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Original Article

Prevalence of congenital heart disease in rural population of Himachal – A population-based study

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ABSTRACT

Aim: There is no community-based study about the prevalence of congenital heart disease (CHD) in Himachal; hence, we undertook this study.
Methods and results: A population-based survey was done in four villages of different districts of Himachal Pradesh. In total, 1882 persons were examined. 909 were male and 973 were female. There were 12 cases of CHD in the population (6.3/1000): four of these were male (33.3%) and 8 were female (66.6%). Mean age of these patients was 19.5 ± 11.07 years. Atrial septal defect (ASD) was the commonest lesion followed by ventricular septal defect (VSD).
Conclusion: Prevalence of CHD in general population was 6.3/1000. ASD was the commonest lesion. CHD was more common in female.

1. Introduction

Congenital heart diseases (CHDs) are the leading cause of mortality in the first year of life.[1–3] These account for around 30% of total congenital anomalies.[1] Large majority of these structural abnormalities of heart occur as an isolated anomaly, but around 33% have associated anomalies.[4] There are few population-based studies in India about the prevalence of CHD and none in Himachal, hence the purpose of the study.

2. Materials and methods

This was a community-based study, carried out in four villages of Himachal – one of them situated at a low altitude – Kunihar in Solan District, and the remaining three situated at moderately high altitude – Sahu in remote Chamba District, Haripur Dhar in Sirmaur District, and Ribba in tribal Kinnaur District. A team of eight doctors including two consultants in Cardiology, three senior residents in Cardiology, two junior

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residents in Medicine, and one junior resident in Pediatrics undertook the study. The study was done on holidays, so that maximum population would have been available. The people were informed well in advance about the dates and purpose of the study through local leaders and advertisements through posters. The study was undertaken on three consecutive holidays in Kunihar, one day each in Sahu, Haripur Dhar, and Ribba. All the persons were asked about history of (H/O) palpitation/increased precordial activity in child, any H/O recurrent chest infection, or bluish discoloration of tongue/lips. Then the detailed cardiovascular examination was done. In the patients suspected of CHD, ECG was done and patients were called for echocardiographic examination in Indira Gandhi Medical College, Shimla.

3. Diagnostic criteria for CHD

1. Patients found to have CHD on echocardiography.
2. Patients having an echo/cardiac catheterization report of CHD from a cardiac center.
3. Patients possessing documentary evidence of having undergone surgery for CHD.

4. Exclusion criteria

Since mitral valve prolapse and bicuspid aortic valves are very common anomalies, they were excluded from the study.

5. Sampling size/technique

There was no definite sampling as we did door to door survey and tried to cover the whole population of these villages, of all age groups who gave consent for the study. We could thus cover around 70% of the population.

6. Results

Table 1 shows the prevalence of CHD in the population. Total 1882 persons were examined, 1081 in Kunihar, 254 in Sahu, 99 in Haripur Dhar, and 448 in Ribba. Twenty of these were suspected to have CHD but finally 12 of these were found to have CHD (6.37/1000). Four of these were male and eight were female. Atrial septal defect (ASD) was the commonest anomaly found in five patients (41.66%), followed by ventricular septal defect (VSD) in 4 (33.66%). Two patients had patent ductus arteriosus (PDA) and one had tetralogy of Fallot (TOF). Four patients had already been operated, two for VSD, and one each for ASD and PDA.

In the age group <18 years, the prevalence of CHD was 12.95/1000.

Ten out of 1081 persons (9.25/1000) at low altitude had CHD, whereas at moderate altitude, 4 out of 801 persons had CHD (5/1000).

Table 1 – Patient characteristics and pattern of congenital heart disease in the population.

Population screened	1882
Male	909
Female	973
Age group of population studied	
<1 year	28
1–5 years	192
5–18 years	540
18–30 years	349
>30 years	773
Congenital heart disease	12 (6.37/1000)
Male	04 (33.66%)
Female	08 (66.66%)
CHD at low altitude	9.25/1000
CHD at moderate altitude	5/1000
CHD in <18 years of age	12.95/1000
Mean age of CHD patients	19.5 ± 11.07 years
Pattern of CHD	
ASD	5 (41.66%)
VSD	4 (33.66%)
PDA	2 (16.66%)
TOF	1 (8.33%)
Patients already operated	04
VSD	02
ASD	01
PDA	01

7. Discussion

Most of the studies have focused on the prevalence of CHD in newborn or school children. Most of the studies in newborn are hospital-based and so do not reflect the true prevalence of CHD. Some of the patients with complex form of CHD die in infancy and some defects close spontaneously. Our study, being population-based, covered all age groups. We found the prevalence of CHD in entire population as 6.37/1000. However, in <18 years of age, the prevalence was 12.95/1000.

In our study among school children, the prevalence of CHD was low (2.25/1000).[5] This could be due to the fact that not all children are attending school, especially in rural areas. Moreover, parents of patients suffering from symptomatic heart disease may not be sending them to schools. In a hospital-based study, Smitha et al. found the prevalence of CHD in newborn for 5 years in Mysore from 6.6 to 13.06/1000.[6] However, in a recent study from Kanpur,[7] again a hospital-based study, the prevalence of CHD was found to be 26.4/1000. But since these were hospital-based studies, higher prevalence could be due to referral bias. Both these studies found VSD as the commonest lesion.

