Journal of Cardiovascular Disease Research

ISSN: 0975-3583, 0976-2833 VOL 12, ISSUE 03, 2021

PREVALENCE OF DCM IN PUNE POPULATION AND FACTORS AFFECTING ITS PHENOTYPIC EXPRESSIONS

[1]Mosin A. Mansuri, [2]Padmapani A. Jagtap, [3]Chandrakant B. Chavan,[4] *Varsha W. Wankhade

[1]Mosin A. Mansuri, M.Sc. (Zoology), Ph.D. Scholar, Department of Zoology, Savitribai Phule Pune University.
[2]Padmapani A. Jagtap, M.Sc. (Zoology), Ph.D. Scholar. Department of Zoology, Savitribai Phule Pune University.
[3]Chandrakant B. Chavan, Associate Professor/Cardiologist Department of Cardiology, Bharti Hospital, Pune.
[4]*Varsha W. Wankhade, Associate Professor, Ph.D., Department of Zoology, Savitribai Phule Pune University.

***Corresponding Author:** Dr. Varsha W. Wankhade
Correspondence Email: varsha3w@unipune.ac.in

Abstract

Dilated Cardiomyopathy (DCM) is an irreversible and slowly progressive disease that occurs at any stage of life. DCM is characterised by left ventricle enlargement and systolic dysfunction. There is no study of DCM that has been carried out in the Pune population. Therefore, the present study was undertaken to examine the clinical and demographic profile of patients with dilated cardiomyopathy in the fast-urbanizing Pune population.

Methods:

The Institutional Human Ethics committee of Bharti Hospital, Pune approved the present study. A study was carried out for a period of five years (2016-2020). Data was collected from the Medical records Department (MRD) of Bharti hospital, Pune. Data were analysed using software past 3 and SPPS.

Results:

Among all cardiovascular diseases, DCM was the second commonest disease in the Pune population. A total of 165 phenotypically positive DCM patients were considered for the current study. A higher percent of hypertension, diabetes mellitus, and lower ejection fraction were observed above the age group of 40 years. We observed that DCM patients had a progressive decrease in EF and a progressive increase in the size of LVIDd and LVIDs with age.

Conclusion:

HTN, DM, and age-related co-morbidities are the major risk factors for DCM in the Pune population with major phenotypic expressions such as left ventricle dilation, reduced ejection fraction, and risk of heart failure.

Keywords: Dilated cardiomyopathy, hypertension, LVEF, systolic dysfunction.

Introduction

In the 21st Century, cardiovascular diseases (CVDs) have become the major cause of mortality in India[1]. According to the Global Burden of Disease (2010) study in India, the CVD death rate is higher than the global death rate. In India, the CVD mortality rate is 272 per 100000 population, which is higher than the global death rate of 235 per 100000 population[2]. Cardiomyopathy is mainly divided into four types as Hypertrophy Cardiomyopathy, Dilated Cardiomyopathy, Restrictive cardiomyopathy, Arrhythmogenic right ventricular cardiomyopathy[3]. Dilated cardiomyopathy (DCM) is an autosomal dominant disease of the heart muscle, initially affecting the left ventricle chamber and characterized by ventricular dilation, systolic dysfunction, and reduced heart contractility[4]. DCM is the third commonest disease responsible for heart failure in the general population[5]. The prevalence of DCM in the general population is 1:2500[6]. Many people with DCM have symptoms like dyspnoea, fatigability, chest pain, swelling of legs, cough, and palpitation[7]. In DCM, dilation of the left ventricle, left atrium, and reduced left ventricular ejection fraction is responsible for systolic dysfunction[8]. Risk factors for heart disease are largely divided into two categories as modifiable and non-modifiable risk factors. Modifiable risk factors include hypertension (HTN), diabetes mellitus (DM), metabolic disorder, long-term alcohol consumption, excessive tobacco consumption, and viral infection. Non-modifiable risk factors are age, gender, race-ethnicity, and family history[9]. Echocardiography is the most vital investigation in establishing the diagnosis of DCM. Using traditional echocardiography, Doppler ultrasound, and recent

ISSN: 0975-3583, 0976-2833 VOL 12, ISSUE 03, 2021

technologies like tissue-Doppler imaging, strain analysis, and real-time three-dimensional echocardiography provide important pathophysiological information[10]. The prevalence of DCM is not studied yet in highly urbanized and heterogeneous populations of Pune. The present work aims to study the prevalence of DCM in the Pune Population and its associated clinical outcomes.

