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Prevalence of cardiac abnormalities and heart failure in India: An overview

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Abstract
Cardiovascular diseases (CVDs), including cardiac abnormalities and heart failure (HF), have emerged as a leading cause of morbidity and mortality in India. Rapid urbanization, changing dietary habits, sedentary lifestyles, and increasing prevalence of comorbid conditions such as diabetes and hypertension have contributed significantly to the burden of heart diseases. This review highlights the current scenario of cardiac abnormalities and heart failure in India, discussing epidemiological trends, major risk factors, urban-rural disparities, and health system challenges.

Keywords: Heart failure, hypertension, diabetes, human health, cardiovascular disease

1. Introduction

India is witnessing a cardiovascular transition, with non-communicable diseases (NCDs), especially cardiovascular diseases, replacing infectious diseases as the primary health concern. Among these, cardiac abnormalities such as congenital heart disease (CHD), valvular heart disease, ischemic heart disease (IHD), and heart failure (HF) are increasing alarmingly (Gupta *et al*., 2016) [7]. With nearly 63% of total deaths in India attributed to NCDs and 27% due to CVDs alone, heart diseases have become a significant public health issue.

Cardiovascular diseases (CVDs) are the leading cause of mortality globally, with a disproportionate burden borne by low- and middle-income countries, including India. Among various cardiac conditions, cardiac abnormalities and heart failure (HF) have emerged as major public health challenges, contributing significantly to morbidity, mortality, and healthcare costs. India, with its rapidly transitioning socio-economic and lifestyle patterns, is witnessing a concerning rise in the incidence and prevalence of cardiac diseases. The convergence of traditional risk factors, such as hypertension and diabetes, along with emerging contributors like air pollution, stress, and sedentary behavior, has made India a critical epicenter for cardiovascular health discourse.

Heart failure, characterized by the heart's inability to pump sufficient blood to meet the body's needs, is often the final common pathway for many cardiovascular conditions. It is not merely a disease but a complex clinical syndrome with varying presentations, ranging from preserved ejection fraction (HFpEF) to reduced ejection fraction (HFrEF). In India, HF poses a particularly acute challenge due to its early onset, diverse etiologies, and limited healthcare infrastructure in rural areas. According to the Global Burden of Disease (GBD) study, cardiovascular diseases contributed to 28.1% of all deaths in India in 2016, a stark increase from 15.2% in 1990 (India State-Level Disease Burden Initiative CVD Collaborators, 2018). Among these, ischemic heart disease and stroke remain the predominant causes, yet HF and related cardiac abnormalities are increasingly recognized as critical contributors to this rising burden.

The epidemiological shift in India, marked by aging populations, urbanization, and lifestyle changes, has altered the disease landscape. Historically, communicable diseases were the major health concerns in India, but over the past few decades, non-communicable diseases (NCDs), particularly cardiovascular diseases, have taken center stage. The prevalence of heart failure in India is estimated at around 1.3 to 4.6 million cases, with an annual incidence of 491,600 to 1.8 million cases (Goyal & Yusuf, 2006; Huffman *et al*., 2010) [4, 8].

However, this may be a conservative estimate due to underreporting and lack of nationwide registries.

The etiology of heart failure in India is multifactorial. Rheumatic heart disease (RHD), once a dominant cause, still persists in several rural and economically backward regions, although its prevalence is declining with better access to antibiotics and healthcare. Coronary artery disease (CAD), hypertension, diabetes, valvular heart disease, cardiomyopathies, and congenital heart defects are now major contributors to the HF burden. Notably, Indian patients often develop heart failure at a younger age compared to their Western counterparts, with a median age of onset between 50 to 60 years, about a decade earlier than in developed countries. This early onset translates into a prolonged disease trajectory, with significant implications for economic productivity and healthcare utilization.

Another important aspect of cardiac abnormalities in India is the prevalence of structural and electrical disorders. Conditions such as left ventricular hypertrophy, left bundle branch block, atrial fibrillation, congenital heart diseases, and cardiomyopathies are commonly observed. Many of these abnormalities go undetected in the early stages due to lack of routine cardiac screening and limited public awareness. For example, atrial fibrillation, which increases the risk of stroke and HF, remains underdiagnosed in India due to lack of electrocardiogram (ECG)-based mass screening programs (Chugh *et al*., 2014) [2].

India's vast heterogeneity in terms of geography, socio-economic status, education, and healthcare infrastructure further complicates the assessment and management of cardiac conditions. Rural areas suffer from a disproportionate shortage of cardiologists, diagnostic tools, and tertiary care centers. The India Heart Watch study revealed significant regional differences in cardiovascular risk factors, with northern and eastern states demonstrating higher prevalence of hypertension and diabetes (Gupta *et al*., 2012) [5]. Moreover, the lack of nationwide heart failure registries and real-time surveillance systems has resulted in poor documentation of disease prevalence and treatment outcomes. Efforts such as the Trivandrum Heart Failure Registry and the Indian Heart Failure Registry have attempted to address this gap by providing valuable data on patient demographics, clinical profiles, treatment modalities, and outcomes (Kurian *et al*., 2020) [13].

