



Original Article

An observational study of left ventricular hypertrophy and left axis deviation in ECG among type 2 diabetic patients with and without hypertension from a rural hospital in Karnataka.

Sindhu B R¹, Shashikantha^{2*}

1. Assistant Professor Department of General Medicine, Sri Devaraj Urs Medical Collage, Sri Devaraj Urs Academy of Higher Education and Research, Kolar.
2. Professor and HOD, Department of General Medicine, Adichunchanagiri Institute of Medical Sciences, BG Nagar, Mandya.

Abstract

Introduction: Type 2 diabetes mellitus is rampant around us. Diabetes and hypertension go hand in hand when it comes to non-communicable diseases and diabetes per se leads to hypertension and together they increase cardiovascular diseases. This increases morbidity and mortality in diabetic patients. Assessing ECG in rural health settings would help us to decrease the cardiovascular morbidity by initiating appropriate treatment.

AIM: To study the age and gender of type 2 diabetic patients with and without hypertension and to compare LVH, LAD among 2 groups.

Material and Methods: 97 diabetics attending OPD and IPD from Nov 2015- May 2017 were grouped into 2. Group I of 50 were hypertensive diabetics and group II of 47 were normotensive diabetics. Detailed history was noted and relevant investigations were done.

Result: Among the 97 diabetics, mean age in the group I was 62±10.76yrs and in group II was 62±9.44 yrs. Females outnumbered males among the hypertensive diabetics (group I) and males were more among the normotensive diabetics (group II). In group I, maximum percentage (26%) was diabetic from 6-10yrs and 20% patients were newly detected diabetics. In group II, 27.7% were newly detected, 25.5% diabetic from 6-10yrs. Pulse rate, systolic blood pressure and diastolic blood pressure were higher in group I compared to group II and it is statistically significant with P value 0.003, <0.001 and <0.001 respectively.

Conclusion: Majority was among the age group of 51-70yrs and majority were females in hypertensive diabetic groups. Maximum number of patients had LVH finding in hypertensive diabetics (22%) in ECG. Large number of studies should be conducted to understand the disease and variation in its risk factors in India.

Keywords: Hypertension, type 2 diabetes mellitus, ECG, Left Ventricular Hypertrophy.

Introduction

Adults with diabetes have a two- to three-fold increased risk of heart attacks and strokes.¹ In 2016, diabetes was the direct cause of 1.6 million deaths. In 2014, 8.5% of adults aged 18 years and older had diabetes.²

Diabetes is evidenced to increase the risk of heart failure in the absence of co morbidities such as CAD and hypertension. Thus far, cardiac adverse effects influenced by diabetes are mainly for the left ventricle, particularly systolic and diastolic dysfunction identified at rest and/or during exercise.² In a multi-national study, 50% of people with diabetes die of cardiovascular disease.³ Diabetes is the leading cause of death worldwide.⁴ As of 2019, approximately 463 million adults were living with diabetes; by 2045 this will rise to 700 millions.⁵ At present India has about 77million adults living with diabetes and it is expected to rise to 101million adults by 2045.⁶ Type 2 diabetes mellitus is an endocrine disorder due to ineffective use of insulin in the body. This is mainly due to sedentary life style and high BMI. This life style is mainly seen in urban areas whereas in rural area, the

*Corresponding Author

Dr. Shashikantha

Professor and HOD, Department of General Medicine,
Adichunchanagiri Institute of Medical Sciences,
BG Nagar, Mandya,
Karnataka, India.

Mobile No : +919448038616

E-mail : drshashikantha@gmail.com

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people usually work in farms and are heavy workers. Diabetes and hypertension go hand in hand and diabetes per se leads to hypertension which leads to increased morbidity and mortality. This study is to see the ECG evidence of LVH and Left axis deviation of QRS complex in diabetics with and without hypertension visiting a rural hospital in Karnataka.

AIM

1. To study the age and gender distribution of type 2 diabetic patients with and without hypertension.
2. To compare the LVH and LAD of QRS complex in ECG in patients with diabetes alone and with hypertension.

Methodology

97 diabetics attending Outpatient medicine department or admitted as in-patient and who fulfilled the inclusion and exclusion criteria at Adichunchunagiri hospital and research Centre, Balagangadhara-nathanagara were studied. Written informed consent was taken. The study period was from November - 2015 to May 2017. 50 diabetic patients in group I who were hypertensive and 47 diabetic patients in group II were normotensive .Detailed history noted and physical examination were done. Patient's blood samples were collected from antecubital vein following aseptic precaution. FBS sample was taken after 8 hours of fasting and PPBS 2 hours post breakfast. HbA1c was estimated using the same sample. ECG of 12 standard lead was recorded and reported using criteria for LVH and QRS axis. RFT and TSH were done to exclude renal disorders and thyroid disorders respectively.

