

## ECHOCARDIOGRAPHY BASED STUDY OF THE PREVALENCE AND PATTERN OF CONGENITAL HEART DISEASE (CHD) IN 5-15 YEARS OLD SCHOOL GOING CHILDREN OF MANIPUR, A NORTH-EAST HILLY INDIAN STATE

Rajendra Singh Thangjam<sup>1</sup>, Rothangpui<sup>2</sup>, Anil Irom<sup>3</sup>, Rameshchandra Thounoujam<sup>4</sup>, Indrajit Singh Abujam<sup>5</sup>

<sup>1</sup>Associate Professor, Department of Medicine, Jawaharlal Nehru Institute of Medical Sciences, Porompat, Imphal, Manipur, India.

<sup>2</sup>Associate Professor, Department of Medicine, Jawaharlal Nehru Institute of Medical Sciences, Porompat, Imphal, Manipur, India.

<sup>3</sup>Assistant Professor, Department of Medicine, Jawaharlal Nehru Institute of Medical Sciences, Porompat, Imphal, Manipur, India.

<sup>4</sup>Senior Resident, Department of Medicine, Jawaharlal Nehru Institute of Medical Sciences, Porompat, Imphal, Manipur, India.

<sup>5</sup>Assistant Professor Department of Medicine, Jawaharlal Nehru Institute of Medical Sciences, Porompat, Imphal, Manipur, India.

### ABSTRACT

#### BACKGROUND

CHD is the leading cause of morbidity and mortality in the developed world, while reports from India looking into the burden of the disease have been variable depending on the age group of subjects studied and the methodology involved. We were interested to find the prevalence and pattern of the disease in this north eastern Indian state of Manipur, which has a unique geographical and racial composition.

#### MATERIALS AND METHODS

This is a community based, prospective, cross sectional study where each and every child aged 5-15 years from randomly selected schools of Manipur were examined by 2D colour Doppler Echocardiography and physically as well, where the examiners were blinded, and the findings were noted independent of each other. The anthropometric parameters, clinical details and echocardiography findings were all recorded.

#### RESULTS

Of the 3600 children examined, 47 cases of CHD were detected, giving echocardiographic prevalence of 13 per 1000 where BAV (44%) was found as the commonest lesion followed by VSD (17%) and ASD (14%). Clinically detectable lesion was found in 21 subjects (VSD -8, ASD-7, PS-3, PDA -1, AVSD-1, BAV-1 with AR). Of the clinically detectable CHD, VSD was the commonest followed by ASD. In the subclinical CHD category, 20 cases of BAV, 4 cases of mild MVP without MR, 1 case of apical LV discompacta, 1 case of IASA were detected.

#### CONCLUSION

The echocardiography prevalence of congenital heart disease in school going children of Manipur is 13/1000. This highest ever reported prevalence of CHD in children is most probably related to the use of the highly sensitive investigative tool of Echocardiography in each subject of our study resulting in detection of clinically silent lesions.

#### KEYWORDS

Congenital Heart Disease, Echocardiography Prevalence, Pattern, School Children.

**HOW TO CITE THIS ARTICLE:** Thangjam RS, Rothangpui, Irom A, et al. Echocardiography based study of the prevalence and pattern of Congenital Heart Disease (CHD) in 5-15 years old school going children of Manipur, a North-east hilly Indian state. J. Evid. Based Med. Healthc. 2017; 4(94), 5870-5873. DOI: 10.18410/jebmh/2017/1182

#### BACKGROUND

Congenital heart disease, as defined by Mitchell et al, is "a gross structural abnormality of the heart or intra-thoracic great vessels that is actually or potentially of functional significance".<sup>1</sup> The reported incidence of congenital heart

disease (CHD) in the developed world is 8-10/1000 live births.<sup>2,3</sup>

However, little data is available from developing countries. The birth prevalence of CHD is estimated to be 8 per 1000 live births.<sup>4</sup> A recent systemic review pointed out that highest prevalence of CHD reported from Asia (9.3/1000 live birth) and least from Africa (1.9 /1000 live birth).<sup>5</sup> The burden of CHD in India is likely to be enormous, because of a very high birth rate. It is estimated that over 180,000 children in India are born with CHD every year.<sup>6</sup> Contrast to other developed country there are few Indian studies showing the prevalence of CHD. Available Indian community based studies showed the prevalence of CHD ranging from 0.8-5.2/1000 patients.<sup>7-8</sup> A retrospective study from a

