Pattern of cardiovascular diseases in Sudurpaschim province according to echocardiography findings

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ABSTRACT

Introduction: Cardiovascular diseases (CVDs) are the leading cause of mortality globally, with rising incidence in low-and middle-income countries like Nepal. Understanding regional patterns is critical for targeted interventions. This study sheds light on the pattern of CVDs seen in patients coming to the only government hospital with cardiologists in Sudurpaschim Province.

Methods: A cross-sectional observational study was conducted at Seti Provincial hospital from 1st January to 31st December 2023. All patients undergoing echocardiography during the study period were included. Data on demographics, history, and echocardiographic findings were collected using a standardized proforma and analyzed using SPSS. Diagnoses were made based on American Society of Echocardiography (ASE) guidelines for comprehensive transthoracic echocardiography and World Heart Federation (WHF) criteria for rheumatic heart disease (RHD).

Results: A total of 3,971 patients were enrolled with 53.8% female. Most patients were over 12 years of age (97.7%). The majority were from Kailali district (50.8%) and the Terai region (70.5%). Habitual smoking was observed in 31.5% of patients. Echocardiography showed normal findings in 27.02%. Common abnormalities included valvular heart disease (12.28%), hypertensive heart disease (12.13%), pulmonary artery hypertension (14.90%), and rheumatic heart disease (6.5%). Cardiomyopathies were found in 8.89% (5.4% dilated, 3.3% ischemic). Congenital heart diseases (2.49%) were predominantly acyanotic.

Conclusion: The burden of CVDs in Sudurpaschim Province is substantial. Valvular, hypertensive, and rheumatic heart diseases are common. Targeted screening and healthcare strengthening are essential for early detection and management.

Keywords: Cardiovascular Disease, Echocardiography, Sudurpaschim Province, Rheumatic Heart Disease, Valvular Disease.

INTRODUCTION

Cardiovascular diseases (CVDs) remain predominant cause of death worldwide and significantly impact the health system in Nepal. CVD accounts for an estimated 17.9 million lives which is equivalent to 31.4% of the death. About one third of these deaths occurred in younger age group (between 30 and 69 years).[1] The burden of disease is increasing day by day. CVD is the collective term designating all type of affliction affecting the blood circulatory system including heart.[2] CVDs include ischemic heart disease (IHD), Rheumatic heart disease (RHD), Valvular Heart Disease (VHD), Cardiomyopathies of various forms and several other heart conditions.[3] Non-communicable Diseases (NCDs) kill 41 million people each year, equivalent to 74% of the death globally. Each year 17 million people die from NCD before age 70; 86% of these premature deaths occur in low- and middle-income countries. Of all the NCDs deaths, 77% are in low- and

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middle-income countries. Of all the NCDs deaths, 77% are in low- and middle-income countries like Nepal.[4] The recent study estimated the prevalence of NCDs to be 31% in Nepal.[5] CVDs are the 7th most frequent conditions accounting for 40% of NCDs according to National data from 2019. IHD and stroke are the major killers in the context of Nepal.[6,7] There have been many comprehensive studies of CVDs globally on a continental basis. In Nepal, there are limited number of studies and those too mostly from tertiary centers of the capital city of Kathmandu or eastern part of Nepal.[8-10] Almost none of studies have been found to be done in Sudurpaschim regarding pattern of cardiovascular diseases. Sudurpaschim province constitutes of three regions; Himal, Pahad and Terai. All together nine districts are present. Majority of people live in terai districts; Kailali, Kanchanpur.[11] CVDs are also increasing in Sudurpaschim Province as many people are coming to Outpatient Department (OPD) to treat hypertension, IHD, RHD, VHD and other conditions. Addressing the increased burden requires knowing the pattern of CVDs and addressing their risk factors. Nepal health system is underprepared for the increasing trend in CVDs. This this study will shed light on the pattern of CVDs seen in patients coming to the only government hospital in Sudurpaschim Province where direct consultation with cardiologists is available. The authors hope that it will be a landmark study guiding the stakeholders in making plans to strengthen health services to better tackle CVDs and its complications in the province.

METHODS

This study is the single hospital based cross sectional observational study done at Seti Provincial Hospital, Dhangadhi, Kailali, including all patients undergoing echocardiography from 1st January to 31st December 2023. Incomplete records or technically inadequate echocardiographic studies were excluded.

