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Original Research Article

Epidemiological Analysis of Atrial Septal Defect (ASD): A Comperative Study of Pediatric and Adult Population

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Abstract:

Background: Atrial Septal Defect (ASD) is a common congenital heart defect characterized by an abnormal communication between the atria, leading to shunting between systemic and pulmonary circulations. It is one of the most prevalent congenital heart diseases (CHD), with increasing recognition in both pediatric and adult populations, especially with advancements in diagnostic imaging. This study aims to assess the prevalence of ASD cases among CHD patients in a tertiary care hospital in eastern India, highlighting demographic factors and associated characteristics.

Methods: A prospective observational study was conducted at the Cardiothoracic and Vascular Surgery unit of IPGME&R and SSKM Hospital, Kolkata, India. The study enrolled 250 CHD patients from December 2021 to September 2023. Among these, 112 patients were diagnosed with ASD. Patients were categorized into two groups: pediatric (0-14 years) and adult (>14 years). Data were collected via standardized questionnaires, including demographic, clinical, and family history details. Statistical analysis was performed using descriptive statistics, Student's t-test, and Chi-square test for comparison.

Results: Among the 112 ASD patients, 61 were pediatric and 51 were adult. In the pediatric cohort, there was a near-equal gender distribution, with a mean age at diagnosis of 31.6 months. In contrast, the adult group had a predominance of females (76%) and an average diagnosis age of 346.5 months (approximately 28.9 years). A family history of heart disease was reported in 7.14% of ASD cases. The analysis revealed significant differences in the age at diagnosis and gender distribution between the two groups.

Conclusion: The study highlights significant age-related disparities in the diagnosis of ASD, with pediatric patients being diagnosed at a much earlier age compared to adults. A gender bias was observed in the adult group, warranting further investigation into the potential underlying causes. Early diagnosis and intervention in pediatric patients are crucial to reducing long-term complications. Additionally, the role of genetic factors and family history underscores the importance of genetic counseling and screening in managing ASD. This study provides valuable epidemiological insights into the prevalence and characteristics of ASD in eastern India, contributing to a better understanding of this congenital heart defect in diverse populations.

Introduction

Atrial septal defect (ASD) is an abnormal communication between the two atria of the heart, enabling shunting between systemic and pulmonary circulations. It is one of the most common types of congenital heart disease (CHD) [1–4], ranking as the second most prevalent CHD in children, with an occurrence rate of 0.07–0.2% [5]. Globally, the estimated incidence is 56 per 100,000 live births, with a prevalence of 1.6 per 1,000 live births [6, 7]. Advancements in echocardiography have led to the detection of previously silent defects, potentially raising the incidence to 100 per 100,000 live births [6]. ASD is also the most frequently undiagnosed CHD during childhood. Among adults, it represents 7–10% of all CHD cases and 20–40% of newly diagnosed CHD cases [1, 8]. In developed countries, surgical and catheter-based interventions have improved survival rates for ASD patients,

with current life expectancy ranging between 50 and 60 years [9]. In the United States, adults with CHD now outnumber children, comprising 60% of the CHD population [10]. Consequently, developed nations are intensifying efforts to manage the growing number of adolescents and adults with ASD [10, 11]. However, in developing countries like India with limited resources, healthcare systems often face challenges in timely diagnosis and treatment of ASD. Additionally, limited data from low-income countries contribute to underestimation of the burden and treatment costs associated with ASD [12, 13]. In Eastern India, some studies have examined ASD, but they primarily focused on the proportion and patterns of ASD among CHD patients. With the expanding availability and use of echocardiography, the prevalence of ASD may increase due to improved diagnostic capabilities, particularly in neonates. However, comprehensive hospital-based data on ASD remain limited. Therefore, this study aims to assess the prevalence of ASD cases among CHD patients attending outpatient department (OPD) of a tertiary care hospital in eastern India and specially identify associated factors in ASD cases.

