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Prevalence of congenital heart disease and related factors among children admitted to the pediatric cardiac center in Rafsanjan, southeastern Iran

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Abstract

Background: Congenital heart diseases (CHD) are the most common congenital defects and the leading cause of birth defects-associated morbidity, mortality, and medical expenditures. This study aimed to assess the prevalence and associated risk factors of congenital heart disease among children in Rafsanjan, southeastern Iran.

Objectives: The current study evaluated the psychometric properties of the Persian version of the Fear of COVID-19 Scale (FCV-19S) among emergency nurses.

Methods: In this cross-sectional study, the research population included all pediatric patients admitted to the Pediatric Cardiac Center in Rafsanjan, southeastern Iran, from September 2018 to March 2019. A researcher-made checklist was used to collect data, including disease and demographic information, about children and their parents through face-to-face interviews. Echocardiography was applied to diagnose CHD.

Results: Of the 50 children, 30 (60%) were girls and 20 (40%) were boys. Patent ductus arteriosus (PDA), which affects approximately 50% of children with CHD, and atrial septal defect (ASD), which affects approximately 20% of children with CHD, were the most common CHD anomalies. There was a significant difference between the frequency of PDA and ventricular septal defect (VSD) based on the delivery method and gestational age ($P < 0.05$).

Conclusion: Our findings demonstrated a significant prevalence of PDA among children with CHD. Gestational age may serve as a contributing factor to CHD. These results can benefit specialists in preventing and treating these conditions.

Keywords: Congenital heart disease, Infants, Risk factors, Prevalence.

Introduction

Congenital heart disease (CHD) comprises a wide range of anomalies and malformations affecting the heart and major blood vessels that arise during fetal development and are present at birth, even if diagnosed later in life.[1] This defect is one of the most common health issues and a leading cause of mortality in newborns.[2] Indeed, around 30% of infant deaths at birth are due to some form of CHD.[3]

Problems of congenital heart disease are typically manageable during intrauterine life, but complications arise after the birth of the infant, including closure of the arterial ducts and foramen ovale and termination of fetal blood circulation.[4] These complications significantly impact the quality of life of those affected and result in substantial medical costs for families and society as a whole.[5]

The prevalence and patterns of these disorders vary widely within and between areas and countries, ranging from 4 to 50 per 1,000 live births.[6] In the US, the CHD frequency rate is approximately 1%, or 10 per 1,000 live births, according to the CDC.[7] The frequency rate of the disease in Asia has been reported to be around 9.3 per 1,000 live births through a systematic review and meta-analysis.[8] A clinical study conducted in Iran found the mean prevalence to be 12.30 per 1,000 live births over the period of 1998 to 2007 for the disease.[9]

In fact, CHD, like congenital malformations identified during the first year of life, is mostly complex, with both genetic and environmental causes.[10,11] CHD patterns might vary based on several etiologic parameters, including geographic location, genetic background, maternal age, seasonal influences, and CHD incidence among other family members.[12]

In most developing countries, a small proportion of the population can afford the costs of diagnosis, medical treatment, and/or surgical correction of CHD. The situation is particularly dire for individuals residing in remote areas where accessing basic healthcare is already a significant challenge.[1]

Rafsanjan City is located in the southeastern part of Iran and lies in the northwestern corner of Kerman Province. The city is surrounded by around 80,000 hectares of pistachio orchards, which use a significant quantity of chemical pesticides, an environmental contaminant, each year.[13,14] Additionally, the Sarcheshmeh Copper Mine, which ranks as the second-largest copper deposit globally, is situated 50 kilometers south of the city. This mining facility has been criticized for its role in polluting the environment.[15] Thus, this city presents unique risk factors that make it an ideal location for conducting the current study.

For proper planning and decision-making in controlling and managing CHD, it is crucial to conduct accurate studies to identify incidence rates and effective factors in developing this type of disease. Various studies have been uncovered in this respect through a search undertaken by researchers,[16-19] but in Rafsanjan, with the exception of one study conducted on newborns,[20] no other study has been located.

Objectives

Given the significance of this topic and the scarcity of relevant studies in this area, the current study aims to determine the prevalence of CHD and identify its associated risk factors among children in Rafsanjan, Iran.

