

ORIGINAL ARTICLE

PREVALENCE OF CONGENITAL HEART DISEASE IN RURAL COMMUNITIES OF PAKISTAN

Syed Faiz-ul-Hassan Rizvi, Ghulam Mustafa, Asadullah Kundi*, Mushtaq Ahmed Khan

Sheikh Zayed Medical College/Hospital, Rahim Yar Khan, *Karachi Institute of Heart Disease, Karachi-Pakistan

Background: Prevalence of Congenital Heart Disease (CHD) is well established in most of the developed countries, where childbirth is obligatory in hospitals and allied facilities. In rural Pakistan the situation is reverse, where most of deliveries take place in homes by traditional birth attendants' therefore true prevalence of CHD in our population is unknown. In rural Pakistan almost 80% children are born at home hence the figures are unknown. This study was designed, to determine the prevalence of congenital heart disease in rural Pakistan. **Methods:** During a cross-sectional survey of rural population belonging to major ethnic groups living in three provinces of Pakistan to determine the prevalence of rheumatic heart disease (RHD), CHD rates were calculated as a sub study. Nine thousand four hundred and seventy-six (9476) subjects of all ages were screened using cluster sampling technique. Socio-demographic variables were recorded. Auscultation and short physical examination performed for initial screening and final diagnosis was confirmed on M-mode/2D/Doppler. **Results:** Thirty two patients had RHD, 25 Patients identified with CHD and another 7 patients had mixed CHD & RHD. Overall prevalence for CHD was 3.4/1000. The commonest lesion was Atrial Septal Defect (ASD) 40%, Ventricular Septal Defect (VSD) 35%, Aortic Stenosis (AS) 10%, Atrio Ventricular Septal Defect (AVSD) 5%. **Conclusion:** This is the first study to report CHD prevalence from multiethnic representative sample from rural communities of Pakistan. Apparently CHD rate seems less compared with facility based data because records of still stillbirths are not available and autopsies are not performed as routine. Very high infant mortality from rural areas of Pakistan also favours high prevalence for CHD; however these figures represent an overall picture of CHD in a community where medical facilities are lacking.

Keywords: congenital heart disease, Prevalence, Rural communities

J Ayub Med Coll Abbottabad 2015;27(1):124-7

INTRODUCTION

Congenital Heart Disease (CHD) is a common form of cardiac disorder encountered in paediatric and adult age groups.¹⁻³ CHD is an important proportion of all major congenital malformations, which are present in 2-3% of neonates.^{1,4} Its prevalence varies from 3-10/1000 live births and this rate is reportedly constant around the globe.²⁻⁸

In Pakistan few studies have been published from tertiary care centres indicating CHD profile mainly in hospital population, reporting prevalence of CHD from 16.76-60%.^{9-11,2-3} This facility based data is not representative of a community where child birth is not obligatory in hospitals and maternity homes. It is particularly not applicable to rural population where 80% of children are born at home by traditional birth attendant.^{12,5} Majority of children in the villages are born at home with the assistance of formal birth attendants (Daies), therefore no one knows the birth prevalence of CHD in rural Pakistan.^{9,12} Due to overall prevailing poverty in rural area the families are unable to travel from far flung places to the big cities hence the picture painted from these studies seems unlikely to represent the true prevalence. This study was designed to determine

the RHD prevalence in a representative sample of rural population. CHD rates were calculated as bi-product of this study.

MATERIAL AND METHODS

Rahim Yar Khan is located at a place in Pakistan, where three of the four provinces meet and main ethnic groups of the four provinces live in scattered rural establishments. Its unique location and multi ethnic composition is important. Its latitude and longitude are 28.30 and 71.7, respectively. Weather is generally dry and hot with little rains. Population density is 155 persons/square kilometre and area is 11,880 square km. Sheikh Zayed Hospital is located in Rahim Yar Khan and is a 650 bedded medical facility serving vast rural areas.

The study was conducted in a "tehsil" (sub-district) of Rahim Yar Khan District. The census of 1998 shows the population of Rahim Yar Khan District to be 3.1 million, of whom 2.5 million (80%) reside in rural areas. The main occupation is agriculture. A typical family's income is 1000 Pakistani Rupees ((US\$10) a month. The average family size is seven people, and 70% of the houses are constructed with semi-permanent materials. The overall literacy rate is

18%. The Sheikh Zayed Hospital, a 650 bed facility, provides the majority of tertiary medical care for the people of this area.