Methods

Study Setting: The study was conducted at Cardiothoracic and Vascular Surgery unit of IPGME&R and SSKM Hospital, which is a Medical research Institute of international repute and one of the super speciality Hospitals in the eastern India. [13]

Data Sources and Data Collection: This was a prospective observational single-centre study based on the ASD cases among CHD patients attending outpatient department (OPD) of Cardiothoracic and Vascular Surgery unit of IPGME&R and SSKM Hospital. The study proposal was approved by the Ethical Committee Commitee of IPGME&R and SSKM Hospital. All personal information of the patients involved in the research was anonymized and kept confidential, with access restricted to researchers only when necessary.

All coded data were securely stored in compliance with the hospitals' guidelines and regulations. Data from all patient records were collected for the period between 1st December, 2021 to September, 2023. The inclusion criteria encompassed all CHD patients who had undergone treatment through either surgical or transcatheter interventions. The exclusion criteria excluded CHD patients who were not eligible for surgical or transcatheter interventions or those requiring only medical management. Based on these criteria, a total of 250 CHD patients were enrolled in the study.

Data Collection: Pediatric patients between ages 0 to 14 years and Adult patients aged greater than 14 attending the cardiovascular surgery department were included. Diagnosis of ASD was done by clinical findings and echocardiography. Standardized and validated questionnaires were used for collecting data from ASD patients. Information were collected on baseline demographics (age, sex, residential address, family income), birth information (place of delivery, type of delivery, whether delivered full term or premature, birth weight and height,), general health of the patient as assessed by the person answering the questionnaire, schooling/work history (whether the child/adult goes to school/ work, absenteeism), health service utilization (number of times the patient needed hospitalizations or visits to the doctor) and the year of ASD diagnosis. The age at diagnosis was set to 0 day if the cardiac defect was reported from the maternity ward; otherwise, it was set as the age at first echocardiography confirming ASD. Family history about presence or diagnosis of CHD in any of the parent or first degree relative in the family was recorded,

Statistical Analysis: The proportion of ASD was categorized according to the patient's demographics, e.g., age, sex, clinical presentations and concurrent congenital conditions, using descriptive statistic methods. Quantitative data were presented as mean and standard deviation. To compare differences between two groups, Student's t-test was used for quantitative variables, and Chi-square test was used for qualitative variables. The level of statistical significance was set at p-value less than 0.05.

Results

Out of a total of 250 patients, 112 were diagnosed with Autism Spectrum Disorder (ASD). [Table 1] The demographic characteristics of the ASD patients were divided into two age groups: pediatric (0-14 years) and adult (>14 years).

Table 1: Point prevalence of CHD

Point prevalence of CHD						
CHD	**N**	**%**	**Male**		**Female**	
			n	**%**	**N**	**%**
CHD all	250	100	100	40	150	60
ASD	112	44.8	42	37.5	70	62.5
ASD+ Other	20	8	5	25	15	75
ASD all (ASD & ASD+ Other)	132	52.8	47	35.6061	85	64.3939

AVSD/ASD+VSD	16	6.4	7	43.75	9	56.25
VSD	69	27.6	33	47.8261	36	52.1739
VSD+ Other	15	6	7	46.6667	8	53.3333
VSD all	84	33.6	40	47.619	44	52.381
TOF	16	6.4	7	43.75	9	56.25
TOF+ Other	13	5.2	5	38.4615	8	61.5385
TOF all	29	11.6	12	41.3793	17	58.6207
Single defect	196	78.4	82	41.8367	114	58.1633
Multiple/Mixed defect	54	21.6	18	33.3333	36	66.6667

Pediatric Age Group (0-14 years): In the pediatric cohort, there were a total of 61 patients diagnosed with ASD. The gender distribution was nearly balanced, with 30 male patients (49%) and 31 female patients (51%). The average age at diagnosis for this group was calculated to be 31.618 months, with a standard error of 9.888 months. The 95% confidence interval (CI) for the average age of diagnosis was [11.000, 52.236] months. This suggests that the majority of patients in this group were diagnosed within the early years of life, with a wide variability in the ages at diagnosis.