Materials and Method

The current study was descriptive cross-sectional and based on the records available at Bharati hospital, Pune. The study was carried out for a period of five years (2016-2020). All cases were subjected to a detailed history, clinical examination, and routine as well as special investigation i.e., electrocardiography.

Data collection method

Clinical history of DCM and control group records were collected from the Medical records Department (MRD) of Bharti hospital, Pune. DCM Patients were categorized into four groups as below 20 years, 21-40 years, 41-60 years, and above 60 years. The data sheet included age, symptoms, history of smoking, alcohol consumption, clinical examination. and Echocardiography parameters were recorded. DCM and control groups were diagnosed with the help of 2-dimensional and Doppler echocardiography performed by expert technicians of the Cardiology Department of Bharati Hospital, Pune.

Inclusion criteria

Patients with Left ventricular ejection fraction (LVEF) < 40%, absence of a history of myocardial infarction or coronary artery disease. The control group consisted of the population having LVEF > 40%.

Exclusion criteria

Patients with diseases like infection, autoimmune disease, cancer, and acute chronic renal failure.

Statistical Analysis

Data were entered in MS Office Excel 2019 and statistical calculations were performed by Past 3.02a software. For non-parametric data, Kruskal-Wallis tests were employed for comparison of sample medians, and a post hoc test by Mann- Whitney. Graphical representation was performed in GraphPad Prism version 8.0.0 (GraphPad Software, San Diego, California USA). $p<0.05$ were considered significant for the current study.

Result

1. Distribution of Cardiovascular disease in the Pune population

A total of 2240 patients were admitted to Bharati hospital, Pune with different types of cardiac diseases from January 2016 to December 2020. In our study, we observed that DCM was the second most prevalent disease in the selected population after MI. MI, DCM, and HCM were observed most common in males. In this population, we observed that RVHD was very rare and more prevalent in females **(Fig 1).**

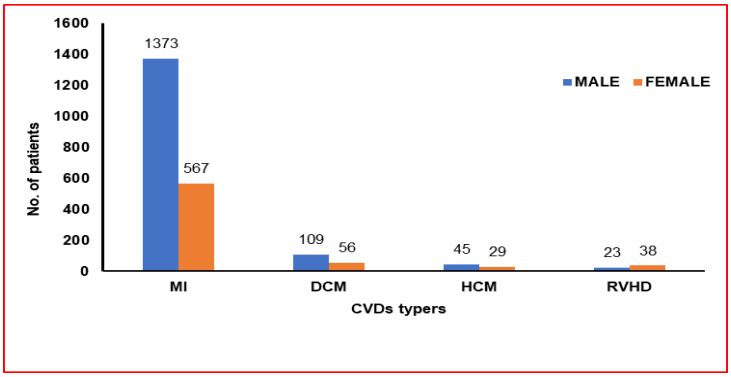

Fig. 1. Distribution of cardiovascular disease in Pune population.
MI: Myocardial Infraction, **DCM:** Dilated Cardiomyopathy, **HCM:** Hypertrophy Cardio myopathy, and **RVHD:** Rheumatic Valvular Heart Disease. All values are in Numbers.

