050 cases of total echocardiography performed over two years, 205 (3.38%) were with Down's syndrome. Commonest type of congenital heart lesion was AV canal defect (15.60%). Normal cardiac anatomy was found in 17 (8.29%) cases.

Materials and Methods:

This is a retrospective study carried out in the pediatric echocardiography laboratory and pediatric cardiac out patient clinic of Lab Aid cardiac hospital from November 2007 to October 2009. Patients were referred either to the out

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patient clinic for cardiac evaluation or to the Echo laboratory for color Doppler echocardiography. All the cases who were less than 3 years of age were sedated first with syrup Promethazine hydrochloride 1 mg/kg body weight. Sequential segmental analysis of the heart was done using color Doppler, M-mode and 2-D Echocardiography. Echocardiography was advised to all out patient cases also even if there was no audible murmur. This was done for screening purpose. All the cases that were referred for echocardiography only were sent back to their referral center. Most of the cases that were positive for various types of congenital heart lesions were again referred back to the pediatric cardiologist for further management. Management plan was designed for each and every patient depending on the individual requirement. Before doing that, history, clinical examination, chest X-ray, ECG were done and analyzed thoroughly. Most of the patients had history of developmental delay, constipation, recurrent respiratory tract infection, feeding difficulties etc. Surgical correction was planned for those who had no chance of cure with medical management. Medical treatment was planned for those who had chance for cure with medicine and moreover there was no complications related to their heart lesions. Device closure was advised for those cases that will never require open heart surgery for any other existing lesions. All patients with congenital heart lesions were advised to attend out patient clinic at regular intervals. Interval was more for less serious lesions and less for more serious lesions. Post operative and post intervention cases were followed up according to the protocol. For device cases, follow up plan was as 1, 3, 6, 9, 12, 18, 24 month of intervention and yearly thereafter for 02 years. For surgery, follow up plan was at 6 weeks, 03 months, 06 months, 01 year of surgery and yearly thereafter for 05 years.

Results:

Table-I showed frequency of Down's syndrome cases amongst all who had Doppler echocardiography over a period of two years. Amongst 605 of total cases, 205 (3.38%) cases had Down's syndrome.

Table-I

Frequency of Down's syndrome cases amongst total pediatric echocardiography load.

Subject	No	Percentage
Total Echocardiography	6050	100%
Down's syndrome Baby	205	3.38%

Among 205 cases of Down baby, 90 (43.90%) were male and 115 (56.09%) were female. So female patients outnumbered male patients.

Table II

Sex distribution of patients (n =205).

Sex	No	Percentage
Male	90	43.90%
Female	115	56.09%

Ninety seven (47.32%) cases were in 0-6 month's age group, 69 (33.66%) cases were in more than 6 months to 3 years age group, 34 (16.59%) cases were in more than 3 years to 10 years age group and 5 (2.44%) cases were in more than 10 years age group.

Table-III

Age distribution of patients (n =205)

Age	0-6 months	> 6 months to 3 yrs	>3 years to 10 yrs	> 10 years
Number	97	69	34	5
Percentage	47.32%	33.66%	16.59%	2.44%

As 20 patients had only echocardiography and not reported to pediatric out patient clinic for other work up, total case here was 185. History of recurrent respiratory tract infection was present in 127 (68.64%) cases; Murmur was detected with stethoscope in 160 (86.49%) cases. Developmental delay was present in 185 (100%) cases and murmur was not detected in 25 (13.51%) cases.

Table IV

Clinical findings in Down's syndrome cases (n =185)

Symptoms and signs	No	Percentage
Recurrent RTI	127	68.64%
Presence of murmur	160	86.49%
Developmental Delay	185	100%
G I Tract abnormality	25	13.51%
Hypothyroidism	8	4.32%
Eye problem	4	2.15%
Hearing defect	1	0.44%

20 cases had not reported to out patient clinic after echocardiography. Cardiomegaly was observed in 108 (52.68%) cases; Extreme axis in ECG was noticed in 32 (15.6%) cases, Doppler echocardiography showed presence of various types of congenital heart diseases in 188 (91.71%) cases.

Table-V

Investigation findings in study cases (n =205)

Investigation		No	Percentage
CXR	Cardiomegaly	108	52.68%
	Boot shaped heart	9	4.39%
ECG	Extreme axis	32	15.61%
	LVH	82	40%
	RVH	42	20.49%
Doppler	Abnormal	188	91.71%
echocardiography	Normal	17	8.29%

A-V canal defect was found amongst maximum cases (15.60%), ASD amongst 13.17% cases, VSD amongst 14.63% cases, PDA amongst 5.85% cases and TOF amongst 2.44% cases.