Methods

In this cross-sectional study, the research population consisted of all pediatric patients admitted to the Pediatric Cardiac Center of Ali Ibn Abitaleb Clinic in Rafsanjan, southeastern Iran, between September 2018 and the end of March 2019. The sample size was determined to be equivalent to the research population (N=60). Children under the age of 16 who had been diagnosed with at least one kind of CHD based on an echocardiogram conducted by a pediatric cardiologist, including the first author, were eligible. Children unwilling to participate in the study or those with incomplete data were excluded (n=3). Therefore, 50 children met the inclusion criteria and were included in the study using simple convenience sampling.

Data collection tools included a checklist for disease information about the child as well as a checklist for parental information on the type of CHD, including details on parental relatives, gestational age, delivery method, history of congenital heart disease in parents, history of underlying diseases in parents such as diabetes and hypertension, parental smoking, alcohol consumption, opioid use, history of infections during pregnancy, and history of anemia during pregnancy. To conduct the study, the researcher (the second author) obtained all necessary permits and was referred to the cardiac pediatric clinic. The researcher selected samples based on inclusion and exclusion criteria, obtained informed consent from parents, conducted face-to-face interviews to fill out the checklists, and used echocardiography, performed by the first author, to diagnose CHD in all children.

Statistical Analysis

After collecting the data, they were analyzed using descriptive (frequency and frequency relative) and analytic (Chi-Square and Fisher's exact tests) statistics in SPSS version 18.0. In addition, a p-value below 0.05 was regarded as significant statistically. SPSS 18.0 and AMOS software were used for data analysis.

Ethical Consideration

The Ethics Committee of Rafsanjan University of Medical Sciences approved the study (IR.RUMS.REC.1397.086). The subjects provided informed consent forms, were informed about the study objectives, and were assured about the confidentiality of their information.

Results

The participants included 30 girls (60.0%) and 20 boys (40%). Most of the children were born via cesarean section, and their ages ranged from 1 to 16 years old. With regards to education, the majority of mothers (74%) and fathers (78%) held degrees lower than a high school diploma. Furthermore, the majority of them did not have a history of smoking, opioid abuse, or alcohol consumption. Analysis revealed that PDA was the most common form of CHD, accounting for 50%, while ASD made up 20%. In approximately 28% of the children with CHD, there existed a familial connection between their parents, or more specifically, they had a consanguineous marriage. Additionally, around 12% of them experienced infections during pregnancy; 6% had a history of maternal anemia; 22% had a history of maternal hypertension; and 20% had a history of gestational diabetes. Lastly, there were no notable discrepancies between the frequencies of any type of CHD across these parental characteristic categories [Table 1].

The prevalence rate of PDA was higher in girls than in boys. Furthermore, the prevalence rate of PDA was higher among children born via C-section than among those born vaginally (38% versus 12%). Additionally, it was higher among preterm infants delivered before 37 weeks compared to those delivered after 37 weeks (38% versus 12%) [Table 2].

Table 1. Distribution of CHD among children

Type of CHD	Number (%)
Patent ductus arteriosus (PDA)	25 (50)
Atrial septal defect (ASD)	10 (20)
Ventricular septal defect (VSD)	5 (10)
Coarctation of aorta (COA)	2 (4)
Patent Foramen Ovale (PFO)	4 (8)
Hypertrophic cardiomyopathy (HCM)	2 (4)
Transposition of great arteries (TGA)	1 (2)
Pulmonary Stenosis (PS)	1 (2)
Total	50 (100)

Table 2. Comparison of the frequency of CHD based on childhood characteristics

Children Characteristics	PDA	ASD	VSD	COA	PFO	HCM	TGA	PS
Gender								
Girl (%)	16 (32)	5 (10)	4 (8)	1 (2)	2 (4)	1 (2)	0 (0)	1 (2)
Boy (%)	9 (18)	5 (10)	1 (2)	1 (2)	2 (4)	1 (2)	1 (2)	0 (0)
*P-value	0.54	0.71	0.68	1	0.47	1	0/4	1
Type of Delivery								
Vaginal (%)	6 (12)	4 (8)	4 (8)	1 (2)	0 (0)	0 (0)	1 (2)	0 (0)
Cesarean (%)	19 (38)	6 (12)	1 (2)	1 (2)	4 (8)	2 (4)	0 (0)	1 (2)
*P-value	0.03	1	0.03	1	1	0.31	0.34	1
Gestational age								
<37 weeks (%)	16 (32)	6 (12)	2 (4)	1 (2)	4 (8)	1 (2)	0 (0)	0 (0)
≥37 weeks (%)	9 (18)	4 (8)	3 (6)	1 (2)	0 (0)	1 (2)	1 (2)	1 (2)
*P-value	0.004	0.52	0.44	1	0.25	1	1	1