We estimated a sample size based on the following assumptions: the prevalence of RHD in the population was 6 in 1000. We calculated that a sample of 4700 people would suffice to measure a prevalence of $0.6\% \pm 0.22\%$ with 95% confidence. We multiplied this number by a correction factor of 2 to account for the cluster sampling method we used, yielding a final sample size of 9400. We expected to find this number of people in 1343 households of seven people each. We rounded the number of households to 1400 to account for refusals. We divided the tehsil into seven equal clusters and used random number tables to select a single village in each cluster. We surveyed all the households in each village. In cases where fewer than 200 households were present in a single village, we surveyed the neighbouring village to complete the required number, yielding a total of 11 villages.⁶

All the households in the sample village were enumerated and surveyed in two rounds. The first round was a census, with information on household and individual characteristics. Socio-demographic variables like age, sex, education, occupation, socioeconomic status and crowding indicators were noted in detail. Repeated attempts were made to find the missing family members, some of them were examined in the farms; and a few children not present at home were seen at their schools.

On an average two visits were paid to each household. The survey was conducted at the time of minimum crop activity and maximum availability of villagers at their homes. In the second round, medical team composed of the principal author and his associate visited each household in the selected village to examine all family members for screening purpose.

Every family member was auscultated by one of the team members in the supine and left lateral decubitus position, creating a possible silent atmosphere in the surroundings. All doubtful cases were cross-checked by each other. Suspect cases were declared with any of the following abnormalities. (1) Any diastolic murmur. (2) Systolic murmur of grade 2/6 or more. (3) Abnormal heart sounds. (4) Any other important clinical findings suggestive of organic heart disease. All subjects with suspect murmur were evaluated using echocardiographic machine, (Toshiba's Model SSH60A). Proven CHD cases were our study group. Detailed history, physical

examination and other laboratory tests e.g., 12-lead ECG, X-Ray chest throat swabs for culture and sensitivity and complete blood picture were taken on proven CHD cases.

Statistical analysis was performed using SPSS version 10. The responses and findings were coded, computerized and comparing data was analyzed by Chi-square and *t*-test and *p*-value of 0.05 or less was considered significant.

RESULTS

The screened population was 9476. About 15% of all population was less than 15 years of age. Average income was Pak Rupees 2000/month= 20 USD. Average family size was 8 members. Literacy rate was 18%. Housing and sanitation was poor in two third of the families.

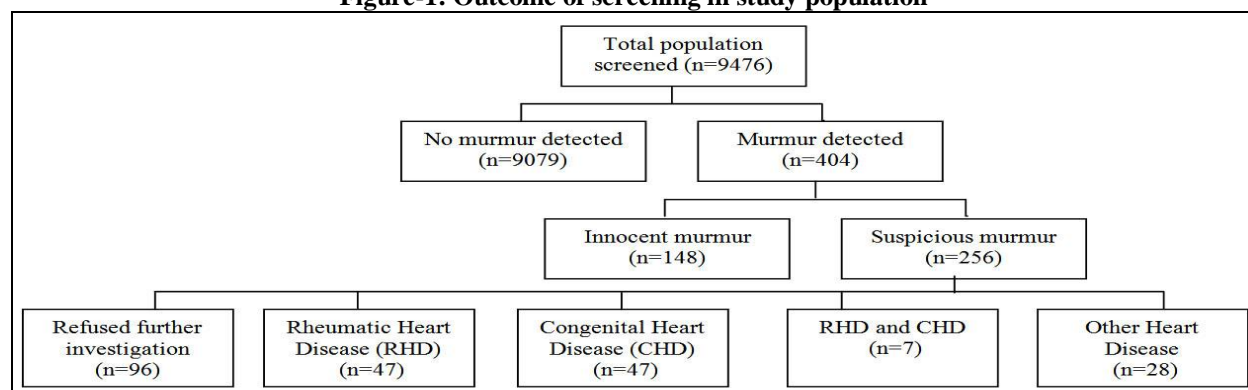
We examined 78 new-borns and 458 infants. Murmurs were detected in 402 subjects of them, 253 had suspected murmur Echo/Doppler studies were performed on 203 persons to define the cause of murmur. Fifty subjects refused to take part in further investigations. Forty seven patients identified with proven RHD (23%). Twenty five patients had pure CHD and another seven patients had mixed CHD and RHD, it makes 32 case of CHD with overall prevalence of 3.4/1000 (95% confidence interval: 2.22/1000 to 4.18/1000) versus 5.7/1000 prevalence for RHD. (Figure-1)

We did not encounter any CHD case in newborns. The prevalence was highest in infants as compared to other age group. Prevalence decreased sharply in age group 2–5 years.