2. Baseline characteristics of DCM patients

ISSN: 0975-3583, 0976-2833 VOL 12, ISSUE 03, 2021

The baseline clinical characteristics of all 165 patients fulfilled with inclusion and exclusion criteria of DCM are summarized in **Table I**. The patients selected for the present study were in the age group of 11 to 82 years, while the mean of their age was 50.88 ±16. Male patients constituted 66.06% and female patients 33.93% of the total study population. If we look at the age-wise distribution approximately ¾ of the patients were above the 40 plus age group in both the males and females. In our current study, almost all the patients had shown four basic symptoms such as dyspnoea, fatigability, chest pain, and palpitation. Frequencies of other etiological distribution like HTN, DM, smoking, and alcohol consumption were more in males than females **(Tables I).**

Table I. Baseline characteristics and clinical presentation of the patient

Clinical data		**Male (n=109)** 66.06%	**Female(n=56)** 33.93%	**Total Percent** (%)
Age in group (Years)	**< 20**	5 (3.03%)	3 (1.81%)	8 (4.84%)
	21-40	26 (15.75%)	11 (6.66%)	37 (22.42%)
	41-60	43 (26.06%)	28 (16.96%)	71 (43.03%)
	>60	35 (21.21%)	14 (8.48%)	49 (29.69%)
Symptoms	**Breathlessness**	90 (82.56%)	50(89.28%)	140 (84.84%)
	Fatigue	87 (79.81%)	46 (82.14%)	133 (80.60%)
	Chest Pain	78 (71.55%)	38 (67.85%)	116 (70.30%)
	Palpitation	57(52.29%)	26 (46.42%)	83 (50.30%)
Etiological distribution	**Hypertension**	48 (44.03%)	12 (21.42%)	60 (36.36%)
	Diabetes Mellitus	35 (32.11%)	14 (25%)	49 (29.69%)
	Smoking	15 (9.09%)	0	15 (9.09%)
	Alcoholic	10 (6.06%)	0	10 (6.06%)

All the values are in the number and mean ±SD.

3. Effect of HTN and Non-HTN on left ventricle ejection fraction

Enrolled patients were grouped into two categories: category 1: DCM with hypertension and category 2: DCM with non-hypertension **(Table II)**. In the current study, clinical factors like SP and DP were significantly higher in HTN than non-HTN patients however RR and echocardiography parameters like LVEF was not showed any significant difference in both males and females. The non-HTN patient group showed slightly more LVEF as compared to the HTN patients, but there was no significant difference in LVEF between these two groups.

ISSN: 0975-3583, 0976-2833 VOL 12, ISSUE 03, 2021

Table II. Effect of hypertension on left ventricle ejection fraction of heart.

Risk Factor	Male		Female	
	HTN	**Without HTN**	**HTN**	**Without HTN**
SP	146.14 ±14.41	117.29* ±10.36	144.16 ±11.64	114.88* ±18.25
DP	93.64 ±7.12	80.78* ±8.33	90.83 ±9.96	78.86* ±8.05
RR	19.16 ±3.87	19.27 ±4.14	18.25 ±3.27	18.56 ±6.77
LVEF	25.31 ±5.09	25.90 ±5.12	25.41 ±3.34	26.70 ±4.69

SP: Systolic Pressure (mmHg), **DP:** Diastolic Pressure (mmHg), **RR:** Respiration Rate**,** **LVEF:** Ejection Fraction (%), and **HTN:** Hypertension. All values are in mean ±SD**.** *p<0.0001**,** HTN vs. Non-HTN.