*Chi-Square, Patent ductus arteriosus (PDA); Atrial septal defect (ASD); Ventricular septal defect (VSD); Coarctation of aorta (COA); Patent Foramen Ovale (PFO); Hypertrophic cardiomyopathy (HCM); Transposition of great arteries (TGA); Pulmonary Stenosis (PS)

Discussion

According to the findings, among all types of CHD, patent ductus arteriosus (PDA) was the most frequently diagnosed, accounting for 50% of cases. This was followed by atrial septal defects (ASD) and ventricular septal defects (VSD), which had a 20% and 10% prevalence rate, respectively. Another study conducted in the same urban area found similar results, with PDA being the most

common type of CHD anomaly in neonates with extra-cardiac abnormalities, occurring in 78.9% of these cases. 20 PDA was the most prevalent kind of CHD in the research by Khasawneh et al.,[12] which was consistent with the current one. VSD was second. High rates of PDA have been reported in Pakistan[16] and Iran[17] as well. However, the majority of global studies on CHD have reported that VSD is the most common type of CHD.[7,18] Reviewing CHD at four local cardiac centers in the Gaza Strip in Palestine, it was found that VSD was the most frequently diagnosed lesion.[19] Reviewing CHD patterns in an Iranian province,[9] it was determined that ASD and TOF were the most commonly diagnosed lesions. CHD patterns can vary depending on various etiological, genetic, and non-genetic factors. In addition, the variability between the aforementioned studies could be attributed to differences in the research population, sample size, or inclusion criteria.

The results of the current study imply no significant difference between various types of CHD regarding parental characteristics, except for the mode of delivery, gestational age, and use of opiates, which are inconsistent with findings from other studies.[2,21]

The prevalence of CHD, particularly PDA, was higher in girls than in boys in this study, whereas in previous studies,[22,23] the majority of patients with congenital heart disease were male, contradicting the current findings. Contrastingly, other studies conducted in Saudi Arabia[24] and Iceland[25] found no significant difference in the prevalence of the disease between girls and boys. The difference in gender depends on the type of disease. The reasons for differences in the prevalence of the disease in girls and boys, as discussed in previous studies, can be attributed to genetic, environmental, and maternal factors, which require further investigation into these effective factors.

In this study, despite the lack of significant differences in the frequency of any type of CHD between individuals who are married contagiously, 28% of the parents of the children with CHD shared a familial relationship, meaning they had a consanguineous marriage. Given the important role of genetic factors in the development of congenital heart disease, additional research is needed in this area to provide more reliable information on the risks of consanguineous marriages in offspring.

There was no significant difference between the history of maternal infections during pregnancy and the frequency of CHD. In contrast to the present study, previous research by Oster et al.,[26] found a direct correlation between maternal infections during pregnancy and the birth of a baby with CHD. According to the results, there was no significant relationship between the frequency of any type of CHD and the mothers' conditions, such as diabetes, hypertension, or anemia. In contrast, a previous study by Jenkins et al.,[11] found that mothers with gestational diabetes were at a higher risk of giving birth to babies with congenital heart defects compared to those without diabetes. In addition, a cohort study performed in Taiwan[27] indicated that the CHD frequency in infants of mothers with chronic disorders, such as diabetes, hypertension, and anemia, was high. Differences between these studies and the present one could be due to variations in sample size, inclusion criteria, and timing of the study. Therefore, additional studies are necessary to be carried out at larger centers with long-term follow-up.

In this study, there was a significant relationship between the frequency of PDA and VSD and gestational age. Similar to a population-based cohort study[28] involving 2,189 infants with CHD, it was found that approximately 13.5% of infants with CHD were preterm. Thus, the prevention of preterm delivery is highly recommended. Conducting this study for the first time in the pediatric research population in Rafsanjan was one of the strengths of the present study. However, this study was conducted in a small urban area with a limited sample size, which were the weaknesses and limitations of the present study. As such, similar studies should be conducted at larger centers.