The sample comprised all patients undergoing echocardiography during the study period. Brief history taking aided provisional diagnosis, followed by comprehensive transthoracic echocardiography. Diagnoses followed ASE guidelines for echocardiographic assessment, including chamber quantification, valvular function, and systolic/diastolic evaluation. For RHD, WHF echocardiographic criteria were used, emphasizing morphological valve changes and Doppler-based severity grading.[12] Data on personal details, history, and findings recorded in a pre-designed proforma, entered into Microsoft Excel, and analyzed using IBM SPSS version 25. Qualitative variables were summarized as absolute frequencies and percentages was expressed as means ± standard deviation or medians and interquartile ranges (25th percentile–75th percentile) according to distribution for each variable. Results were presented in tables and charts.

RESULTS

Of the 3,971 enrolled patients, 97.7% were over 12 years of age, with 53.8% female and 46.2% male. Habitual smoking was reported in 31.5% of patients. Most patients resided in the Terai region (70.5%), followed by Pahad (19.4%) and Himal (10.1%), with 50.8% from Kailali district, reflecting its higher population density and urban access.

In our study of 3971 patients, 1073 (27.02%) were found to have no abnormalities in findings. VHD in 488 (12.28%) and CHD in 95 (2.93%) was diagnosed. 216 patients were found to be having DCM while 133 patients were suffering from ICM. Only 51 patients were diagnosed new case of IHD. Interestingly there was one case of infective endocarditis (IE) and three cases of Hypertrophic cardiomyopathy (HCM/HOCM). The study diagnosed 262 and 488 patients with RHD and VHD respectively. Overall distribution of the echocardiography findings is represented in the (Table 1).

Further classifying them on the basis of the valvular status reveals that more than half of the patients were having Mitral Regurgitation (MR) and almost 11.20% and 4.91% of the RHD and VHD were having severe MR. The valve involved and severity of lesion is shown below (Table 2).

The classification of the patients suffering from DCM and ICM on the basis of Left Ventricular Ejection Fraction (LVEF) showed that more

Table 1. Diagnosis as per ECHO findings

	Diagnosis		Number	%
1	Normal echo		1073	27.02
2	VHD: valvular heart disease		488	12.28
3	PAH: pulmonary artery hypertension		592	14.9
4	HHD = hypertensive heart disease		482	12.13
5	Cardiomyopathies		353	8.89
	A	DCM = dilated cardiomyopathy	216	5.41
	B	ICM = ischemic cardiomyopathy	133	3.32
	C	PPCM = post partum cardiomyopathy	1	0.02
	D	HCM/HOCM = hypertrophic cardiomyopathy/ hypertrophic obstructive cardiomyopathy	3	0.07
6	RHD: rheumatic heart disease		262	6.51
7	Right heart abnormality		244	6.14
8		CHD: congenital heart disease	99	2.49
	A	ASD = atrial septal defect	47	1.12
	B	VSD = ventricular septal defect	29	0.73
	C	PDA = patent ductus arteriosus	8	0.23
	D	PS = pulmonary stenosis	4	0.11
	E	Others	11	2.49
9	IHD: ischemic heart disease		51	1.28
10	Pericardial diseases		20	0.5
	A	Pericardial effusion	19	0.47
	B	CCP: chronic constrictive pericarditis	1	0.02
11	Aortic disease		2	0.05
12	IE = infective endocarditis		1	0.02
13	Other unspecified minor findings		304	7.65

Table 2. Classification of the valvular abnormalities in RHD and VHD.

Rheumatic heart disease (RHD)	**Mild**	**Moderate**	**Severe**
MR=mitral regurgitation	37(10.10%)	38(10.38%)	41(11.20%)
MS=mitral stenosis	13(16.25%)	22(27.5%)	23(28.75)
AS=aortic stenosis	3(10%)	1(3.33%)	4(13.33%)
AR=aortic regurgitation	6(3.37%)	5(2.80%)	3(1.68%)
TR= tricuspid regurgitation	27(13.36%)	1(0.49%)	6(2.97%)
Valvular Heart Disease (VHD)	**Mild**	**Moderate**	**Severe**
MR=mitral regurgitation	156(42.62%)	76(20.76%)	18(4.91%)
MS=mitral stenosis	2(2.5%)	0	0
AS=aortic stenosis	9(30%)	3(10%)	10(33.33%)
AR=aortic regurgitation	119(66.85%)	41(23.03%)	4(2.24%)
TR= tricuspid regurgitation	120(59.40%)	38(18.81%)	10(4.95%)

than half of the patients were having decreased LVEF in the moderate range (30-44) % of our classification. (Table 3)

Secondary Mitral Regurgitation (MR) is the common finding in both DCM and ICM. Our study shows that in DCM group, there were 80

patients with MR while 43 MR patients in the ICM. Out of which 31.25% of DCM and 30.23% of ICM patient had Severe MR as shown below.