4. Distribution of echocardiographic parameters in DCM and Non-DCM patients.

While comparing 2-D echocardiographic parameters of DCM patients with the control group, we had reported a significant growth in the sizes of AR, LA, LVIDd, LVIDs, and a significant reduction in the function of LVEF in DCM patients, whereas there were no significant differences IVSs and LVPWd **(Fig. 2).** DCM males showed a significant increase in the size of AR, LA, LVIDd, and LVIDs as compared to female patients while the LVEF did not show any difference (p=0.3). We examined that size of LVIDd, and LVIDs were inversely proportional to the LVEF function. As the size of the left ventricle diameter increases, the left ventricle ejection fraction was decreased. Similarly, we observed that with the increased age, the size of LVIDd and LVIDs was increased, and the ejection fraction of the heart was decreased (**Fig. 3A & 3B).**

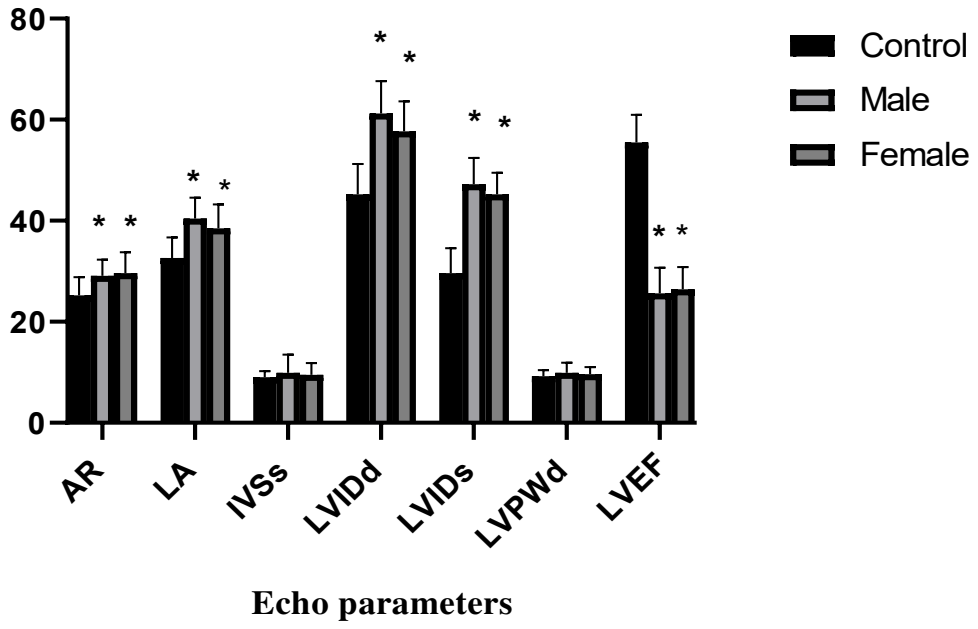

Fig. 2. Echocardiographic parameters of DCM and Control group

AR: Aortic Root (mm), **LA**: Left Atrium (mm), **IVSs:** Interventricular Septal end-systole (mm), **LVIDd:** Left Ventricular Internal Diameter in diastole (mm), **LVIDs:** Left Ventricular Internal Diameter in systole (mm), **LVPWd:** Left Ventricular end-diastolic Posterior Wall (mm), and **LVEF:**

ISSN: 0975-3583, 0976-2833 VOL 12, ISSUE 03, 2021

Left Ventricle Ejection Fraction (%), Error bar represented as a ±SD of the mean value. *p<0.0001, males and females compared to control.