Another critical concern is the affordability and accessibility of cardiac care in India. Despite improvements in tertiary healthcare in urban areas, the cost of diagnostics, medications, and interventions remains prohibitive for a large segment of the population. Generic medications and government-sponsored health insurance schemes such as Ayushman Bharat have somewhat mitigated this burden, but challenges persist in consistent availability and quality of care. Furthermore, adherence to guideline-directed medical therapy (GDMT) remains suboptimal. The CREATE registry noted that many patients with acute coronary syndrome were not receiving evidence-based therapies at discharge, indicating gaps in care (Yusuf *et al*., 2008) [23].

Environmental and lifestyle factors also play a significant role in the growing burden of cardiac diseases in India. Urbanization has led to a rise in unhealthy diets rich in saturated fats, trans fats, and salt, along with reduced physical activity and increasing obesity rates. The National Family Health Survey (NFHS-5) reported a steady increase in overweight and obesity among Indian adults. Additionally, air pollution, a neglected cardiovascular risk factor, has been shown to increase the risk of heart attacks, stroke, and HF. Chronic exposure to particulate matter (PM2.5) is particularly harmful and prevalent in Indian cities.

Psychosocial stress, depression, and poor mental health also contribute significantly to cardiac risk. India's fast-paced economic changes have placed a considerable psychological burden on its population, which in turn affects heart health through neuroendocrine pathways, leading to endothelial dysfunction and arrhythmias. There is growing evidence that social determinants of health such as education, occupation, and income level are intricately linked with cardiovascular outcomes.

In recent years, India has witnessed increasing efforts in both public and private sectors to tackle cardiac disease burden. Advances in echocardiography, cardiac MRI, and point-of-care testing have improved diagnostic accuracy. Innovations in telemedicine and mobile health platforms have increased the reach of cardiac care to underserved populations. However, prevention remains the cornerstone of reducing cardiac morbidity and mortality. Large-scale public health campaigns promoting lifestyle modifications, early detection, and risk factor management are crucial. Integration of cardiovascular screening into existing healthcare platforms such as the National Program for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS) offers a scalable approach to reduce disease burden.

2. Burden of Cardiac Abnormalities in India

2.1 Congenital Heart Disease

CHD is one of the most common congenital anomalies in Indian newborns, with an estimated incidence of 8-10 per 1000 live births (Mondal *et al*., 2018) [15]. Due to lack of early screening and specialized pediatric cardiac care in many parts of India, especially rural and semi-urban regions, many CHD cases remain undetected or untreated.

2.2 Rheumatic Heart Disease (RHD)

RHD, a preventable sequela of rheumatic fever, is still prevalent in low-income communities, with a national prevalence ranging from 0.5 to 2 per 1000 children in school-based studies (Kumar & Tandon, 2013) [11]. Though RHD rates have declined globally, India continues to bear a high burden, primarily due to poor living conditions, inadequate access to antibiotics, and limited awareness.

2.3 Ischemic Heart Disease

Ischemic heart disease remains the leading cause of cardiac morbidity and mortality in India. A study by the Global Burden of Disease (GBD) showed a significant rise in IHD from 1990 to 2016, with a 50% increase in mortality (GBD India Compare, 2017) [3]. Lifestyle factors, smoking, high blood pressure, and diabetes contribute significantly to IHD prevalence.

3. Heart Failure in India

Heart failure (HF) is a clinical syndrome with varied etiology including CHD, RHD, and IHD. An estimated 8-10 million people in India are affected by HF, with annual incidence ranging from 1.5 to 2 million (Pillai *et al*., 2019) [17]. Unlike Western countries, heart failure in India tends to occur at a younger age, and outcomes are often poor due to delayed diagnosis and inadequate management (Kumar *et al*., 2020) [12].

3.1 Risk Factors for HF in India

The following major risk factors are associated with heart failure in India:

- **Hypertension:** Prevalence of hypertension among Indian adults ranges from 25-35%, significantly contributing to HF (Gupta *et al*., 2019) [6].
- **Diabetes Mellitus:** India has over 77 million diabetics, many of whom are undiagnosed and are at a higher risk of HF due to diabetic cardiomyopathy (Anjana *et al*., 2017) [1].
- **Obesity and Dyslipidemia:** Rising obesity rates, particularly abdominal obesity, have been implicated in the growing burden of cardiac dysfunctions. Obesity and dyslipidemia are major modifiable risk factors contributing to the pathogenesis and progression of heart failure (HF), particularly heart failure with preserved ejection fraction (HFpEF). Obesity is associated with structural and functional changes in the cardiovascular system, including left ventricular hypertrophy, increased cardiac output, and elevated blood volume, which can lead to myocardial remodeling and impaired diastolic function (Lavie *et al*., 2013) [14]. Moreover, excess adiposity is linked to a chronic inflammatory state and insulin resistance, both of which exacerbate endothelial dysfunction and cardiac fibrosis, key components in the development of HF.