CHD prevalence in both sex show different patterns comparing level of education. Female children studying in primary classes had the highest prevalence followed by preschoolers and illiterate. Among male, prevalence increases in ascending order till it peaks at intermediate level.

Majority of cases lies in middle income brackets and there is no statistically significant difference in prevalence between income group below Pak Rs.5000 and above ($p > 0.5$). Ethnically low caste Hindus (Marwari) had the highest rates, however, it was not statistically significant, (5.78 vs 3.3, $p > 0.05$).

No significant difference was noted between two main ethnic groups of this area (Saraiki and Punjabi). Prevalence was more in crowded houses (3 persons and above per room vs <3 persons room), however, it was not statistically significant ($p > 0.5$). Pattern of CHD in children and adults is shown table-1.

Figure-1: Outcome of screening in study population**Table-1: Pattern of CHD among children and adults**

Lesion: Children	No. of Patients	% ages
Ventricular Septal Defect (VSD)	4	40
Atrial Septal Defect (ASD)	3	30
Aortic Stenosis (AS)	1	10
AVSD	1	10
Adults		
ASD	5	27.8
VSD	3	16.7
Dextrocardia	2	11.1
AS	1	5.6

DISCUSSION

To the best of our knowledge; no epidemiological study regarding prevalence and pattern of CHD in all age groups from rural communities have ever been reported from Pakistan. However, a recent study conducted on school children in urban areas of Lahore, had revealed a prevalence of CHD in 17.6% children.^{7,10} Whereas, present study is the first of its kind that attempted to determine the prevalence of CHD in a representative sample of rural Pakistan, where about 70% of country's total population lives. The current data is derived from a cross sectional survey of rural areas, hence not comparable to local or distant facility based and school based data. The hospital based studies are biased because very few tertiary care centres are available in Pakistan with the capabilities to diagnose and manage CHD. Moreover, only symptomatic patients are being referred to the tertiary care centres.

We did not encounter any case of CHD in 78 newborns, probably due to small number of babies examined (<1% of total population). Still births and spontaneous abortions, commonly occur due to underlying severe cardiac malformations. Autopsy is customarily abandoned in this part of the world, except in medico-legal cases, this may lead to underestimation of true prevalence. We report high prevalence of CHD in infants and interestingly prevalence sharply declined after the first year of life. It may be explained on the basis of high

neonatal and infant mortality rate that may be due to severe congenital cardiac malformation not surviving beyond one year without intervention.^{14,7} In this setting well equipped paediatric cardiology centre is not located nearby to deal with the serious congenital heart disease. In adults usually stable CHD persists, hence no significant difference noted above 19 years. Higher prevalence noted in 30 years and above due to frequently encountered complicated bicuspid aortic valve.

In higher secondary school and intermediate level, male patients were dominated. No significant difference was noted in various socioeconomic classes however more trends were observed in middle classes. Preschooler, illiterate and primary school female children had higher prevalence than other school groups. Ethnically low caste Hindus, a minority group had higher prevalence compared to other major ethnic groups ($p>0.05$). Contrary to RHD which was more prevalent among major ethnic groups and least in this group.¹³ This may be explained on different genetic background. The effect of ethnicity on CHD has been well reported.^{8,15} Crowded houses had more prevalence indicating poverty and malnourishment being potential risk factors for CHD.

Pattern of CHD in children is similar to local and international studies.^{2,3,7,8,10} VSD being the commonest lesion, complex CHD noted in <10%. It is mainly because of poor survival in these lesions. ASD is the second most frequent lesion in children and adults; this has been reported in recent studies.^{2,9} A school based survey from India examining children revealed prevalence of 1.5/1000. The lesion in order of frequency is similar to our study. VSD was the commonest, followed by ASD.^{8,16} The low rate for complex cardiac defects may be a cause of high mortality due to these defect in early life. Poverty, illiteracy and lack of health care awareness and paediatric cardiac services are among many reasons of delay in early referral to tertiary care centres.

Our study did not include autopsy data which is customarily abandoned in this area hence underestimating the prevalence of CHD in this setting where high infant mortality and still births may be due to severe congenital cardiac malformations. Potential risk factors like smoking, nutritional deficiencies, use of drugs and cousin marriages were not studied because this survey was primarily designed to determine the prevalence of rheumatic heart disease and CHD data was calculated as a by-product.