Conclusions

According to the results, PDA was the most common form of CHD. Gestational age can be a contributing factor to CHD. The study's findings revealed new information about the prevalence of congenital heart disease and associated factors among children. These insights may aid healthcare professionals, particularly pediatric

cardiologists and gynecologists, in understanding the topic more effectively and developing appropriate care strategies for prevention and treatment. This is the first known study to focus on this subject in pediatrics in Rafsanjan, providing novel data that could inform expert practitioners and inspire additional investigations in the field.

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Competing interests

None declared.

Abbreviations

Congenital heart diseases: CHD; Patent ductus arteriosus: PDA; Atrial septal defect: ASD; Ventricular septal defect: VSD; Coarctation of aorta: COA; Patent Foramen Ovale: PFO; Hypertrophic cardiomyopathy: HCM; Transposition of great arteries: TGA; Pulmonary Stenosis: PS.

Authors' contributions

All authors read and approved the final manuscript. All authors take responsibility for the integrity of the data and the accuracy of the data analysis.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

All procedures performed in this study involving human participants were in accordance with the 2017 Helsinki Declaration. Informed consent was obtained from all participants.

Consent for publication

By submitting this document, the authors declare their consent for the final accepted version of the manuscript to be considered for publication.

References

1. Committee on Publication Ethics (COPE): Authorship and artificial intelligence tools; February 13, 2023 Available from:https://publicationethics.org/cope-position-statements/ai-author (accessed August 8,2023)
2. Tantchou Tchoumi JC, Butera G, Giamberti A, Ambassa JC, Sadeu JC. Occurrence and pattern of congenital heart diseases in a rural area of sub-Saharan Africa. Cardiovasc J Afr. 2011; 22 (2): 63-6. doi:10.5830/CVJA-2010-046
3. Reller MD, Strickland MJ, Riehle-Colarusso T, Mahle WT, Correa A. Prevalence of congenital heart defects in metropolitan Atlanta, 1998-2005. J Pediatr. 2008;153(6):807-13. doi:10.1016/j.jpeds.2008.05.059
4. Rosamond W, Flegal K, Friday G, Furie K, Go A, Greenlund K, et al. Heart disease and stroke statistics--2007 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Circulation. 2007;115(5):e69-171. doi:10.1161/CIRCULATIONAHA.106.179918
5. Naghavi-Behzad M, Alizadeh M, Azami S, Foroughifar S, Ghasempour-Dabbaghi K, Karzad N, et al. risk factors of congenital heart diseases: a case-control study in northwest Iran. J Cardiovasc Thorac Res. 2013;5(1):5-9.
6. Ou Y, Mai J, Zhuang J, Liu X, Wu Y, Gao X, et al. Risk factors of different congenital heart defects in Guangdong, China. Pediatr Res. 2016;79(4):549-58. doi:10.1038/pr.2015.264
7. Andreassi MG. Radiation risk from pediatric cardiac catheterization: friendly fire on children with congenital heart disease. Am Heart Assoc. 2009. doi:10.1161/CIRCULATIONAHA.109.904458
8. Control CfD, Prevention. Data and statistics on congenital heart defects. 2019.
9. Van Der Linde D, Konings EE, Slager MA, Witsenburg M, Helbing WA, Takkenberg JJ, et al. Birth prevalence of congenital heart disease worldwide: a systematic review and meta-analysis. J Am Coll Cardiol. 2011;58(21):2241-7. doi:10.1016/j.jacc.2011.08.025
10. Rahim F, Ebadi A, Saki G, Remazani A. Prevalence of congenital heart disease in iran: a clinical study. J Med Sci. 2008;8(6):547-52. doi:10.3923/jms.2008.547.552
11. Brent RL. Environmental causes of human congenital malformations: the pediatrician's role in dealing with these complex clinical problems caused by a multiplicity of environmental and genetic factors. Pediatrics. 2004; 113 (Supplement 3):957-68. doi:10.1542/peds.113.S3.957
12. Jenkins KJ, Correa A, Feinstein JA, Botto L, Britt AE, Daniels SR, et al. Noninherited risk factors and congenital cardiovascular defects: current knowledge: a scientific statement from the American Heart Association Council on Cardiovascular Disease