In community-based studies from India, the prevalence of CHD varies from 0.8 to 5.2/1000 population.[8,9] Marelli et al. studied the CHD in the general population. The prevalence was 4.09/1000 in 2000. Female subjects accounted for 57% of adult CHD population and prevalence increased from 1985 to 2000. In 2000, there were equal number of children and adults with severe CHD.[10] The prevalence of CHD was higher than this study in our population. However, the above study was based on the people who required health services, and so less severe lesions might have been missed. As in the above study, ASD

Table 2 – Congenital heart disease in defined live birth population.

Author	Community/hospital-based	Total number	CHD (*n*)	CHD/1000 live births
Khalil et al.[14]	Hospital	10,964	43	3.9
Wren et al.[15]	Community	377,310	1942	5.2
Subramanyan et al.[16]	Hospital	139,707	992	7.1
Samanek et al.[17]	Community	816,569	5030	6.16
Roy et al.[18]	Hospital	–	–	8.0
Robida et al.[19]	Hospital	49,887	610	12.23
Fixler et al.[20]	Community	379,561	2509	6.6
Bitar et al.[21]	Hospital	–	–	11.5

Table 3 – Profile of congenital heart disease in India.

Author/year	Age group	No of CHD	Profile (% of all CHD)							
			ASD	VSD	PDA	TOF	TGA	HLH	CoA	P. Atr.
Shrestha (1980)[22]	5–16 years	111	23	30	11	4				
Kinare (1981)[22]	<1 year	170		4	9	12	12	10	8	
Vashishtha (1993)[12]	5–1 years	44	11	41	4	14				
Thakur (1995)[25]	5–16 years	30	38	32						
AIIMS (1996) (Sharma et al.)[26]	<12 years	5000	13	53	13	32	22		8	6

ASD, atrial septal defect; CHD, congenital heart disease; AOA, coarctation of aorta; HLH, hypoplastic left heart; P. Atr, pulmonary atresia; PDA, patent ductus arteriosus; VSD, ventricular septal defect; TGA, transposition of great arteries; TOF, tetralogy of Fallot.

was commonest lesion in our study and prevalence was more in females. Prevalence of CHD also varies with altitude.

Certain CHDs are more common at high altitude. Miao et al. tested the effect of high altitude on the prevalence of CHD by examining 1116 school children at four study sites in the People's Republic of China. Sites ranged in altitude from sea level to 4500 m above sea level. A high prevalence of PDA and ASD was found at the three high altitude sites and the effect of altitude was progressive. Both anomalies were postulated to be the result of lower atmospheric oxygen tension present at high altitude. Failure of lower oxygen tension to constrict the ductus is thought to be the mechanism in PDA. It is theorized that the persistence of high pulmonary vascular resistance and high right heart pressures at high altitude inhibits early closure of the foramen ovale. Subsequent growth may result in stretching of the fossa ovalis and incompetence of the flap and may produce an ASD.[11]

Penazola et al.[12] found that PDA was the dominant CHD lesion at high altitudes, such as Mexico City (2300 m) and concluded that the relationship between the incidence of PDA with altitude follows a parabolic curve.

Sandridge et al. studied the altitude and CHD burden in all 103 Saudi Arabian cities.[13] The cities were categorized using three cut-points (165, 2000, and 3000 ft) derived from the quartiles of altitude which produced four groups containing approximately equal numbers of cities. This revealed a non-linear relationship between altitude and CHD burden such that both high and low altitudes appeared to be associated with an increased burden. They suggested that cities which lie at very low altitudes (close to sea-level) are also associated with higher CHD burdens. In fact, among the 20 cities with the highest burdens, 6 are in the highest quartile for altitude but 7 are in the lowest quartile. Low altitudes have never been previously reported to impact CHD burden but one plausible explanation for such a ''low-altitude effect'' might be that – since all cities located at low altitudes also lie along the coast – the authors observed that it could simply be a ''coastal effect''.

Table 2 shows some community- and hospital-based studies of prevalence of CHD. Prevalence varies from 3.9 to 12.25 in infants.

Though our study shows ASD as commonest lesion, followed by VSD, profile of CHD varies depending upon the age group studied. As is shown in Table 3, simple and potentially correctable heart diseases like ASD, VSD, and PDA are common in all age groups. However, autopsy series show higher incidence of serious and complex heart diseases.

Our study did not show higher prevalence of CHD at higher altitude. However, none of our population studied was situated at high altitude. Out of the 4 lesions detected at moderate altitude, 2 had ASD and one had PDA, thus amounting to 75% lesions, which are more common at high altitude.

8. Conclusion

The prevalence of CHD in rural population of Himachal was 6.37/1000. ASD was the commonest lesion and CHD was more common in female in this study population.

Limitations of study

The population screened was small, but was keeping in view the topography of the hilly areas and scattered population of the villages. Large population-based study is practically difficult to carry out.

Conflicts of interest

The authors have none to declare.

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