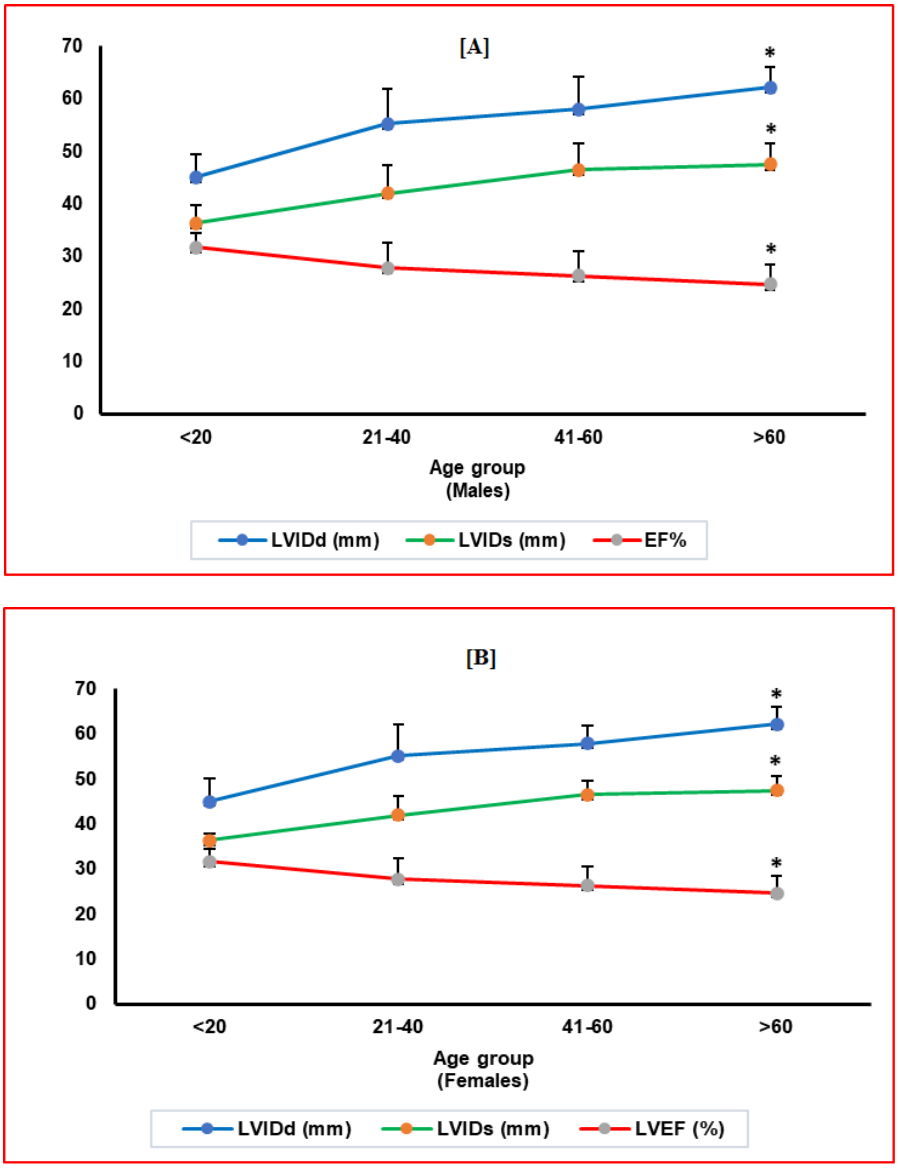

Fig. 3A. Age-wise Distribution of LVIDd, LVIDs, and LVEF in males **Fig. 3B.** Age-wise Distribution of LVIDd, LVIDs, and LVEF in females.
LVIDd: Left Ventricular Internal Diameter in diastole (mm), **LVIDs:** Left Ventricular Internal Diameter in systole (mm), and **LVEF:** Left Ventricle Ejection Fraction (%). Error bar represented as a ±SD of the mean value. *p<0.001, >60 age years group vs <20 years age group in males and females.

Discussion

This was the first study to the best of our knowledge showing the distribution of DCM in the Pune population. The purpose of the current study was to examine the clinical and echocardiographic characteristics of patients with the clinical diagnosis of dilated cardiomyopathy and to study the prevalence of DCM in the fast-urbanizing Pune population. This study elucidates that both males and females in the fast-urbanizing Pune population were equally at increased risk of various cardiac diseases. In most of the CVD types, the prevalence of the disease was more in males as compared to females except RVHD which was more prevalent in females than males[11-12]. In our study, we found that the prevalence of the DCM was more common in males than females and the ratio was 2:1. A similar trend of the distribution of DCM was reported by Fairweather et al[13] at the global level as well as in the Indian population[14]. According to Ushasree et al[14] in the study of the Indian population, DCM was more predominant in males because of their social lifestyle, smoking and alcohol; heredity; and