Financial or Other, Competing Interest: None.  
Submission 02-12-2017, Peer Review 09-12-2017,  
Acceptance 16-12-2017, Published 18-12-2017.  
Corresponding Author:  
Dr. Rothangpui,  
#A/77, Zone III, National Games Village,  
Imphal West, 795004, Manipur, India.  
E-mail: rothangpui@gmail.com  
DOI: 10.18410/jebmh/2017/1182



multispecialty corporate hospital in north India has reported the highest prevalence of 26/1000 patients.<sup>9</sup>

Many school going children with congenital heart disease may go unnoticed as symptoms are neglected or less recognised by the parents. These problems or diseases may be already late when detected thereby precluding corrective surgery. Hence, early detection of congenital heart disease is of paramount importance to improve the quality of life of children and prevent morbidity and mortality. Early detection among school children is a novel approach which is time saving and cost effective. It is well known that routine clinical examination of newborns has a poor sensitivity for detection of CHD.<sup>10,11</sup> Echocardiography with Doppler is the gold standard for the diagnosis of CHD in newborns with a very high sensitivity and specificity.<sup>12-14</sup>

The prevalence of congenital heart disease may vary from place to place depending on racial, socioeconomic and environmental factors. Manipur, being a hilly state with its people having mongoloid origin, may have different prevalence of congenital heart disease. As no study has been conducted in this part of the country, we were interested to look into the burden of the disease in this state.

**MATERIALS AND METHODS**

The study was conducted in Manipur which represent an underdeveloped region of the world. Manipur is situated in the eastern corner of India and has a unique geographical characteristic of being a blend of valley and larger portion of hilly areas covering a total area of 22,327 sq. km. hosting a population of 21, 66,788 inhabitants giving a population density of 631 per sq. km. in the valley and 44 per sq. km. in the hills as per 2001 census publication of Govt. of India

The study was conducted in the primary and secondary schools, covering almost all districts of Manipur. The schools in various districts were randomly selected and identified, and then categorized into Government and Private schools. The principals of the school were approached formally and necessary permissions and informed consent forms duly signed by the parents or class master were collected before conducting the study.

Members with PG degree holders from the department of Medicine, JNIMS Manipur headed by a cardiologist conducted the study. This is an offshoot from the study of the prevalence of RHD conducted from 2012 June to 2014 December. Ethical clearance was obtained from the institute Ethical Committee. The paramedical staff noted the demographic and anthropometric data such as weight, height and waist circumference etc. The onsite physician took a brief relevant history and examined the child for general and systemic findings with emphasis on the presence of pallor, cyanosis, clubbing, breathlessness and murmur. Blood pressure was measured using appropriate cuff size under resting condition in right upper arm in recumbent position in a quiet room.

Cardiovascular examination was performed for any respiratory distress, cyanosis, cardiomegaly, congestive heart failure, abnormal heart sounds, murmurs etc. first by any one of the post graduate degree holder physician.

Clinical examination findings were reconfirmed, if necessary, later by the primary investigator who is a cardiologist. Echocardiography including colour Doppler was performed by a cardiologist for all children, using a portable echo machine (Sonosite M Turbo, USA) All the echocardiographic images were stored in digital format for later review by one more cardiologist.

**RESULTS**

A total of 3600 children were screened over 2 years. The age ranges from 5-15 years and children of government and private schools have been enrolled. Out of total 3600 children screened, 1865 (51.8%) were males and 1735(48.2%) were females.

Children aged 5-10 years were comparatively less, comprising of 41% of the total study population while the highest representation was from the age range of 12 – 15 years of age.

The age and gender wise breakup of the study population is given in table 1.