Table-VI

Pattern of heart disease in Down's syndrome cases

Outcome	No	Percentage
AV canal defect	32	15.60%
VSD	30	14.63%
ASD	27	13.17%
ASD with PDA	27	13.17%
ASD and VSD	17	8.29%
NAD	17	8.29%
PDA	12	5.85%
CoA with VSD or PDA	12	5.85%
ASD VSD PDA	7	3.41%
VSD PDA	7	3.41%
TOF	5	2.44%
DORV	5	2.44%
PS	5	2.44%
MVP	2	.98%

Note; VSD-ventricular septal defect, ASD- atrial septal defect, PDA-patent ductus arteriosus, CoA- Coarctation of aorta, TOF- Tetralogy of Fallot, DORV-Double Outlet Right Ventricle, PS-Pulmonary stenosis , MVP- Mitral valve prolapse

Surgical treatment was offered in 52.19% cases, device closure of ASD, PDA and VSD was performed in 16.59% cases. Medical management was advised in 21.46% cases and 9.76% cases had not reported to pediatric cardiac OPD after echocardiography.

Table-VII

Outcome of Down's syndrome cases (n=185)

Outcome	No	Percentage
Surgery	107	52.19%
Device closure	34	16.59%
Medical management	44	21.46%
Not reported to Pediatric cardiac OPD	20	9.76%

Discussion:

Down's Syndrome (DS) is a major cause of congenital heart disease (CHD) and the most frequent known cases of atrioventricular septal defects (AVSDs).[4] A normal human cell contains 23 pairs of chromosomes which carry all of a persons genetic information. Due to several possible abnormal mechanism of cell reproduction, patients with Down'ss syndrome have an extra copy of the 21st chromosome.[1,2,3] Advanced maternal age is associated with a high incidence of Trisomy 21, but even women of any age can have affected babies.[5] Molecular studies of rare individuals with CHD and partial duplications of chromosome 21 established a candidate region that included D21s55 through the telomere. One study reports DSCAM (Down's syndrome cell adhesion molecule) as a candidate gene.[4] The type of heart defects in children with Down's syndrome can be broken Down into three broad categories.

Atrio-ventricular septal defects,Ventricular septal defect, Atrial septal defect or patent ductus arteriosus, Other complex heart disease-

AV canal defect comprises 60% of CHD in Down's syndrome in Cincinnati Children's Hospital Medical Center report. But in our study it comprises only 15.60% of the CHD in Down's syndrome. Ventricular septal defect (VSD), Atrial septal defects (ASD) and patent ductus arteriosus (PDA) comprises another 20% of the CHD in some report. But in our study these three defects comprises 33.65% of the cases. Reasons here is that, most of the cases included in this study are very young infant and in this age group ASD, VSD and PDA is very common. Many of these cases close spontaneously once the baby grow older but A-V canal never cure unless operated. In present study

female outnumbered male, but sex prevalence was not mentioned in other studies.

Non cardiac medical problems associated with Down's syndrome found in this study is a) developmental delay in 100% cases b) hypothyroidism in 4.32% cases c) Recurrent RTI in 63.64% cases d)G I tract abnormality in 13.51% cases. Other study showed 100% developmental delay, 2%-5% gastrointestinal abnormalities, 40-75% hearing loss, 60% eye disorder, 1% leukemia and 5% has thyroid disorders.[4,5-10] Most Cardiologist would agree that all babies that have been diagnosed with Down's Syndrome should have a cardiac evaluation because of the high incidence of associated congenital heart defects. In our center, we do screening of all babies with Down's syndrome for congenital heart disease and thyroid disorders. So among 6050 cases of Doppler echocardiography performed, 205 had Down's syndrome (3.38%). Number of Down's Syndrome was high because all cases of Down's syndrome were screened. In our center we use Doppler echocardiography for screening as we found this test almost 100% sensitive and specific. Among 205 cases of Down patient, 185 patient was detected to have heart diseases by this test. But CXR and ECG were not sensitive in all cases though they were specific for the defects. One study showed individual examination methods were insensitive but highly specific.[11] This study concluded that echocardiography performed early in life can defect congenital heart disease that might other wise be missed.[11] Children with Down's Syndrome are initially managed medically with the use of diuretics, Digoxin etc. In general, ASD, VSD and AV canal defects are closed surgically if the child is symptomatic and cannot be controlled with medication.[11] A-V canal are usually repaired by 3.6 months of age. Atrial septal defect, VSD and PDA can be closed with devices if the patient can fulfill the criteria for such. Depending on size of ASD, VSD, surgery can be postponed even longer, keeping in mind the development of Eisenmenger Syndrome.[12,13] Overall survival beyond one year is 85%. Over 50% of individuals with Down's syndrome live more than 50 years of age. Pneumonia and congenital heart disease is the most common cause of death in 1st year of life.

Conclusion:

Diagnosis of Down's Syndrome is strongly suggested by characteristic physical findings, but the final diagnosis is often made only after chromosome analysis which includes a complete count and visualization under microscope of the chromosome taken from blood cell. A Down's Syndrome baby must have cardiac evaluation as 40-60% of them have congenital heart lesions. Multidisciplinary approach of management should be planned for these children to address neurodevelopmental delay, GIT abnormalities, thyroid disorders, cardiac problems and others.

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