ISSN: 0975-3583, 0976-2833 VOL 12, ISSUE 03, 2021

male sex hormones and these factors may be responsible for increased risk of heart disease, diabetes, hypertension, and stroke in males whereas estrogen hormones play as a cardio-protective role in females. There may be a possibility that Pune population have more male DCM patient as compared to female. In this population, there was no significant difference found in the mean of age in male and female patients of DCM. A similar type of result was reported by Kumar et al[15] in the study of the Chandigarh, Punjab population. The mean age of DCM patients was 50.88 ±16 which is close to the age group of the patients (50.17 years) studied by Sonowal et al[7] in North-East India. A study conducted in Bangalore by Girdhar et al[16] reported that around three fourth of the DCM patients were above the age group of 40 years, we also observed a similar type of result in our current study. Thus, DCM is more prevalent in the age group of more than 40 years patients. The prevalence of hypertension in DCM patients was around one-third of the total, which was similar to Zeng et al[17] findings.

We report that DCM patients showed common symptoms include dyspnoea, fatigue, chest pain, and palpitations. Sonowal et al[7] also reported a similar kind of observation in the DCM patients of the North-East Indian population. Long-term HTN has increased the pressure in the left ventricle during systole due to which the left ventricle weakens and gets damaged, such type of abnormal situation in the left ventricle leads to the dilation of the heart[18]. In our present study, HTN in patients did not show any significant difference in ejection fraction of heart, but some other parameters like SP and DP were significantly higher in HTN than non-HTN patients of DCM; similar results were reported by Balije et al[19] in the population of Rajahmundry, Andhra Pradesh (India). Many clinical studies have proven that habits like smoking and alcohol consumption as being equally contributed to cardiomyopathy diseases as Nicotine and alcohol increase the levels of triglyceride in the blood and are associated with hypertension and heart failure[20]. In the present study, the male population was more frequently cigarette smokers and alcohol consumers than women **(Table I).** These findings were similar to the result of Li et al[21].

In our study mean LVEF of DCM was found 25.90 ±0.3 %, LVIDs 46.58 ±0.3 mm and LVIDd 60.3 ±0.50 mm, and this finding is close to other studies [22-23]. In DCM, males and females showed a significantly larger size of LA, AR, LVIDd, LVIDs and the reduced function of the LVEF than the control group, but other echo parameters like IVSs and LVPWd were in the normal range **(Fig. 2)**, as Harkness et al[24] mentioned the normal size of IVSs and LVPWd is 5-11mm and 6-12 mm respectively in the general population. In DCM patients, both males and females showed an increased size of a LA, LVIDd, and LVIDs indicate that enlargement of the left ventricle and left atrium. Kumar et al[25] reported that LVEF of the heart was closely associated with a left ventricle, on these bases we stated that increased size of LVIDd and LVIDs diameter were responsible for reduced LVEF. Similarly, Hess[8] reported that increase size of the left atrium, left ventricle, and reduced LVEF was responsible for systolic dysfunction in the heart. This correlation between left atrial size and left ventricular function has been found in some other studies too[26-27]. Therefore, the left atrium and left ventricle dilation were responsible for lower LVEF, and such type of physiological abnormalities were responsible for systolic dysfunction in heart of DCM patients of the Pune population. In our study we found that there was a relationship between age and outcomes of 2-D echo parameters; the older age group of patients had shown the worst outcomes as compared to the younger patients. A similar type of outcome was reported by Griffin et al[28] in DCM infants and children. Likewise, a study of the Australian population by Daubeney et al[29] was reported that progressed age was the most common risk factor for mortality in DCM. Our study also elucidates that increased age with a significantly increased size of LVIDd, LVIDs, and significantly reduced function of LVEF were found in both males and females.