Age (years)	Male		Female		Total	
	No.	%	No.	%	No.	%
5	70	1.77%	67	1.68%	137	3.45%
6	97	2.56%	89	2.33%	186	4.90%
7	126	3.42%	119	3.21%	245	6.64%
8	110	2.95%	133	3.63%	243	6.58%
9	133	3.63%	147	4.04%	280	7.67%
10	181	5.05%	205	5.75%	386	10.80%
11	183	5.10%	147	4.04%	330	9.15%
12	228	6.43%	215	6.05%	443	12.49%
13	284	8.09%	224	6.32%	508	14.41%
14	227	6.40%	216	6.08%	443	12.49%
15	226	6.46%	173	4.90%	399	11.37%
<b>Total</b>	<b>1865</b>	<b>51.80%</b>	<b>1735</b>	<b>48.20%</b>	<b>3600</b>	<b>100%</b>

**Table 1. Age and Gender Distribution of Study Population**

In this community based study, echocardiography detected 47 cases of CHD irrespective of whether they have any clinical manifestations or not, which give a prevalence of 13/1000 population (Table 2). Of these total cases of 47, BAV was the commonest lesion (44%), while VSD and ASD was the second and third commonest lesion found in 17% and 14% respectively. Only 1 case of AVSD (combination of small ostium primum ASD and VSD), 3 cases of mild PS (pulmonary valvular stenosis), and 1 case of PDA (patent ductus arteriosus) were detected. Other lesions were subtle and may not be clinically relevant much, which consists of 1 case of interatrial septal aneurysm (IASA) without definite ASD, 4 cases of borderline mitral valve prolapse (MVP) and 1 case of borderline left ventricular discompacta. It may be noted that of all the 21 cases of BAV, only 2 children had echocardiographically detectable mild aortic regurgitation (AR). The spectrum of the different types of CHD and their proportions are depicted in Table 3, while the distribution of the lesions according to the age and gender is given in Table 4.

In the category of 21 clinically manifest CHD cases, presence of murmur was the only indicator in all the

individuals while tachycardia was an additional sign in the single case of AVSD. None of the children had significant breathlessness, tachypnoea, cyanosis, clubbing. Taking into account of only the clinically manifest CHD, the prevalence rate would be 5.8/1000 population. In this category, VSD

(38%) would be the commonest followed by ASD (33%) and PS (14.2). The remaining portion is composed of 1 (4.7%) case each of PDA, AVSD, BAV with AR.

CHD Detected by	Number of Cases Detected	Prevalence (Per 1000)	Proportion (per 100)
Echocardiography only	47	13.05	1.30
Clinical + Echocardiography	21	5.80	0.58

**Table 2. Prevalence of Congenital Heart Disease in the Study Population of 3600 Children**

Type of CHD	Number	Proportion/100
BAV	21	0.58
VSD	8	0.22
ASD	7	0.19
AVSD	1	0.02
PS	3	0.08
PDA	1	0.02
LV discompacta	1	0.02
IASA	1	0.02
Borderline MVP	4	0.11
<b>Total</b>	<b>47</b>	

**Table 3. Prevalence of Congenital Heart Disease in 3600 Children According to Type**

Type of CHD	5-10 Male	5-10 Female	10-15 Male	10-15 Female	TOTAL
BAV	10	1	4	6	21
VSD	2	3	1	2	8
ASD	4	2	1		7
AVSD				1	1
PS			2	1	3
PDA		1			1
LVDC	1				1
IASA		1			1
MVP	2	1		1	4
<b>Total</b>	<b>19</b>	<b>9</b>	<b>8</b>	<b>11</b>	<b>47</b>