4. Urban-Rural Disparities

Urban populations in India have a higher prevalence of lifestyle-related cardiac diseases due to sedentary behavior, fast-food consumption, and stress. However, rural areas suffer worse outcomes due to poor healthcare access, lack of diagnostic tools, and traditional beliefs (Prabhakaran *et al*., 2018) [18]. This dual burden complicates national health planning and resource allocation.

5. Gender and Age Considerations

Men are more frequently affected by IHD and HF in India, but women often experience worse outcomes due to under-recognition and delayed treatment (Joshi *et al*., 2015) [10]. The onset of cardiac issues in India occurs approximately a decade earlier than in Western populations, leading to economic loss and reduced productivity.

6. Diagnostic and Treatment Challenges

India faces a significant shortage of trained cardiologists and heart care centers. Diagnostic delays due to lack of awareness, financial constraints, and inadequate primary care infrastructure result in late-stage presentation (Iyengar *et al*., 2019) [9]. Furthermore, heart transplant and advanced device therapies are largely inaccessible to the majority due to cost and logistical issues.

7. Public Health Initiatives and Recommendations

The Indian government has launched several programs such as the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS) to combat the rising burden. However, implementation remains inconsistent. There's a critical need to:

- Strengthen primary care and early screening.
- Promote public awareness campaigns.
- Improve training of healthcare workers.
- Subsidize essential cardiac medications.
- Encourage mobile-based telecardiology services in remote areas.

Table 1: Prevalence of Cardiac Abnormalities and Heart Failure in India (Based on Published Literature)

Cardiac Condition	Prevalence / Findings	Population / Study	Citation
Heart Failure (All types)	Estimated 1.3 to 4.6 million prevalent cases; annual incidence of 491,600 to 1.8 million	National estimation from various regional datasets	Goyal & Yusuf (2006) [4]; Huffman *et al*. (2010) [8]
Heart Failure (Hospitalized cases)	In-hospital mortality 10.6%, median age 59 years, 73% males, most had reduced ejection fraction (HFrEF)	Trivandrum Heart Failure Registry (n=1205)	Kurian *et al*. (2020) [13]
Coronary Artery Disease (CAD)	Prevalence: 7-13% in urban and 2-7% in rural adults	Indian urban-rural studies	Mohan; Gupta *et al*. (2012) [5]
Hypertensive Heart Disease	Contributes to 17-32% of heart failure etiologies	Various hospital-based heart failure registries	Huffman *et al*. (2010) [8]; Gupta
Rheumatic Heart Disease (RHD)	Prevalence: 0.5 to 1.0/1000 children (school-age); higher in low-income rural regions	National RHD surveys; rural-based screening	Saxena & Ramakrishnan (2015) [21]
Dilated Cardiomyopathy (DCM)	Accounts for 10-20% of HF cases	Hospital-based HF registries	Kurian *et al*. (2020) [13]; Narang *et al*. (2016) [16]
Ischemic Heart Disease (IHD) leading to HF	48-52% of HF cases are ischemic in origin	CREATE Registry; Indian Heart Failure Registry	Yusuf *et al*. (2008) [23]; Goyal & Yusuf (2006) [4]
Congenital Heart Disease (CHD)	Prevalence: 8-10/1000 live births	Indian pediatric hospital data	Saxena (2018) [21]; IAP Cardiology Chapter
Atrial Fibrillation (AF)	Estimated prevalence in adults: 0.1-0.2%, often underdiagnosed	Community and ECG-based studies	Chugh *et al*. (2014) [2]; Sinha
Left Ventricular Hypertrophy (LVH)	Observed in 16-20% of hypertensive patients	India Heart Watch and ECG studies	Gupta *et al*. (2012) [5]; Ramakrishnan *et al*. (2014) [19]
Sudden Cardiac Death (SCD)	Estimated 7-10% of all cardiovascular deaths annually in India	Registry-based estimates	Rao *et al*. (2019) [20]; Chugh *et al*. (2014) [2]

8. Conclusion

Cardiac abnormalities and heart failure are pressing public health issues in India, with high prevalence, early onset, and poor outcomes. A multi-pronged approach including prevention, early diagnosis, robust healthcare infrastructure, and equitable access to treatment is essential. Enhanced focus on research, surveillance, and policy execution will help mitigate the rising cardiovascular burden in India.

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