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Research Article

EPIDEMIOCLINICAL, ELECTROCARDIOGRAPHIC AND CARDIAC DOPPLER ULTRASOUND ASPECTS OF ATRIAL SEPTAL DEFECT IN CHILDREN IN MADAGASCAR

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Abstract - *Atrial septal defect is the 3rd most common congenital heart disease in children. It is a well-tolerated cardiopathy, but its prevalence is underestimated. It is sometimes discovered at the stage of complications, which places a burden on management. Early diagnosis requires knowledge of this pathology, so that children can be referred to specialized centers for better care. The aim of this study was to obtain a database of epidemiological, clinical and echographic data on atrial septal defects in Madagascar, and to describe them in order to make suggestions for improving early diagnostic and therapeutic management. We conducted a retrospective cross-sectional descriptive and analytical study over a 20-year period. Data were analyzed using Epi-info with a significant threshold of less than 0.05. Prevalence was 10.28%. Females predominated (sex ratio 0.96), with a mean age of 86.02 months. The majority of children were asymptomatic (79.46%). Heart murmur (27%) and respiratory disease were the most common reasons for referral (Figure 1). The most common electrocardiographic abnormalities are right ventricular hypertrophy and right bundle-branch block. Cardiac Doppler ultrasonography revealed a predominance of the isolated ostium secondum type (65%) and the large size (45.09%). Repercussions were mainly dilatation of the right cavities (39.29%) and pulmonary hypertension (16.07%). Interventricular communication (16.96%), patent ductus arteriosus (10.71%) and pulmonary stenosis were the most common congenital cardiovascular anomalies. Large atrial septal defects were associated with hypertension. Early diagnosis should be promoted to avoid avanced stages of the disease.*

Keywords - *Atrial septal defect, Cardiac Doppler ultrasound, Child, Electrocardiogram, Epidemiology, Signs.*

I. INTRODUCTION

Atrial septal defect (ASD) is a congenital heart disease characterised by a septal defect between the left and right atria responsible for a left-to-right shunt. It occurs in 7 to 10% of congenital heart diseases. It is more common in women (twice as common as in men) [2]. It is a well-tolerated malformative heart disease. It accounts for only 10% of malformative heart disease diagnosed at birth. It is frequently diagnosed in adulthood (30 to 40% of cases) [4]. Delayed diagnosis often leads to serious complications such as cardiac rhythm disorders or fixed pulmonary hypertension in adults. The aim of this study was to obtain a database of epidemiological, clinical and echographic data on atrial septal defects in Madagascar, and to describe them in order to make suggestions for improving early diagnostic and therapeutic management.

II. MATERIALS AND METHODS

This was a retrospective descriptive and analytical cross-sectional study over a 20-year period from January 1997 to December 2017. It was carried out in the Department of Internal Medicine and Cardiovascular Diseases

at the Soavinandriana Antananarivo Hospital, in collaboration with the World doctor's team involved in the screening, management and follow-up of congenital heart disease. We included all children under 15 years of age with an atrial septal defect confirmed by cardiac Doppler ultrasound during the study period. Epidemiological parameters such as age, gender, clinical signs and echographic characteristics were studied.

III. RESULTS AND DISCUSSION

A. Results

During the study period, 223 cases of ASD were registered giving a general prevalence of 10.82% of congenital heart disease. There was a predominance of females with a sex ratio of 0.96. The mean age was 86 months, with extremes of 1 month and 15 years. The urban population was the most represented with 58.04% of cases of ASD diagnosed. Among our patients, 27.35% were referred for heart murmur; 21.07% for follow-up and management of previously diagnosed ASD. Respiratory manifestations such as recurrent bronchitis and dyspnoea were present in 11.65% and 8.07% of cases respectively (Figure 1), the remaining 79.46% were asymptomatic. The electrocardiogram was normal in 52.68% of cases. The most common abnormalities were right ventricular hypertrophy (29.46%) and right bundle-branch block (9.38%), all of which were accompanied by right axial deviation. Three children had an atrial rhythm disorder (atrial fibrillation/flutter) (Table 1).

