PREVALENCE OF CONGENITAL HEART DISEASE IN CHILDREN UNDER 6 YEARS OF AGE IN LAO CAI

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ABSTRACT

Objectives: *To assess the prevalence of congenital heart disease in children under 6 years of age in Lao Cai.*

Methodology: *A cross-sectional descriptive study was conducted on 1,087 children who underwent screening echocardiography at Lao Cai Obstetrics and Pediatrics Hospital and 8 district general hospitals in Lao Cai. Demographic information, risk factors, and heart conditions were recorded and analyzed.*

Results: *A total of 69 children were diagnosed with congenital heart disease (6.3%), with the most common risk factor being preterm birth.*

Conclusion: *More research is needed to fully capture the prevalence of congenital heart disease in Lao Cai.*

Keywords: *Congenital, heart disease, children.*

I. INTRODUCTION

Congenital heart disease refers to heart abnormalities that occur while still in the fetus. Due to structural defects in the heart, its function and activity are impaired, leading to abnormal blood circulation throughout the body. Cardiovascular abnormalities are among the most common congenital anomalies and are one of the leading causes of death in newborns, accounting for nearly 4.2% of the causes of neonatal death [1]. Congenital heart disease also accounts for up to 43% of deaths due to congenital defects in young children [2]. However, if surgery is performed, the success rate is high, and the child can have a good quality of life afterward. For patients with congenital heart disease, prenatal diagnosis can allow for better delivery strategies and preparation for intervention or surgery immediately after birth. However, congenital heart disease is one of the most commonly missed anomalies during prenatal screening ultrasounds due to its specialized nature.

After birth, children are examined clinically or undergo a pulse oximetry test (by measuring oxygen saturation in the right hand and foot) to screen for congenital heart disease. Some centers around the world apply these methods. In a study by Muhammad Mohsin, 1,650 newborns participated in the research [3]. All children were measured for oxygen saturation and underwent clinical examination during the study period. Of these, 924 (56%) were female, and 726 (44%) were male. The results showed that 16 (0.9%) cases tested positive for pulse oximetry, 45 (2.7%) cases showed suspected heart abnormalities during

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clinical examination, and 6 cases were positive for both pulse oximetry and clinical examination findings suggestive of congenital heart disease. Positive screening cases were further evaluated with echocardiography: 2 children had congenital heart disease among the 10 who had positive pulse oximetry tests, 6 out of 6 children with both positive pulse oximetry and clinical suspicion were diagnosed with congenital heart disease, and 17 out of 39 children in the clinically suspected group were diagnosed with congenital heart disease. In total, 25 (1.5%) cases of congenital heart disease were identified in the study, with the most common defects being ventricular septal defect, patent ductus arteriosus, atrial septal defect, and pulmonary hypoplasia with an intact interventricular septum. The sensitivity, specificity, positive predictive value, and negative predictive value of the pulse oximetry test were 32%, 99.5%, 50%, and 98.9%, respectively. Kalita and colleagues found 34 cases (1.98%) of congenital heart disease in 1,720 newborns [4]. Another study by Mathur identified 72 (7.57%) cases of congenital heart disease in 950 screened children [5]. Shakila Thangaratinam included 8 studies with 35,960 children. All asymptomatic children were tested for oxygen saturation; 3 studies involved newborns diagnosed prenatally with congenital heart disease. The results showed that the sensitivity of pulse oximetry was 63% (95% CI: 39.0%-83%), and the specificity was 99.8% (95% CI: 99.0%-100%) [6]. The authors concluded that pulse oximetry has high specificity in diagnosing congenital heart disease, but further research is needed to assess its sensitivity with higher accuracy. Author Võ Đức Trí conducted a study at Children's Hospital No. 1 over two years (2013-2014), with approximately 30 cases of congenital heart disease admitted each year during the neonatal period [7]. Among these, the severe congenital heart defects included transposition of the great arteries (44.8%), abnormal pulmonary vein return (6.9%), pulmonary stenosis (10.3%), hypoplastic aortic arch (6.9%), and Tetralogy of Fallot (6.9%). 100% of the children were admitted for cyanosis, 75.9% had respiratory failure, but 100% of them had no prenatal diagnosis, were admitted late despite good birth weight, 58.6% had pneumonia, and 20% required intubation. Pre-surgical conditions were quite severe. The hospital infection rate was high (31%), with 17.2% requiring intubation, and 48.3% had respiratory failure.