The present study on DCM will show light on the status of the distribution of DCM in the fast-urbanizing city like Pune. This finding also shows the variation in phenotypic expressions in DCM and possible factors influencing it. The data generated could be used as a base for future studies. The future study will be the focus on genetic level and finding the mutation of the genes responsible for DCM.

Conclusion

Aging, age-related comorbidities, and the lifestyle of a metro city cause a deteriorating impact on the phenotypic expressions of DCM. This disease is found in all age groups of people, but its prevalence is more in the age group of above forty years. In DCM patients, increase the size of the left atrium, left ventricle, and reduced function of LVEF were responsible for systolic dysfunction of the heart. The old age group of the patient is at high risk for heart failure than the young people in the Pune population.

ISSN: 0975-3583, 0976-2833 VOL 12, ISSUE 03, 2021

Acknowledgments:
This work was supported by the Council of Scientific and Industrial Research (CSIR) Delhi for a Junior and Senior research fellowship. The authors appreciate Dr. Vikrant and the member of MRD section of Bharati hospital, Pune. The authors are also, thankful to UGC-CAS, ISRO, DRDP for partial financial support. I am heartily thankful to my lab members, Kiran and Govind for their endless help.

Limitation:
In our study, one of the main limitations is that the study is small and single-center Therefore, a large population-based multicentre study is needed to understand the true picture and prevalence of the DCM in the Pune population.

Conflict of Interest: Authors declare no conflict of interest.

References

1. Reddy S, Shah B, Varghese C, Ramadoss A. Responding to the threat of chronic diseases in India. Lancet. 2005; 366:1744–1749.
2. Institute of Health Metric sand Evaluation. GBD Compare 2010. http://vizhub.healthdata.org/gbd-compare/. Accessed April 30, 2014.
3. Sisakian H. Cardiomyopathies: Evolution of pathogenesis concepts and potential for new therapies. World J Cardiol. 2014;6(6):478–494.
4. Cohn J, Bristow M, Chien K, Colucci W, Frazier O, Leinwand L, et al. Report of the National Heart, Lung, and Blood Institute Special Emphasis Panel on Heart Failure Research. Circulation. 1997;95:766‐770.
5. Towbin JA, Lowe AM, Colan SD, Sleeper L, Orav E, Clunie S et al. Incidence, causes, and outcomes of dilated cardiomyopathy in children. JAMA 2006**;**296:1867–1876.
6. Weintraub RG, Semsarian C, Macdonald P. Dilated cardiomyopathy. Lancet. 2017;390:400- 414.
7. Sonowal N, Rao V D. Clinical profile of patients with dilated cardiomyopathy in a tertiary care center in northeast India. J of Evolution of Med and Dent. 2014;3(30):8378-8386.
8. Hess O. Hemodynamics in cardiac failure: systolic and diastolic dysfunction. Ther Umsch. 1993;50:414-418.
9. Yusuf S, Hawken S, Ounpuu S, Dans T, Avezum A, Lanas F, et al. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): Case‐control study. Lancet. 2004;364:937‐952.
10. Thomas DE, Wheeler R, Yousef ZR, Masani N. The role of echocardiography in guiding management in dilated cardiomyopathy. Eur J Echocardiogr. 2009;10:15–21.
11. Ahmad S, Chavan C, Badani R, Diwan A, Periasamy M, Wankhade V, et al. Epidemiology of frequent admitters of cardiovascular diseases in urbanizing Pune population. Australa Medical J. 2019;12:189-199.
12. Negi P, Kandoria A, Asotra S, Ganju N, Merwaha R, Sharma R, et al. Gender differences in the epidemiology of Rheumatic Fever/Rheumatic heart disease (RF/RHD) patient population of hill state of northern India; 9 years prospective hospital based, HP-RHD registry. Indian Heart J. 2020;72(6):552-556.
13. Fairweather D, Cooper L, Blauwet L A. Sex and Gender Differences in Myocarditis and Dilated Cardiomyopathy. CurrProbl Cardio. 2013;38(1):7–46.
14. Ushasree B, Shivani V, Venkateshwari A, Jain R, Narsimhan C, Nallari P. Epidemiology and genetics of dilated cardiomyopathy in the Indian context. Indian J Med Sci. 2009;63(7):288-296.
15. Kumar M, Sharma Y**,** Bahl A. Comparative Analysis of Clinical Profile of Patients Admitted with Idiopathic Dilated Cardiomyopathy in a Tertiary Care Hospital. J Cardiovasc Disease Res. 2017;8:38-41.
16. Girdhar R, Pathi J, Boregowda P. A Descriptive Study of Clinical Finding of Dilated Cardiomyopathy at Rural Heart Center, Int. J. Sci. Res. 2020;9:180-181.
17. Zeng X, Chen S, Wang J, Yang T, Chen Y. Dilated cardiomyopathy with hypertension: prevalence and response to high-dose 1-adrenoceptor antagonist therapy, Clin Exp Pharmacol Physiol. 2009;36:945–949.
18. Yancy C, Jessup M, Bozkurt B, Butler J, Donald E, Mark H, et al. 2013 ACCF/AHA Guideline for the management of heart failure: A report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines Am Coll Cardiol. 2013;62(16):147-239.