Inclusion criteria

Group 1: Diabetics on ant diabetic drugs or fulfilling ADA criteria for diagnosing type 2 DM. (FBS \geq 126mg/dl or PPBS \geq 200mg/dl or HbA1c \geq 6.5 or RBS \geq 200mg/dl with symptoms.) Plus newly diagnosed hypertension BP reading $>$ 140/90mmHg or on antihypertensive drugs.

Group 2 : Non hypertensive diabetics fulfilling the same criteria as above.

All the patients were informed about the study, written informed consent were taken and after which they were enrolled into the above study.

Exclusion criteria: Type 1 DM, IHD, CKD, thyroid disorders, COPD and patients not willing for the study were excluded.

Study Design: Prospective observational study

Sample design: Purposive sampling

Study period: November 2015 - May 2017

Sample size: 97 cases calculated based on the no. of diabetic patients visiting hospital in a year.

Statistical Method

Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance. The following assumptions on data is made, Assumptions: 1.Dependent variables should be normally distributed, 2.Samples drawn from the population should be random, Cases of the samples should be independent Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups (Inter group analysis) on metric parameters. Analysis of variance (ANOVA) has been used to find the significance of study parameters between three or more groups of patients. Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups, Non-parametric setting for Qualitative data analysis. Fisher exact test used when cell samples are very small.

Results

1. Age distribution of patients studied

Mean age in the group I is 62 ± 10.76 yrs and in group II is 62 ± 9.44 yrs. In group I, 32% were in the age group of 51-60 years, another 32% in 61-70yrs, 16% in 40-50yrs, 14% in 71-80yrs, 4% more than 80 years and 2% less than 40yrs. In group II, 44.3% were in the age group of 61-70yrs, 24.7% in 51-60yrs, 13.4% in 40-50yrs, another 13.4% in 71-80yrs, 2.1% in $<$ 40yrs and $>$ 80yrs each. The difference was statistically insignificant.

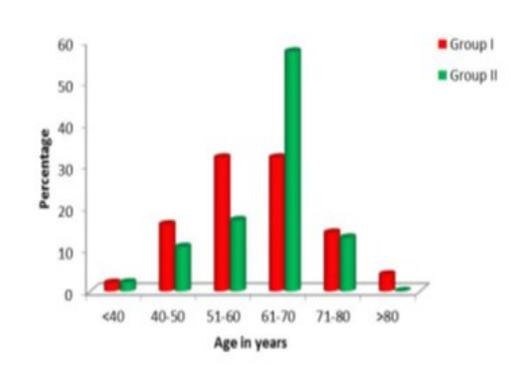


Figure 1: Age distribution of patients studied.

2. Gender distribution in two groups of patients Studied

In group I 62% was females and 32% were males wherein 61.7% were males and 38.3% were

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females in group II. The distribution was statistically significant (P=0.020).

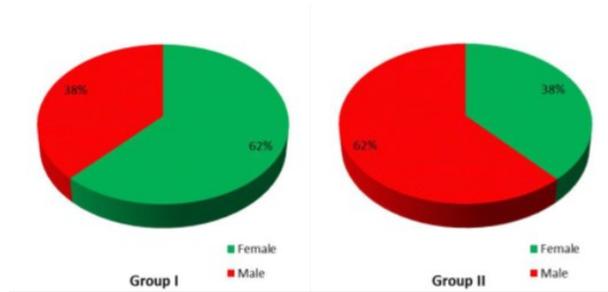


Figure 2: Gender distribution in two groups of patients studied

3. DM (years) distribution in two groups of patients studied

In group I, 20% patients were newly detected diabetics, 10% were diabetics since less than 1 year, 12% were from 1-2yrs, 16% from 3-5yrs, 26% from 6-10yrs and 16% from more than 10yrs. In group II, 27.7% were newly detected, 10.6% were diabetic since less than 1 year, 12.8% from 1-2yrs, 19.1% from 3-5yrs, 25.5% from 6-10yrs, 4.3% from more than 10yrs.

4. Distribution of hypertension duration in years of group 1:

In group I, 24% patients were newly detected hypertensive, 12% since less than 1 year, 16% from 1-

2yrs, 20% from 2.1-5yrs, 16% from 5.1-10yrs, 10% from 10-20yrs, 2% from more than 20yrs.

5. Pulse rate, systolic blood pressure and diastolic blood pressure in groups 2 :

In group I, pulse rate, SBP and DBP were 86.66 ± 10.90 , 135.24 ± 13.55 and 85.76 ± 7.91 respectively. In group II, pulse rate, SBP and DBP were 80.87 ± 6.99 , 117.91 ± 8.37 and 79.15 ± 5.70 respectively.