Table 3. Classification of LVEF in DCM and ICM patients.

DCM	**Number**	**%**
Mild LVSD (45-54)%	19	8.8
Moderate LVSD (30-44)%	136	62.96
Severe LVSD (<30)%	61	28.24
TOTAL	216	100
ICM	Number	**%**
Mild LVSD (45-54)%	42	31.58
Moderate LVSD T (30-44)%	70	52.63
Severe LVSD (<30)%	21	15.79
TOTAL	133	100

DISCUSSION

This study highlights a substantial burden of CVDs across all districts of Sudurpaschim province. with most patients from Terai region due to higher population density and urban access like Kailali (50.8%), as it is the most developed district including city of Dhangadhi, Godawari and Tikapur. Urban centers often have greater access to healthcare services, which may partly explain the higher representation.[11] Diverse spectrum of pathologies including valvular heart disease (VHD), hypertensive heart disease (HHD), rheumatic heart disease (RHD), cardiomyopathies, congenital heart diseases (CHDs), and pulmonary artery hypertension (PAH) were diagnosed. The wide range of CVDs noted is in line with global findings that CVDs are multifactorial and manifest in various forms depending on the demographic, geographic, and socioeconomic context.[13]

High rates of VHD (12.28%) and RHD (6.5%) suggests that RHD continues to be a significant public health issue in Nepal, particularly in underserved regions. RHD is widely recognized as a disease of poverty, linked to untreated streptococcal infections and inadequate access to healthcare.[14] Compared to eastern Nepal studies (RHD prevalence 15%), our findings suggest regional disparities, possibly due to lower access in far-western areas.[10] The persistence of such preventable diseases suggests gaps in early detection, prophylaxis, and public health education efforts in this province. Mitral involvement predominated, with severe MR in 11.20% of RHD cases, correlating with delayed diagnosis and heart failure risk.[8]

The observed prevalence of hypertensive changes (12.13%) and PAH (14.90%) also warrants attention. With hypertension being a major modifiable risk factor for several types of CVDs, the findings align with national trends indicating a rise in non-communicable diseases due to changing lifestyles, dietary habits, and urban stressors.[4,5] Moreover, PAH, which can be secondary to left heart disease, chronic lung diseases, or high-altitude adaptation in Himalayan populations, appears as a significant echocardiographic finding.

Cardiomyopathies - both dilated (5.4%) and ischemic (3.3%) were noted in considerable numbers. These data, in contrast to previous echo studies in Nepal, report an increasing burden of myocardial dysfunction, possibly linked to delayed diagnosis of ischemic disease and uncontrolled hypertension.[6,8] The proportion of patients with moderate to severe left ventricular systolic dysfunction also indicates a need for timely cardiac imaging and medical intervention to prevent heart failure progression.

Congenital heart diseases (CHDs) mainly ASD/VSD were found in 2.49% of patients, consistent with global estimates that CHDs affect roughly 1% of live births.[15] The high detection rate of atrial and ventricular septal defects underscores the importance of pediatric cardiac screening, which is still limited in many peripheral regions of Nepal.

Although cases of infective endocarditis, hypertrophic cardiomyopathy, and aortic diseases were infrequent, their presence demonstrates the comprehensive nature of cardiovascular pathology in the region and highlights the diagnostic capabilities through echocardiography. Compared to previous studies from Kathmandu Valley and Eastern Nepal, this study offers a more localized epidemiological insight from the far-western region, which has been historically underrepresented in national cardiovascular data.[9,10] Such regional studies are essential to guide targeted health policy, allocate resources effectively, and implement preventive strategies

tailored to local disease burdens.

Limitation: Latent cases may have been missed as the overall sensitivity of echocardiograph in diagnosing CVDs is 80-90% and it may vary according to different diseases, some cases may have been missed, over diagnosed or under diagnosed.