**Table 4. Spectrum of congenital heart disease according to age and gender**

Author	Year	Reference	Population Studied	Age Group	No of Subjects	Prevalence
Gupta I et al <sup>(7)</sup>	1992	JIMA; 90:57-59	Community	5-15 years		0.8/1000
Vashistha Vm et al <sup>(8)</sup>	1993	Indian Pediatrics	Community (Agra, UP)	5-15 years	8480	5.2/1000
Khalil et al <sup>(15)</sup>	1994	Indian Pediatrics	Hospital	Live births	10964	3.9/1000
Kapoor R et al <sup>(9)</sup>	2007	Indian Pediatrics	Hospital (Kanpur)	0-15 yrs.	10641	26/1000
M Mishra <sup>(16)</sup>	2009	IHJ	Community (UP)	5-15 yrs.	118212	1.3/1000
Bhat NK <sup>(17)</sup>	2013	Indian journal of Pediatrics	Hospital (Uttarakhand)	0-18 yrs.	36541	8.5/1000
Wanni KA <sup>(18)</sup>	2014	Heart India	Hospital (Srinagar)	0-18 yrs.	767921	1.12/1000
Suryakanta H <sup>(19)</sup>	2016	Int J Advances in Medicine	Community (Latur, Maharashtra)	5-15 yrs.	353761	0.46/1000
A Saxena <sup>(20)</sup>	2016	Ann Ped Cardiol	Hospital (Safdurjung)	Newborns	20307	8.07/1000
A Mahapatra <sup>(21)</sup>	2017	Int J contemporary Pediatrics	Hospital (Odisha)	0-14 yrs.	NA	NA

**Table 5. Different Studies Showing Prevalence of CHD**

Note: NA = Not available.

**DISCUSSION**

In all previous studies conducted at community level, the detection of CHD was entirely based on initial screening by clinical examination, followed by Echocardiography conducted only on those who are found suspected of the lesion based on the clinical finding. This would have resulted to missing out many CHD lesions, though minor, which were silent clinically then but to manifest later.

The finding of BAV as the commonest congenital heart disease in this study has made our study unique, while the detection of VSD as the second commonest lesion has not pushed back this study far away from the rest of the studies in this field. This observation has resulted from the methodology of our study. Our study is unique in the sense that we subjected all the children to echocardiographic examination. As we all know, echocardiography is the best initial tool for diagnosing CHD and can prevent from under diagnosis. Our finding of 13/1000 echocardiography

prevalence of CHD is not surprising as the clinically manifested prevalence of CHD in the tune of 5.8 / 1000 is at par with one of the community based studies where the prevalence was 5.2/1000.<sup>8</sup>

In the available previous studies (Table 5), the prevalence rate of CHD has been variable depending on the type of study, tool of examination used and the type of population studied. Highest prevalence of CHD has been reported as 26/1000 which has resulted from tertiary care institution based study where newborn and children upto 18 years of age were examined. Previous community based studies showed a prevalence of 0.46 to 5.2 per 1000 in school going children. In these community based studies, children were initially screened clinically for suspected lesion of CHD and subsequently echocardiography was done to confirm the presence of the disease.

The increased prevalence of CHD in our study is primarily driven by the detection of BAV, most of which remain

clinically silent in the early period of life. The commonest prevalence of BAV among all CHD in our series would have been missed, had the study be based on initial screening by clinical examination followed by echocardiography confirmation. The abnormality of BAV detected in this magnitude in our study may not be clinically irrelevant as two of the cases had significant though mild AR, which is an indicator of possible progression or worsening of the lesion in the later years of life. A smaller contribution from the presence of minor subclinical lesions like mild forms of MVP and left ventricular discompaction to the enhanced prevalence of the CHD may also be noted in this study.

### CONCLUSION

The clinical prevalence of congenital heart disease in school going children of this small hilly state of India is high in the tune of 5.8 per 1000, while the echo-prevalence of the same disease entity is 13 per 1000 which is still higher. The increased prevalence may be due to enhanced detection by using echocardiography in all subjects, or may be related to some factors like genetic or geographical characteristics of the land. This may prompt to wider coverage and enhanced detection program to diagnose more and more cases of CHD in school going children so that they may be amenable to treatment in the right early period of life to cure the disease or prevent from complications. This study also emphasizes the importance of conducting study in the new born children as the prevalence is expected to be high.

### Acknowledgement

We express our deep gratitude to all the paramedical staffs that extended their untiring co-operation to the whole team all throughout the journey to make the program a success.