Lao Cai is a mountainous border province located in the northern midland and mountainous region of Vietnam, straddling the boundary between the Northwest and Northeast regions. To the north, Lao Cai borders China; to the west, it shares a border with Lai Chau; to the east, it borders Ha Giang; and to the south, it is adjacent to Yen Bai. In recent years, with the province's socioeconomic development policy, many industrial projects have been established and are operational, leading to significant changes in the living environment of Lao Cai. These environmental changes present significant health risks to the local population. Currently, the average life expectancy in Lao Cai is 69 years, which is lower than the national average for Vietnam. The application of scientific and technological advancements in improving healthcare quality and reproductive health, and increasing life expectancy, is one of the primary goals of the provincial healthcare sector. Community-based congenital heart disease research in Vietnam has been limited both in quantity and quality due to constraints in human resources and equipment. This study aims to assess the prevalence of congenital heart disease in children, as well as to transfer echocardiography techniques for early diagnosis of cardiovascular diseases in children to healthcare workers at provincial and district-level hospitals, which offer good medical services and treat a large number of patients. The findings from this study will inform plans to expand these efforts to other hospitals across the province, aiming to detect congenital heart disease in utero and early congenital heart disease in young children, thereby improving reproductive health and the quality of life for children in Lao Cai.

II. METHODOLOGY

2.1. Participants

We selected children under 6 years of age who attended screening at Lao Cai Obstetrics and Pediatrics Hospital and eight district hospitals in Lao Cai: Sa Pa, Bac Ha, Bao Thang, Muong Khương, Bao Yen, Van Ban, Bat Xat, and Simacai.

2.2. Research design

This is a cross-sectional study

2.3. Time and location

This study was conducted from December 2022 to May 2023 at Lao Cai Obstetrics and Pediatrics Hospital and eight district hospitals in Lao Cai: Sa Pa, Bac Ha, Bao Thang, Muong Khương, Bao Yen, Van Ban, Bat Xat, and Simacai.

2.4. Sample size and sample selection process

All children under 6 years old had been screened for congential heart disease were included in this research. Data were collected using a research questionnaire for children under 6 years of age who underwent screening at Lao Cai Obstetrics and Pediatrics Hospital and eight district hospitals in Lao Cai: Sa Pa, Bac Ha, Bao Thang, Muong Khương, Bao Yen, Van Ban, Bat Xat, and Simacai. Doppler echocardiography was applied to detect congenital heart disease in children.

2.5. Variables and indicators

In this study, we collect information of participants, including age, ethnicity, accomodation, status of congenital heart disease, and other risk factors.

2.6. Data analysis

The data were initially recorded on paper-based questionnaires and subsequently transferred to Epidata software for secure storage. Following this, the data from Epidata were extracted into Microsoft Excel for the purposes of data cleansing and standardization, ensuring consistency and accuracy across all variables. Descriptive statistical methods were employed to summarize the data, presenting the frequency distributions and percentages for each variable. The data analysis process was conducted on R software.

III. RESULTS

A total of 1,087 children under the age of 6 underwent screening for congenital heart disease.

Table 1. Demographic Characteristics of Children Under 6 with Congenital Heart Disease

Characteristic	N = 69	%
Age		
≤ 2	42	60.9
> 2 - < 6	27	39.1
Ethnicity		
Kinh	21	30.4
Giay	3	4.3
Dao	12	17.4
Nung	3	4.3
Tay	2	2.9
Thai	12	17.4
Mong	15	21.9
Muong	1	1.4
Districts		
Lao Cai city	22	31.9
Bao Yên	4	5.8
Bao Thang	14	20.5
Bac Ha	5	7.2
Bat Xat	7	10.1
Si Ma Cai	7	10.1
Muong Khuong	4	5.8
Van Ban	5	7.2
Sa Pa	1	1.4

The majority of children diagnosed with congenital heart disease during screening were under the age of 2 (60.9%). The highest proportion of cases were among children of the Kinh ethnic group, accounting for 30.4%, although this did not exceed 50%. This distribution is consistent with the ethnic diversity in Lao Cai, reflecting the presence of various ethnic groups within the region.

Table 2. The prevalence of congenital heart disease in children under 6 years of age varies across different districts

Area	Number of case	Total visit	Percentage of cases per roral visit (%)
Lao Cai city	22	114	19.3
Bao Yen	4	74	5.4
Bao Thang	14	146	9.6
Bac Ha	5	130	3.8
Bat Xat	7	101	6.9
Si Ma Cai	7	245	2.9
Muong Khuong	4	74	5.4
Van Ban	5	171	2.9
Sa Pa	1	32	3.1
Total	**69**	**1087**	**6.3**

The screening results revealed that the highest prevalence of congenital heart disease among children was observed in Lao Cai City, with a rate of 19.3%. In contrast, in other regions, the proportion of children diagnosed with congenital heart disease relative to the total number of children screened did not exceed 10%, and in most districts, it remained below 5%.