The strengths included that it was a general rural population of multi-ethnic composition where door to door auscultation of all family members by cardiologist was done. It was also the first field study in rural Pakistan where Echo/Doppler was used for screening of murmur and precise functional and anatomic diagnosis. Moreover, it is the only community based data from rural areas of Pakistan representing the true prevalence picture of CHD.

CONCLUSION

CHD prevalence in rural Pakistan is quite high comparing urban facility based data and it leads to high infant mortality as indicated by sharp fall in prevalence after one year. It may be an important cause of infant mortality. Early recognition and management of CHD can reduce neonatal and infant mortality. It can be achieved by developing more paediatric cardiac service at secondary and tertiary care centres in Pakistan.

REFERENCES

1. Williams RG, Pearson GD, Barst RJ, Child JS, del Nido P, Gersony WM *et al.* Report of the National Heart, Lung, and Blood Institute Working Group on Research in Adult Congenital Heart Disease. *J Am Coll Cardiol* 2006;47(4):701-7.
2. Russell IA, Rouine-Rapp K, Stratmann G, Miller-Hance WC. Congenital Heart Disease in the Adult: A Review with

- Internet-Accessible Transesophageal Echocardiographic Images. *Anesth Analg* 2006;102:694-723
3. Murphy DJ Jr. Pediatric Cardiology and Adult Congenital Heart Disease. *J Am Cardiol* 2004;44(2 Suppl A):23A-24A.
4. Buskins E, Grobbee DE, Frohn-Mulder IM, Stewart PA, Juttman RE, Wladimiroff JW, *et al.* Efficiency of routine fetal ultrasound screening for CHD in normal pregnancy. American heart Association. *Circulation* 1996;94:67-72.
5. Hoffman JI, Kaplan S, Liberthson RR. Prevalence of congenital heart disease. *Am Heart J* 2004;147(3):425-39.
6. Marelli AJ, Mackie AS, Ionescu-Ittu R, Rahme E, Pilote L. Congenital Heart Disease in the General Population, Changing Prevalence and Age Distribution. *Circulation*. 2007;115:163-72
7. Hoffman JI, Kaplan S. The incidence of congenital heart disease. *J Am Coll Cardiol* 2002;39:1890-900.
8. Sadiq M, Islam K, Abid R, Latif F, Rehman AU, Waheed A, *et al.* Prevalence of rheumatic heart disease in school children of urban Lahore. *Heart* 2009;95(5):353-7.
9. Ahmad R, Awan ZA, Bukshi F. A prevalence study of congenital heart disease in NWFP, Pakistan. *Pak J Med Sci* 2002;18(2):95-8.
10. Burki MK, Babar GS. Prevalence and Pattern of Congenital Heart Disease in Hazara
J Ayub Med Coll Abbottabad 2001;13(4):16-8.
11. Sadiq M, Roshan B, Khan A, Latif F, Bashir I, Sheikh SA. Pediatric Heart Disease in Pakistan - epidemiological data on 6620 patients. *Pak Paed J* 2001;25(2):63-70.
12. Chesney M, Davies SE. Women's birth experiences in Pakistan—the importance of the Dai. *Evidence Based Midwifery* 2005;3(1):26-32.
13. Rizvi SF, Khan MA, Kundi A, Marsh DR, Samad A, Pasha O. Status of rheumatic heart disease in Pakistan. *Heart* 2004;90:394-9.
14. Unicef Pakistan-statistics. Retrieved from: http://www.unicef.org/infobycountry/pakistan_pakistan_statistics.html.
15. Freeman SB, Bean LH, Allen EG, Tinker SW, Locke AE, Druschel C, *et al.* Ethnicity, sex, and the incidence of congenital heart defects: a report from the National Down Syndrome Project. *Genet Med* 2008;10(3):173-80.
16. Misra M, Mittal M, Verma AM, Rai R, Chandra G, Singh DP, *et al.* Prevalence and pattern of congenital heart disease in school children of eastern Uttar Pradesh. *Indian Heart J* 2009;61(1):58-60.

Address for Correspondence:

Dr. Syed Faiz ul Hassan Rizvi, 4 Gulshan E Jameel, Near Shell Rohi Petroleum, Abu Dahbi Road, Rahim Yar Khan-Pakistan

Cell: +92 300 967 4414

Email: drsfaiz@yahoo.com