### REFERENCES

- [1] Mitchell SC, Korones SB, Berendes HW. Congenital heart disease in 56,109 births. Incidence and natural history. *Circulation* 1971;43(3):323-332.
- [2] Behrman RE, Kliegman RM, Jenson HB. Congenital heart disease. In: Nelson textbook of pediatrics. 16th edn. Harcourt Asia Pvt Ltd. 2000;1362-1363.
- [3] Gupta I, Gupta ML, Parihar A, et al. Epidemiology of rheumatic and congenital heart disease in school children. *J Indian Medical Assoc* 1992;90(3):57-59.
- [4] Vashishtha VM, Kalra A, Kalra K, et al. Prevalence of congenital heart disease in school children. *Indian Pediatr* 1993;30(11):1337-1340.
- [5] Kapoor R, Gupta S. Prevalence of congenital heart disease, Kanpur, India. *Indian Pediatr* 2008;45(4):309-311.
- [6] Wren C, Richmond S, Donaldson L. Presentation of congenital heart disease in infancy: implications for routine examination. *Arch Dis Child Fetal Neonatal Ed* 1999;80(1):F49-F53.
- [7] Meberg A, Otterstad JE, Froland G, et al. Early clinical screening of neonates for congenital heart disease: the cases we miss. *Cardiol Young* 1999;9(2):169-174.
- [8] Sung RY, So LY, Ng HK, et al. Echocardiography as a tool for determining the incidence of congenital heart disease in newborn babies: a pilot study in Hong Kong. *Int J Cardiol* 1991;30(1):43-47.
- [9] Sands A, Craig B, Mulholland C, et al. Echocardiographic screening for congenital heart disease: a randomized study. *J Perinat Med* 2002;30(4):307-312.
- [10] Skinner JR. Echocardiography in the neonatal unit: a job for the neonatologist or the cardiologist? *Arch Dis Child* 1998;78(5):401-402.
- [11] Khalil A, Aggarwal R, Thirupuram S, et al. Incidence of congenital heart disease among hospital live births in India. *Indian Pediatr* 1994;31(5):519-527.
- [12] Misra M, Mittal M, Verma AM. Prevalence and pattern of congenital heart disease in school children of eastern Uttar Pradesh. *Indian Heart J* 2009;61:58-60.
- [13] Bhat NK, Dhar M, Kumar R, et al. Prevalence and pattern of congenital heart disease in Uttarakhand, India. *Indian J Pediatr* 2013;80(4):281-285.
- [14] Wannika, Shahzad N, Ashraf M. Prevalence and spectrum of congenital heart diseases in children. *Heart India* 2014;2(3):76-79.
- [15] Nisale SH, Maske VG. A study of prevalence and pattern of congenital heart disease and rheumatic heart disease among school children. *Int J Adv Med* 2016;3(4):947-951.
- [16] Saxena A, Mehta A, Sharma M, et al. Birth prevalence of congenital heart disease: a cross-sectional observational study from North India. *Ann Pediatr Card* 2016;9(3):205-209.
- [17] Mahapatra A, Sarangi R, Mahapatra PP. Spectrum of congenital heart disease in a tertiary care centre of Eastern India. *Int J Contemp Pediatr* 2017;4(2):314-316.
- [18] Fyler DC, Buckley LP, Hellenbrand WE, et al. Report of the New England regional infant caring program. *Pediatrics* 1980;65:375-461.
- [19] Bernier PL, Stefanescu A, Samoukovic G, et al. The challenge of congenital heart disease worldwide: epidemiologic and demographic facts. *Semin Thorac Cardiovasc Surg Pediatr Card Surg Annu* 2010;13(1):26-34.
- [20] van der Linde D, Konings EE, Slager MA, et al. Birth prevalence of congenital heart disease worldwide: a systematic review and meta-analysis. *J Am Coll Cardiol* 2011;58(21):2241-2247.
- [21] Saxena A. Congenital heart disease in India: a status report. *Indian J Pediatr* 2005;72(7):595-598.