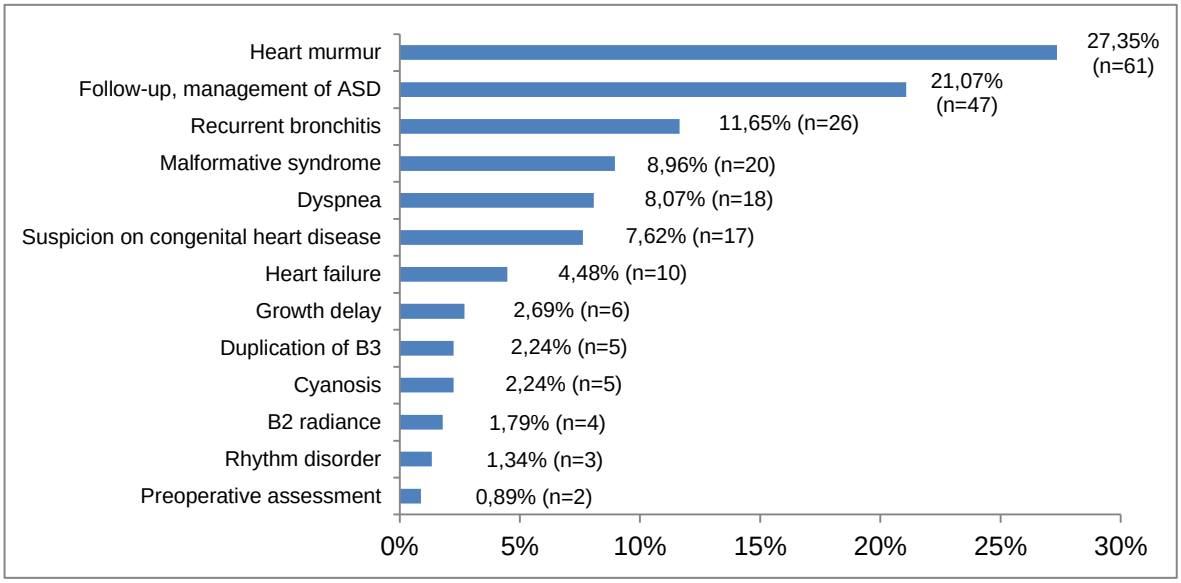

Figure 1. Distribution of Patients by Reason for Referral

Table 1. Distribution of Patients According to Electrocardiographic Abnormality

Electrocardiography	Number n=224	Report 100%
Normal	118	52,68
Right ventricularhypertrophy	66	29,46
Right branch block	21	9,38
Bi-ventricularoverload	16	7,14
Rhythmdisorders: atrial tachycardia, atrial fibrillation	3	1,34

On cardiac Doppler ultrasound, the isolated form was observed in 61% of cases, and was associated with other cardiovascular malformations in 39% of cases. The ostium secondum type was predominant (65%) (Figure 2). The size of the ASD was large in the majority of cases (45.09%). Doppler ultrasound findings were mainly dilatation of the right heart chambers (39.29%) and pulmonary arterial hypertension (16.07%) estimated from tricuspid insufficiency flow (Table 2). Interventricular septal defect (16.96%), patent ductus arteriosus (10.71%) and pulmonary stenosis (3.13%) were the most common congenital cardiovascular anomalies associated with ASD. Wide ASD was significantly associated with the development of pulmonary hypertension (Table 3). There was also a significant association between ostium primum ASD, whether isolated or associated with other cardiac malformations, and the presence of trisomy 21 (Table 4).