6. Plasma glucose levels in two groups of patients studied:

In group I, 8% had FBS less than 100, 22% had from 100-140, and 70% had more than 140. In group II, 8.5% had FBS less than 100, 19.1% had from 100-140 and 72.3% had more than 140. In group I, 2% had PPBS less than 140, 28% had from 140-200, 70% had more than 200. In group II, none had PPBS less than 140, 19.1% had from 140-200, and 75.3% had more than 200.

7. LV Axis distribution in two groups :

In group I, 96% of patients had normal axis and 4% had left axis deviation. In group II, 100% patients had normal axis.

8. LVH distribution in two groups of patients studied :

In group I, 78% had no LVH and 22% had LVH in ECG. In group II, 97.9% had no LVH and 2.1% had LVH and it was statistically significant P=0.003.

Table 1: Pulse rate, systolic blood pressure and diastolic blood pressure in groups 2.

variables	Group I	Group II	Total	P value
Pulse rate (bpm)	86.66 ± 10.90	80.87 ± 6.99	83.86 ± 9.62	0.003**
SBP (mm Hg)	135.24 ± 13.55	117.91 ± 8.37	126.85 ± 14.25	<0.001**
DBP (mm Hg)	85.76 ± 7.91	79.15 ± 5.70	82.56 ± 7.65	<0.001**

Table 2: LV Axis distribution in two groups.

Axis	Group I	Group II	Total
Normal axis	48(96%)	47(100%)	95(97.9%)
LAD	2(4%)	0(0%)	2(2.1%)
Total	50(100%)	47(100%)	97(100%)

P=0.495, Not Significant, Fisher Exact Test

Table 3: LVH distribution in two groups of patients studied.

QRS	Group I	Group II	Total
Normal	39(78%)	46(97.9%)	85(87.6%)
LVH	11(22%)	1(2.1%)	12(12.4%)
Total	50(100%)	47(100%)	97(100%)

P=0.003**, Significant, Chi-Square Test

Discussion

Diabetes and hypertension are the most common non communicable diseases. According to international diabetic federation in 2019, 463 million adults (20-79 years) were living with diabetes; by 2045 this will rise to 700 million.^{5,6} India ranks second among other countries with 77 million diabetics and expected to rise to 134 million by 2045.^{5,6} Complications of diabetes can be acute like diabetic ketoacidosis and chronic like stroke, ischemic heart disease, diabetic retinopathy, nephropathy, neuropathy etc. The burden of the disease increases as the duration of diabetes increase. The demographic figures change according to time. At present, due to increased sedentary lifestyle, unhealthy food habits, there is increase in diabetes epidemic. It affects regardless of social or economic status. Myocardial infarction, stroke, and non-ischemic cardiovascular disease are the cause of death in up to 80% of patients with T2DM. T2DM increases the cardiovascular morbidity and mortality by itself and also by its interaction with smoking, hypertension and dyslipidaemia. Although dyslipidaemia and hypertension occur with great frequency in type 2 diabetic populations, there is still excess risk in diabetic subjects after adjusting for these other risk factors.^{7,8}

Diabetes itself can confer 75% to 90% of the excess risk of coronary disease in these diabetic subjects, and it enhances the deleterious effects of the other major cardiovascular risk factors.^{9,10} In the present study, 50.5% subjects were females. The mean age of the study subjects among normotensive diabetics and hypertensive diabetics was 62.04±10.08yrs. Majority (43.4%) of patients were in the age group of 61-70 years. A majority of the hypertensive diabetics were females (68%) and males were a majority among the normotensive diabetics. In a study conducted by Chaudhary et al from 2013-2018 with 4556 diabetics at Southern Punjab, mean age of population was 47.72±10 and females were 56%¹¹. In the study conducted by Cesare Russ et al¹² in 2010 in Manhattan with a cohort of 708 patients, 63.3% subjects were females and the mean age was 70.4±9.6 years, whereas in the study conducted by Nicolino A et al¹³ at Italy in 1995 with a cohort of 84 patients, females constituted 50.5% of the subjects and the mean age was 64.65±9.3years.

The difference in the mean age and gender could possibly be due to the year and the place of the studies. In hypertensive diabetics, majority of patients (26%) were known diabetics since 6-10yrs and majority in normotensive diabetics (27%) were newly detected. In hypertensive diabetics, majority of patients were newly detected hypertensive. The hypertensive diabetics had higher pulse rate, systolic blood

pressure and diastolic blood pressure when compared to normotensive diabetics and it was statistically significant. In group I, 8% had FBS less than 100, 22% had from 100-140, and 70% had more than 140. In group II, 8.5% had FBS less than 100, 19.1% had from 100-140 and 72.3% had more than 140. In group I, 2% had PPBS less than 140, 28% had from 140-200, 70% had more than 200. In group II, none had PPBS less than 140, 19.1% had from 140-200, and 75.3% had more than 200. In group I, 78% had no LVH and 22% had LVH in ECG. In group II, 97.9% had no LVH and 2.1% had LVH and it was statistically significant $P=0.003$. In group I, 96% of patients had normal QRS axis and 4% had left axis deviation (QRS). In group II, 100% patients had normal axis.