Adult Age Group (>14 years): The adult cohort consisted of 51 patients diagnosed with ASD. This group showed a significant gender difference, with 12 male patients (24%) and 39 female patients (76%).

The average age at diagnosis for this adult group was 346.451 months (approximately 28.88 years), with a standard error of 56.266 months. The 95% confidence interval (CI) for the average age of diagnosis was [234.023, 458.879] months, indicating that diagnoses were made later in life for many patients in this group.

The age at diagnosis in the adult cohort was considerably higher than in the pediatric cohort, highlighting the delayed recognition of ASD in adulthood.

Family History of Heart Ailment: A family history of heart ailments was reported in 8 patients (7.14%) from the ASD cohort. This information suggests that a small percentage of ASD patients had a family history of heart conditions, though the association between ASD and family heart health was not further explored in this dataset.

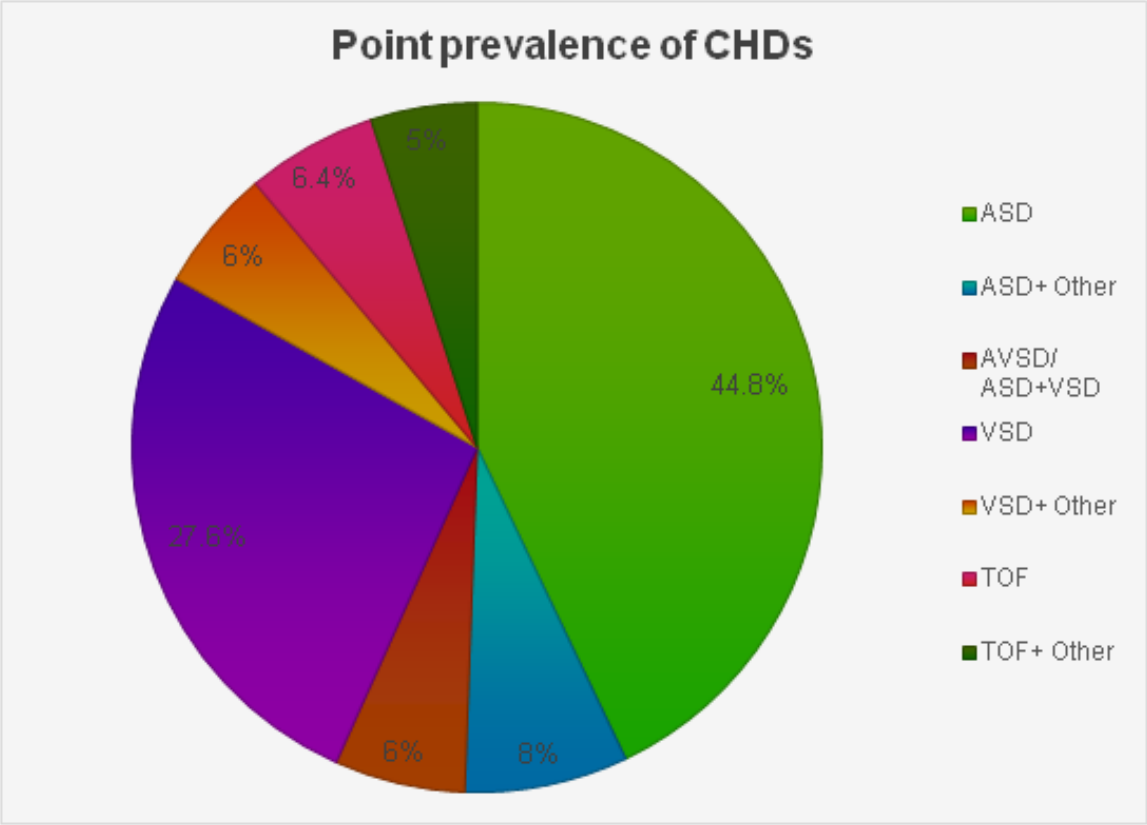

Figure 1: Point prevalence of CHDs

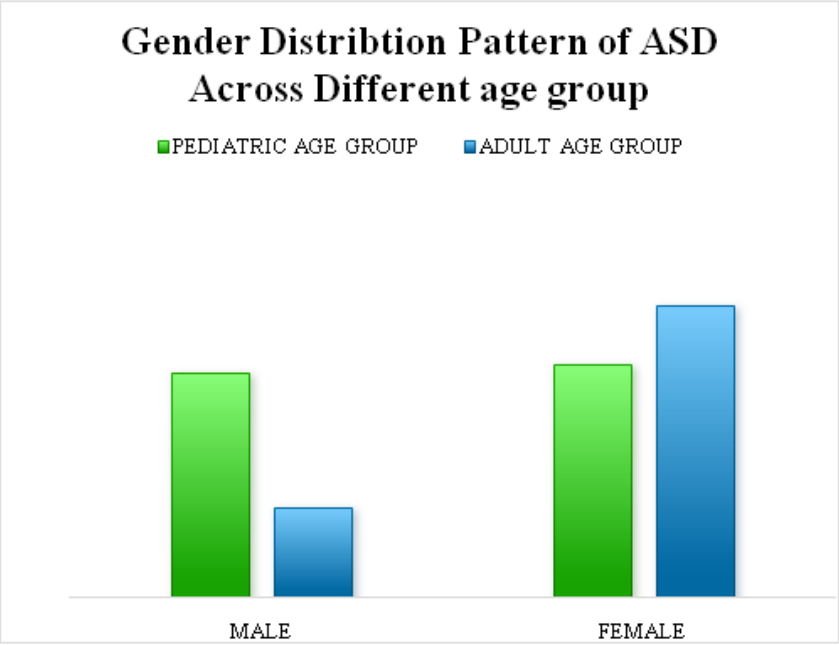

Figure 2: Gender Distribution Pattern of ASD across Different age group

Discussion

Point Prevalance of CHDs suggest that ASD is the most common congenital heart defect among the collected data, with 112 patients diagnosed accounts for 44.8% Of total CHD Patients. [Figure 1].

This comprehensive epidemiological analysis of atrial septal defect (ASD) patients, divided into pediatric (0-14 years) and adult (>14 years) age groups, reveals several significant findings and implications.

Age at Diagnosis Disparities: The analysis of age at diagnosis for Atrial Septal Defect (ASD) in both pediatric and adult cohorts reveals a clear disparity in the timing of diagnosis between the two groups. In the pediatric cohort (0-14 years), the average age at diagnosis was approximately 31.6 months (2.6 years), with a relatively early detection in life. This early diagnosis is indicative of the congenital nature of ASD, where early clinical