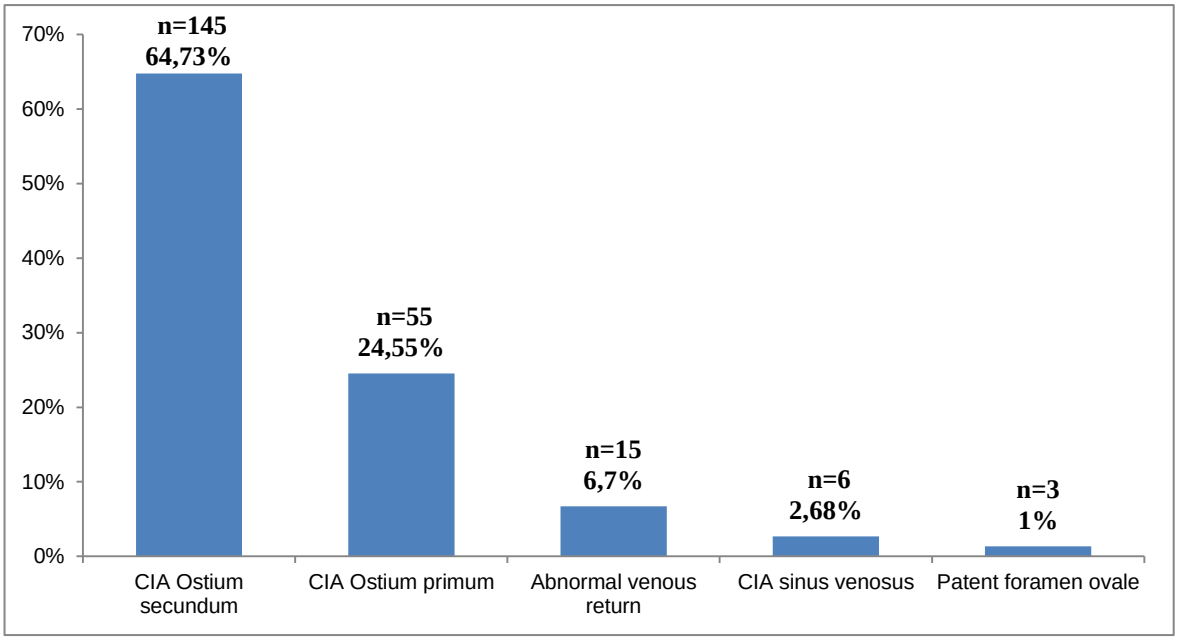

Figure 2. Distribution of Atrial Septal Defect's Type

Table 2. Distribution of Atrial Septal Defect's Effects

	Number n=222	**Report 100%**
No repercussions	76	33,93
Dilation of right cavities	86	39,29
PAH	36	16,07
Tricuspid insufficiency + dilatation of the right cavities	15	6,70
Dilatation of the pulmonaryartery	8	3,57
Tricuspidinsufficiency	1	0,45

Table 3. Association between Pulmonary Hypertension and Atrial Septal Defect Size

PAH				
Size of ASD	Yes n= 36	No n=188	No n=188	P
Large	25	83	108	$<10^{-5}$
Medium	2	41	43	
Small	4	56	60	
Not specified	5	6	11	

Table 4. Association between Type of Atrial Septal Defect and Trisomy 21

ASD Type				
Trisomy 21	Ostium primum n= 57	Ostium non primum n=167	Total n=222	P
Yes	19	8	27	$<10^{-5}$
No	38	159	195	

B. Discussion

The prevalence of atrial septal defect continues to increase despite its good tolerability during its evolution. This is largely due to the development of diagnostic tools such as cardiac Doppler ultrasound. In our study, there was an increase of 10.28% compared with another study conducted previously by Rakotondrajaona ON in 2014 at the Centre Mother and Child University Hospital Tsaralalana, which found 9.3%. A meta-analysis in East Africa and a study conducted in France found a frequency of 10.36 and 10% respectively, which is substantially similar to our results [1, 2].The meanage of discovery in our study was higher (86 months) than that of the study described by Wone in Senegal, with a meanage of discovery of 2 months, and that of Elalj in Morocco, with a meanage of discovery of 23 months [3]. This may be explained by the inadequacy of screening centres in Madagascar, but also by the difficulty of access and the neglect of symptoms.

A predominance of females was found, with a sex ratio of 0.93 in this study. This was also the case in the study by Basse et al in Senegal and Robert Gnansia in France[3, 4]. On the other hand, a study carried out in Burkina Faso showed a male predominance[5]. Children from urban areas are the most affected (58.04%). This could be explained by the greater exposure of pregnant women to environmental pollutants in urban areas. According to the study by Peyvandi S and colleagues, exposure to environmental pollutants had an influence on the incidence of congenital heart disease [6]. According to Tikkanen J et al in 1992, maternal exposure to certain chemical agents or alcohol during the first trimester of pregnancy constitutes a risk for the development of atrial septal defects [7].In addition, access to screening centres iseasier for the urban population than in more remote areas. However, the study by Tuan HX et al in Vietnam found a different result, with a higher frequency of ASD in rural than in urban areas, but the difference was not significant (p=0.51) [8].