in the Young: endorsed by the American Academy of Pediatrics. Circulation. 2007; 115 (23):2995-3014. doi:10.1161/CIRCULATIONAHA.106.183216
13. Khasawneh W, Hakim F, Abu Ras O, Hejazi Y, Abu-Aqoulah A. Incidence and Patterns of Congenital Heart Disease Among Jordanian Infants, a Cohort Study From a University Tertiary Center. Front Pediatr. 2020;8:219. doi:10.3389/fped.2020.00219
14. Dehghani R, Moosavi SG, Esalmi H, Mohammadi M, Jalali Z, Zamini N. Surveying of Pesticides Commonly on the Markets of Iran in 2009. J Environ Prot. 2011;2(8):1113. doi:10.4236/jep.2011.28129
15. TavakolianFerdosieyeh V, Karimifared M, Esmaeili A, Hassanshahi G, Vazirinejad R. Pesticide induced complications among pistachio farmers: In the rural area of Rafsanjan, Iran (2010). J Occup Health Epidemiol. 2012;1(2):111-7. doi:10.18869/acadpub.johe.1.2.111
16. Hakimi H, Ahmadi J, Vakilian A, Jamalizadeh A, Kamyab Z, Mehran M, et al. The profile of Rafsanjan cohort study. Eur J Epidemiol. 2021;36(2):243-52. doi:10.1007/s10654-020-00668-7
17. Zahid SB, Jan AZ, Ahmed S, Achakzai H. Spectrum of congenital heart disease in children admitted for cardiac surgery at Rehman Medical Institute, Peshawar, Pakistan. Pak J Med Sci. 2013; 29 (1): 173. doi:10.12669/pjms.291.2910
18. Wanni KA, Shahzad N, Ashraf M, Ahmed K, Jan M, Rasool S. Prevalence and spectrum of congenital heart diseases in children. Heart India. 2014;2(3):76. doi:10.4103/2321-449X.140230
19. Majeed-Saidan MA, Atiyah M, Ammari AN, AlHashem AM, Rakaf MS, Shoukri MM, et al. Patterns, prevalence, risk factors, and survival of newborns with congenital heart defects in a Saudi population: a three-year, cohort case-control study. J Congenit Cardiol. 2019;3(1):1-10. doi:10.1186/s40949-019-0023-8
20. Zaqout M, Aslem ES, Oweida FS, De Wolf D. Prevalence of congenital heart disease among Palestinian children born in the Gaza Strip. Cardiol Young. 2014;24(5):905-9. doi:10.1017/S1047951113001418
21. Derakhshan R, Barfeii N, Sadeghi T. Frequency of Congenital Heart Disease in Neonates with Extra Cardiac Anomalies. Int J Pediatr-Mashhad. 2020;8(7):11597-602.
22. Oster ME, Riehle-Colarusso T, Simeone RM, Gurvitz M, Kaltman JR, McConnell M, et al. Public health science agenda for congenital heart defects: report from a Centers for Disease Control and Prevention experts meeting. J Am Heart Assoc. 2013;2(5):e000256. doi:10.1161/JAHA.113.000256
23. Nikyar B, Sedehi M, Mirfazeli A, Qorbani M, Golalipour M-J. Prevalence and pattern of congenital heart disease among neonates in Gorgan, Northern Iran (2007-2008). Iran J Pediatr. 2011;21(3):307.
24. Smitha R, Karat S, Narayanappa D, Krishnamurthy B, Prasanth S, Ramachandra N. Prevalence of congenital heart diseases in Mysore. Indian J Hum Genet. 2006;12(1):11-6. doi:10.4103/0971-6866.25296
25. Alabdulgader A. Congenital heart disease in Saudi Arabia: current epidemiology and future projections. East Mediterr Health J. 2006;12 (Supp 2), S157-S167.
26. Stephensen SS, Sigfusson G, Eiriksson H, Sverrisson JT, Torfason B, Haraldsson A, et al. Congenital cardiac malformations in Iceland from 1990 through 1999. Cardiol Young. 2004;14(4):396-401. doi:10.1017/S1047951104004081
27. Oster ME, Riehle-Colarusso T, Alverson CJ, Correa A. Associations between maternal fever and influenza and congenital heart defects. J Pediatr. 2011;158(6):990-5. doi:10.1016/j.jpeds.2010.11.058
28. Chou H-H, Chiou M-J, Liang F-W, Chen L-H, Lu T-H, Li C-Y. Association of maternal chronic disease with risk of congenital heart disease in offspring. Can Med Assoc J. 2016;188(17-18): E438-E46. doi:10.1503/cmaj.160061

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