Limitations

This was done at a tertiary care, small sample size and purposive sampling.

Conclusion

As the majority of age group were in 51-70yrs, it is very important to educate the patients to start screening at the earliest in their children. Females were more in hypertensive diabetics hence there should be strict advice regarding diet, exercise and proper plus timely method of taking the medications as they neglect about themselves while taking care of the family. This would help to educate the family as a whole. LVH and LAD are most commonly seen in diabetes with hypertension which could lead to LV systolic or diastolic dysfunction, hence leading to increased morbidity and mortality due cardiovascular risk. Earliest start of ACE or ARBS would help to slow the complication in these patients as regular follow up for monitoring is much needed in rural settings. More demographic picture would help us to device our own strategy to fight the pandemic of type 2 DM.

Keywords: Type 2 DM; HTN.

References

1. Emerging Risk Factors Collaboration. Sarwar N, Gao P, Seshasai SR, Gobin R, Kaptoge S, Di Angelantonio E. Diabetes mellitus, fasting blood glucose concentration, and risk of vascular disease: a collaborative meta-analysis of 102 prospective studies. *Lancet* 2010 ;375:2215-22.
2. Devereux RB, Roman MJ, Paranicas M, O'grady MJ, Lee ET, Welty TK, Fabsitz RR, Robbins D, Rhoades ER, Howard BV. Impact of diabetes on cardiac structure and function. *Circulation* 2000.16;101:2271-6
3. Who.int. WHO | 10 facts about diabetes [Internet]. 2020 [cited 06 May 2020]. Available from <https://www.who.int/features/factfiles/diabetes/en/>

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- European Society of Cardiology .Global statistics on diabetes [Internet]. Available from: [https://www.escardio.org/Sub-specialty-communities/European-Association-of-Preventive-Cardiology-\(EAPC\)/News/global-statistics-on-diabetes](https://www.escardio.org/Sub-specialty-communities/European-Association-of-Preventive-Cardiology-(EAPC)/News/global-statistics-on-diabetes) [Accessed 24 Jan. 2020].
- Idf.org. International Diabetes Federation - Facts & figures. [online] Available at: <https://www.idf.org/aboutdiabetes/what-is-diabetes/facts-figures.html> [Accessed 24 Jan. 2020].
- International diabetes federation. Demographic and geographic outline. [Online]. Available from: <https://diabetesatlas.org/en/sections/demographic-and-geographic-outline.html> [Accessed 24 January 2020].
- Stamler J, Vaccaro O, Neaton JD, Wentworth D, Multiple Risk Factor Intervention Trial Research Group. Diabetes, other risk factors, and 12-yr cardiovascular mortality for men screened in the Multiple Risk Factor Intervention Trial. *Diabetes care.* 1993.1;16:434-44.
- Fitzgerald AP, Jarrett RJ. Are conventional risk factors for mortality relevant in type 2 diabetes?. *Diabetic medicine.* 1991.1;8:475-80.
- Fuller J, Shipley M, Rose G, Jarrett RJ, Keen H. Coronary-heart-disease risk and impaired glucose tolerance The Whitehall Study. *The Lancet* 1980 28;315:1373-6.
- Rosengren A, Welin L, Tsipogianni A, Wilhelmsen L. Impact of cardiovascular risk factors on coronary heart disease and mortality among middle aged diabetic men: a general population study. *Bmj* 1989.4;299:1127-31.
- Chaudhary GM, Chaudhary FM, Tanveer A, Din AT, Chaudhary SM, Din AT et al. Demographic and Clinical Characteristics of 4556 Type 2 Diabetes Mellitus Patients at a Tertiary Care Hospital in Southern Punjab. *Cureus* 2019 ;11(5).
- Russo C, Jin Z, Homma S, Rundek T, Elkind MS, Sacco RL et al. Effect of diabetes and hypertension on left ventricular diastolic function in a high -risk population without evidence of heart disease. *Eur J Heart Failure* 2010 1;12:454-61.
- Nicolino A, Longobardi G, Furgi G, Rossi M, Zoccolillo N et al. Left ventricular diastolic filling in diabetes mellitus with and without hypertension. *AM J HTN* 1995.1;8:382-9.
- Lago, R., Singh, P. & Nesto, R. Diabetes and hypertension. *Nat Rev Endocrinol*3, 2007;667: <https://doi.org/10.1038/ncpendmet0638>
- Melmed S. Williams textbook of endocrinology. Elsevier Health Sciences; 2016.