Table 3. The prevalence of congenital heart disease (CHD) in children under 6 years of age varies by type of defect

Diseases	Number of cases (N = 69)	Percentage (%)
I Defect	7	10.1
Atrial Septal Defect	10	14.5
Patent Ductus Arteriosus	18	26.1
Tetralogy of Fallot	2	2.9
Pulmonary Valve Stenosis	5	7.2
Atrioventricular Canal Defect	1	1.4
Coarctation of the Aorta	1	1.4
Pulmonary Vein Abnormality	1	1.4
Single Ventricle Physiology	1	1.4
Heart Valve Regurgitation	19	27.9
Cardiomyopathy	3	4.3
Arrhythmia	1	1.4

The most common congenital heart disease is valvular regurgitation (27.9%), all of which are mild cases that do not require medical or surgical intervention. The next most common condition is patent ductus arteriosus (26.1%), which is frequently found in children under 2 years of age, particularly in premature newborns, during screening. In most of these cases, the ductus arteriosus is small in size and does not require surgical intervention.

Atrial septal defect (14.5%) is also commonly observed, consisting of small holes in the atrial septum in children over 2 years old, with no clinical symptoms. Following that, ventricular septal defect (10.1%) is seen, and all identified cases are recommended for surgical intervention.

Other congenital heart conditions account for a smaller proportion, each under 10%. Among these, there is one case of complex congenital heart disease involving a single ventricle, with a poor surgical prognosis.

Table 5. Distribution of risk factors for congenital heart disease among children under 6 years old

Risk factors		Number of cases (N = 69)	Percentage (%)
Mother	Fever in the first 3 months	2	2.9
	Diabetes	3	4.3
	Hypertension	3	4.3
	Other chronic diseases	2	2.9
Children	Pre-term birth	10	14.5
Family	History of congenital heart disease	2	2.9
	Total	**22**	**31.9**

Among the 69 patients diagnosed with congenital heart abnormalities, 22 cases were identified as having risk factors for congenital heart disease. The most prominent risk factor was a history of preterm birth, which was observed in 10 cases (14.5%). Additionally, within the group of patients diagnosed with congenital heart disease, 2 cases had a family history (sibling) of congenital heart disease.

IV. DISCUSSION

Among the children diagnosed with congenital heart disease during screening, the highest proportion were of the Kinh ethnic group, followed by the Hmong ethnic group. This is relatively consistent with the ethnic structure in Lao Cai, where the Kinh ethnic group makes up 33.8% of the population, followed by the Hmong at 25.1% (8).

Lao Cai City had the highest number of children diagnosed with congenital heart disease, accounting for 31.9%. Lao Cai City has the highest population density in the province, as well as the best access to healthcare services and mobility within the province (8). This explains why the incidence of congenital heart disease is highest in Lao Cai City compared to other areas in the province.

The congenital heart disease most in need of intervention is ventricular septal defect, which accounts for 10.1% of the children diagnosed with congenital heart disease. Isolated ventricular septal defects occur in 2/1000 live births and account for about 20% of congenital heart diseases (9). Being the most common congenital heart disease, it is also the most frequently classified and studied, with various intervention methods and indications researched and applied [9].

Atrial septal defect is the most commonly diagnosed congenital heart disease found during screening in children over 2 years old. A study by Ho XT in 2019, which involved 1,220 congenital heart disease patients in Da Nang, indicated that the incidence of atrial septal defects increases with age. This is because it is often asymptomatic or presents with mild symptoms, progressing slowly, and is mostly discovered incidentally during examinations for other health issues [10].

Among children under 2 years old, patent ductus arteriosus is the most common congenital heart disease found during screening, particularly in premature infants. The incidence of patent ductus arteriosus in full-term infants

is approximately 0.1% to 0.2%. However, the incidence in preterm infants (especially those with low birth weight) is much higher, ranging from 30% to 60%. In extremely premature infants (those born before 28 weeks of gestation), the incidence can reach 50% to 70% [11]. This is consistent with the findings of our study, where preterm birth was the most common risk factor for patent ductus arteriosus.

V. CONCLUSIONS

Congenital heart disease is a health issue that has not been fully documented and detected in Lao Cai, and further research as well as improved disease detection capabilities across the province are needed.

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