signs or screening methods facilitate the identification of the defect in the formative years. In contrast, the adult cohort (>14 years) exhibited a much later average diagnosis age of approximately 28.9 years (346.5 months). This significant delay in diagnosis suggests that ASD is frequently undiagnosed in adulthood, despite the potential presence of symptoms. The delayed recognition may be attributed to a lack of early screening, misdiagnosis, or the gradual onset of symptoms that may not be immediately linked to ASD. These findings underscore the importance of early detection, particularly in the pediatric population, to ensure timely intervention and prevent long-term cardiovascular complications. The late diagnosis observed in adults highlights the need for increased awareness and targeted screening programs for ASD in the adult population, which could improve patient outcomes and reduce the burden of undiagnosed congenital heart defects in later life.

Gender Disparity: Within the adult age group, there is a substantial gender disparity, with a higher number of female patients (39) compared to male patients (12). This gender bias warrants further investigation to understand whether it reflects true epidemiological trends or is influenced by healthcare-seeking behavior, genetic factors, or other variables. In contrast, the pediatric age group shows a relatively balanced gender distribution between male (30) and female (31) patients. [Figure 2]. This disparity between age groups in gender representation raises intriguing questions about how ASD may manifest differently across the lifespan. A chi-square test was conducted to determine whether there is a significant association between gender distribution and age group among ASD patients. The analysis showed a statistically significant association with a p-value less than 0.05. This suggests that the gender distribution of ASD patients differs significantly between the adult and pediatric age group and therefore, the gender distribution is not independent of age group.