The same was true of the study by Langlois PH et al in Texas, where ASD was more prevalent in children living in rural areas where there was more cultivated land. These different results may be explained by the use of agricultural chemicals in these countries, exposing pregnant women [9].Most ASDs are asymptomatic and are discovered by chance. According to the literature, symptoms depend mainly on the form (isolated or not) and the size of the ASD [10]. Dyspnoea and cough were the functional signs most frequently found in ourstudy. The studyconducted by Basse et al in Senegalconcerning the epidemioclinical and echographic profiles of atrial septal defects in children describes these same manifestations [3]. The symptoms vary from one patient to another according to the literature, but the most commonly reported were dyspnoea, fatigue, intolerance to exertion and palpitations [10]. The ECG is essential in the search for rhythm and conduction disorders in ASD[11]. In our case, we observed mainly signs of repercussions on the right cavities, including right axial deviation, with right cavity hypertrophy mainly in the atrium. The Senegalese studies by Basse et al and the Burkinabe study by Kinda G et al showed the same results [3, 5]. Right bundle branch block was frequent and is a specific anomaly in ASD[11].

According to the study by Abdyzhaparova EK et al, the degree of electrocardiographic changes in ostium secondum ASDs varies according to their size. Larger defects are characterised by a deviation of the electrical axis of the heart to the right, pronounced signs of right ventricular hypertrophy and a higher prevalence of right bundle-branch block [12].Wefound 3 cases of cardiac rhythm disorders (atrial fibrillation and/or atrial flutter). Cardiac rhythm disorders consisting essentially of atrial fibrillation and atrial flutter are rare according to the literature[13].On cardiac Doppler ultrasound, wefound a predominance of ostium secondum type ASDs. Our results were similar to those found in other studies, including those by Basse et al and Geva T et al[3, 13]. ASD was isolated in the majority of our cases, which was also found by Kinda G et al in Burkina Faso[5]. In contrast, the results found by Basse et al in Senegal showed a predominance of associated forms (63.26%)[3].A large atrial septal defect was predominant in our study (45.09%), a similar result to the Senegalese study by Basse et al[3].

In our study, ventricular septal defect, patent ductus arteriosus and pulmonary artery stenosis were the most common associated cardiovascular malformations. These results were similar to those of other African studies according to Basse et al[3]. With regard to the complications found on echocardiography, wefound a predominance of dilatation of the right cavities and pulmonary arterial hypertension. These were also the most predominant complications according to other African studies, particularly in Senegal[3]. In Europe, late complications of atrial septal defect are rare thanks to advances in technology enabling early detection and management, according to Stolt VS and colleagues[14]. This discrepancy shows the extent of the efforts that

developing countries must make to promote access to screening centres and resources for this condition. Regarding the factors associated with the occurrence of complications, we found that large ASDs were significantly associated with the occurrence of pulmonary arterial hypertension (p = 0.005). Mahon C J et al, studying the natural history of growth of ostium secondum type atrial septal defects, reported that the large size of the ASD was statistically significantly associated with the occurrence of repercussions, especially PAH[15].

In addition, by studying the effect of ageat the time of repair and the size of the ASD prior to repair on pulmonary artery pressures, Motiwala and colleagues found that for each 1 mm increase in ASD, pulmonary artery pressure increased by 0.32 mmHg, demonstrating this correlation between ASD size and the development of pulmonary arterial hypertension[16]. Chinawa J and colleagues, in their studies aimed at determining the factors predictive of pulmonary arterial hypertension in children with isolated ASD, found that only age was strongly correlated with the development of pulmonary arterial hypertension, whereas ASD size was very weakly correlated with its development (increase in ASD size correlated with increase in pulmonary arterial hypertension but was statistically insignificant) [17]. We also found thattrisomy 21 was significantly associated with the development of ostium primum ASDs (p=10-5). Morales D et al, in their study of heart disease and outcomes of cardiac procedures in patients with trisomy 21 and Turner syndrome; and Stos B et al in their study of the benefits and risks of cardiac surgery in trisomy 21, also found the same results[18, 19]. On the other hand, Tan M and colleagues in Singapore, studying the types and distribution of congenital cardiac malformations associated with trisomy 21, found a high number of ostium secondum type ASDs in trisomy 21 patients[20].

IV. CONCLUSION

Atrial septal defect was the third most common congenital heart disease, with a prevalence of 10.82% in our study, a predominance of females and amean age of discovery of 86.2 months. Heart murmur and respiratory disease are the main reasons for referral, even though the majority of children are asymptomatic, demonstrating the important role of systematic examination of all newborns. The repercussions are dominated by dilatation of the right cavities and pulmonary arterial hypertension. Large ASD was significantly associated with the development of right-sided dilatation and PAH. Early diagnosis should be promoted to avoid these stages of the disease.

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