ISSN: 0975-3583, 0976-2833 VOL 12, ISSUE 03, 2021

19. Balije S, Kumar A, Bhawani G, Murthy K, Kumari N. Effect of hypertension at presentation on prognosis in patients with dilated cardiomyopathy presenting with normal renal angiogram. Indian J Med Res. 2016;144:281-287.
20. Mukamal K., The Effects of Smoking and Drinking on Cardiovascular Disease and Risk Factors. Alcohol Res Health. 2006; 29(3): 199–202.
21. Li X, Cai C, Rong L, Jiang R, Zeng J, Tang Y, et al. The usefulness of age and sex to predict all-cause mortality in patients with dilated cardiomyopathy: a single-center cohort study. Clin Interv Aging. 2015;10:1479–1486.
22. Hoque S, Rahman A, Alam Z, Irfan S. Clinical profile of patients with Idiopathic Dilated Cardiomyopathy in a Tertiary Care Hospital of Bangladesh. Bangladesh Crit Care J September 2019; 7 (2): 86-89
23. Goldberger J, Subacius H, Patel T, Cunnane R, Kadish AH. Sudden cardiac death risk stratification in patients with nonischemic dilated cardiomyopathy. J Am Coll Cardiol. 2014; 63(18):1879-89.
24. Harkness A, Ring L, Augustine D, Oxborough D, Robinson S, Sharma V. Normal reference intervals for cardiac dimensions and function for use in echocardiographic practice: a guideline from the British Society of Echocardiography. Echo Res. Pract. 2020;7(1):1-18.
25. Kumar N, Kyndaron R, Carmen T, Evanado A, Aleong R, Chugh H, et al. Left ventricular diameter and risk stratification for sudden cardiac death; J Am Heart Assoc. 2014;3(5):e001193.
26. Hamby R, Zeldis S, Hoffman I, Sarli P. Left atrial size and left ventricular function in coronary artery disease: an echocardiographic- angiographic correlative study. Cathet Cardiovasc Diagn. 1982;8:173-83.
27. The Criteria Committee of the New York Heart Association. (1994). Nomenclature and Criteria for Diagnosis of Diseases of the Heart and Great Vessels. (9th ed.). Boston: Little, Brown & Co. pp. 253–256
28. Griffin M, Hernandez A, Martin T, Goldring D, Bolman R, Spray T, et al. Dilated cardiomyopathy in infants and children. J Am Coll Cardiol. 1988;11(1):139–144.
29. Daubeney P, Nugent A, Chondros P, Carlin J, Colan S, Cheung M, et al. Clinical features and outcomes of childhood dilated cardiomyopathy: results from a national population-based study. Circulation. 2006;114(24):2671–2678.