CONCLUSION

All forms of cardiovascular diseases are prevalent in Sudurpaschim province. RHD was found to be endemic. Maximum number of patients had VHD, Pulmonary Artery Hypertension and hypertensive changes. Both adult and pediatric CHD was prevalent. Cardiomyopathies, mainly dilated and ischemic were also common. As CVDs are abundant in Sudurpaschim province, concerned authorities should significantly work on preventing and diagnosing CVDs to reduce its burden.

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REFERENCES

1. World Health Organization. World health statistics 2018: monitoring health for the SDGs, sustainable development goals [Internet]. Geneva: World Health Organization; 2018 [cited 2023 Dec 12]. Available from: https://iris.who.int/handle/10665/272596. ISBN: 9789241565585.
2. Thiriet M. Cardiovascular Disease: An Introduction. Vasculopathies 2019;8:1–90. DOI: 10.1007/978-3-319-89315-0_1. PMCID: PMC7123129.
3. Davidson DM. An Introduction to Cardiovascular Disease. In: Shumaker SA, Czajkowski SM (eds) Social Support and Cardiovascular Disease. Boston, MA: Springer US, pp. 3–19. DOI: 10.1007/978-1-4899-2572-5_1.
4. World Health Organization. Noncommunicable diseases [Internet]. Geneva: World Health Organization; c2023 [cited 2023 Sep 4]. Available from: https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases.
5. Bhandari GP, Angdembe MR, Dhimal M, et al. State of non-communicable diseases in Nepal. BMC Public Health 2014;14:23. DOI: 10.1186/1471-2458-14-23.
6. Bhattarai S, Aryal A, Pyakurel M, et al. cardiovascular disease trends in Nepal – An analysis of global burden of disease data 2017. Int J Cardiol Heart Vasc 2020;30:100602. DOI: 10.1016/j.ijcha.2020.100602. PMCID: PMC7399110.
7. Paudel S, Karki KB. Burgeoning burden of non-communicable diseases in Nepal: a scoping review. Glob Health. 2014;10:1–10. Available from: https://globalizationandhealth.biomedcentral.com/articles/10.1186/s12992-015-0119-7.
8. Maskey A, Sayami A, Pandey MR. Coronary artery disease: an emerging epidemic in Nepal. J Nepal Med Assoc 2003;42:122–124. DOI: 10.31729/jnma.807.
9. Vaidya A, Pokharel PK, Nagesh S, et al. Prevalence of coronary heart disease in the urban adult males of eastern Nepal: a population-based analytical cross-sectional study. Indian Heart J 2009;61:341–347. PMID: 20635736.
10. Prajapati D, Sharma D, Regmi PR, et al. Epidemiological survey of Rheumatic fever, Rheumatic heart disease and congenital heart disease among school children in Kathmandu valley of Nepal. Nepal Heart J 2014;10:1–5. DOI: 10.3126/njh.v10i1.9738.
11. National Population and Housing Census 2021. http://censusnepal.cbs.gov.np/results/population?province=5&district=57&municipality=1
12. Mitchell C, Rahko PS, Blauwet LA et al. Guidelines for Performing a Comprehensive Transthoracic Echocardiographic Examination in Adults: Recommendations from the American Society of Echocardiography. J Am Soc Echocardiogr. 2019 Jan;32(1):1-64. DOI: 10.1016/j.echo.2018.06.004. Epub 2018 Oct 1. PMID: 30282592.
13. Roth GA, Mensah GA, Johnson CO et al. Global Burden of Cardiovascular Diseases Writing Group. Global Burden of Cardiovascular Diseases and Risk Factors, 1990-2019:

Update From the GBD 2019 Study. J Am Coll Cardiol. 2020 Dec 22;76(25):2982-3021. doi: 10.1016/j.jacc.2020.11.010. Erratum in: J Am Coll Cardiol. 2021 Apr 20;77(15):1958-1959. DOI: 10.1016/j.jacc.2021.02.039. PMID: 33309175; PMCID: PMC7755038.

14. P. Karki, U.K Shrestha, et al. Rheumatic heart disease in Nepal: current status. Nepal Heart J. 2019;16(1):39-43. doi: 10.3126/njh.v16il.23896.
15. Liu Y, Chen S, Zühlke L, Black GC, Choy MK, Li N, Keavney BD. Global birth prevalence of congenital heart defects 1970-2017: updated systematic review and meta-analysis of 260 studies. Int J Epidemiol. 2019 Apr 1;48(2):455-463. DOI: 10.1093/ije/dyz009. PMID: 30783674; PMCID: PMC6469300.