Family History and Concurrent congenital conditions

Pediatric Group: Notably, 8 patients have reported a family member with a similar heart ailment. This finding suggests a potential genetic component in congenital heart defects, warranting

genetic and familial studies to better understand the hereditary aspects of ASD.

Concurrent congenital conditions: The data also reveals the presence of concurrent congenital defects, such as patients with ASD and other congenital heart defects (e.g., VSD, TOF). These conditions are more prevalent in the pediatric age group, further highlighting the complexity of congenital heart diseases and the need for specialized care.

Clinical and Public Health Implications Early Intervention: The age disparity in diagnosis underscores the importance of early detection and intervention, particularly in the pediatric population, to minimize the potential complications associated with untreated ASD.

Genetic Investigations: The presence of family history suggests that genetic screening and counseling may be valuable in managing and preventing congenital heart defects, emphasizing the importance of a multidisciplinary approach in pediatric cardiology.

Gender Disparities: The gender bias observed in the adult age group should prompt further research into gender-related factors that may influence the presentation and management of ASD.

In conclusion, this epidemiological analysis not only provides insights into the contrasting demographics and characteristics of ASD patients across age groups but also underscores the need for tailored healthcare strategies for pediatric and adult populations. Further research is warranted to delve deeper into the gender disparities, genetic aspects, and comorbidities associated with ASD to improve the overall understanding and management of this congenital heart defect. This understanding will contribute to more effective prevention, diagnosis, and treatment strategies for individuals of all ages affected by ASD.

References

1. Bissessor N. Current perspectives in percutaneous atrial septal defect closure devices. Med Devices (Auckl). 2015;8:297–303.
2. Rao PS, Harris AD. Recent advances in managing septal defects: atrial septal defects. F1000Research. 2017;6(F1000 Faculty Rev):2042.
3. Wiktor DM, Carroll JD. ASD Closure in Structural Heart Disease. CurrCardiol Rep. 2018;20:37.
4. Thiene G, Frescura C. Anatomical and pathophysiological classification of congenital heart disease. CardiovascPathol. 2010;19:259–74.
5. Shuler CO, Tripathi A, Black GB, Park YM, Jerrell JM. Prevalence of treatment, risk factors, and management of atrial septal defects in a pediatric Medicaid cohort. Pediatr Cardiol. 2013;34:1723–8.
6. Geva T, Martins JD, Wald RM. Atrial septal defects. Lancet. 2014;383:1921–32.
7. Kuijpers JM, Mulder BJ, Bouma BJ. Secundum atrial septal defect in adults: A practical review and recent developments. Neth Heart J. 2015;23:205–11.
8. Suradi HS, Hijazi ZM. Adult Congenital Interventions in Heart Failure. Interv Cardiol Clin. 2017;6:427–43.
9. Nyboe C, Karunanithi Z, Nielsen-Kudsk JE, Hjortdal VE. Long-term mortality in patients with atrial septal defect: A nationwide cohort-study. Eur Heart J. 2018;39:993–8.
10. Triedman JK, Newburger JW. Trends in Congenital Heart Disease: The Next Decade. Circulation. 2016;133:2716–33.
11. Engelings CC, Helm PC, Abdul-Khaliq H, Asfour B, Bauer UM, Baumgartner H, et al. Cause of death in adults with congenital heart disease—An analysis of the German National Register for Congenital Heart Defects. Int J Cardiol. 2016;211:31–6.
12. Pei L, Kang Y, Zhao Y, Yan H. Prevalence and risk factors of congenital heart defects among live births: A population-based cross-sectional survey in Shaanxi province, Northwestern China. BMC Pediatr. 2017; 17:18.
13. West Bengal Department of Health and Family Welfare. Institution has received the tag of 'Centre of Excellence'. wbhealth.gov.in. 2021 Oct 23.