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Original Research Article

The assessment of echocardiographic findings of diabetes in Sudanese

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Abstract: Diabetes is the most common metabolic disease that affect the heart and blood vessels and cause severe morbidity and mortality. Investigation of the heart in diabetic patients with echocardiography is essential imaging method to study the function and morphology of the heart and to detect early pathological changes. The aim of present study is to assess the echocardiographic findings of diabetic patients compared with healthy controls to determine whether diabetes millitus has impact on heart morphological parameters and ejection fraction. A total of 113 diabetic patients compared with 130 controls had been selected following the non-probability sampling technique. They were investigated using echocardiographyaccording to the recommendations of the American Society of Echocardiography. All the heart findings were accurately measured by two expert Cardiologists and Sonographer. The age of the study population ranged between 20-85 years old. The interventricular septal thickness andleft ventricular posterior wall diameter were significantly higher in diabetes than nondiabetic, p-value = 0.00 for both. The left atrial dimension and aortic root diameter were significantly higher in diabetic patients than nondiabetic, p-values = 0.02 and 0.014 respectively. Ejection fraction and left ventricular diemnsions in systole and diastole were statistically significantly different in diabetic and nondiabetic, p-values = 0.957 and 0.839 respectively.Diabetes millitus has significant impacts on left atrial dimension, aortic root diameter, intetventricular wall thickness and left ventricular posterior wall thickness. According to this study, diabetes has little effect on ejection fraction and left ventricular dimensions(in systole and diastole). Further studies with large sample size were needed to confirm the initial results of this study.
Keywords: intetventricular, echocardiographic, Ejection fraction

INTRODUCTION

The diabetes is one of the most common metabolic disease affecting people in all ages.In 2010, there were 12.1 million people were estimated to be living with diabetes in Africa, and this is projected to increase to 23.9 million by 2030[1].The prevelance of diabetes in Sudan shows high rate since Sudan is one of the sub-saharian country which include high prevalence of variable communicable diseases such as HIV [2], Tuberculosis [3] and Malaria [4]. Diabetes is a major common cause of several lethal systematic diseases such as cardiovascular disease [5] and renal disease [6], pneumonia [7], bacteraemia [8, 9] and tuberculosis [10], which have considerable impacts on morbidity and mortality in the region [11-16].In this study, we aim to determine whether diabetes have impact on heart especially ejection fraction, aortic root diameter, left ventricular posterior wall diameter,interventricular septal thickness and left atrial diameter. All of theses parameters had been measured and determined in every case.

The impact of diabetes on heart has been studied and investigated by many researchers. The diabetes initiates the development of atherosclerotic vascular diseases and results of recent clinical studies have shown that not only hyperglycemia but also other risk factors need to be controlled to prevent atherosclerotic vascular events in diabetic patients [17, 18]. In this article we examined diabetic patients (type-2) using echocardiography andselecting control and diabetic groups to investigate the heart and to determine whether there are significant impacts on heart structure and ejection fraction. In Walker et al, study diabetes mellitus (DM) was observed to associate with features of adverse structural and functional cardiac remodelling in patients with chronic heart failure [19].Diabetes has strong correlation with changes in myocardial functional mehanism and several studies have reported

severe dysfunction of ventricular myocardium in DM patients with potentially poor prognosis. DM diminishes myocardial contractility that related to abnormalities that caused dysfunction of calcium mechanism [20].

The echocardiography palys essential role in evaluationg the morphology and function of the heart because this provide accurate data to detect cardiomyopathy as early as possible. The echocardiography evaluates several heart parameters which are key diagnostic factors that shape the final diagnosis of the heart.

AIMS:

to evaluate the cardiac morphological parameters in diabetic patients using echocardiography.

MATERIALS AND METHODS

This prospective cross-sectionalcase-control study was undertaken in 113 patients with type 2-diabetes mellitus and 130 control (healthy), who were referred to the echocardiography to investigate the heart. The patients were selected following the non-probability sampling technique(quota design). The age range was 20-85 years old.The study was conducted in Al-rebat national hospital from the priod of 15/1/2015 to 1/4/2016.A data clinical sheet was designed to include the demographic data (region, gender, age, ect..)and clinical history. The individuals of the control group were determined to be healthy by physical examination, chest radiograph and medical history. A normal resting electrocardiogram and chest radiograph were prerequisites for participation. Body Mass Index (BMI) was calculated as weight (kgs.) ÷ [height (m)].

Inclusion criteria: Diabetic patients whose age ranged between 20-85 years old, compared with healthy control group.

Exclusion Criteria:We excluded patients with moderate-to-severe valvular disease, abnormal systolic function, heart failuire, coronary artery disease, atrial fibrillation and congenital heart diseases or other severe arrhythmias.

The echocardiographic procedure:

A standard 12 lead electrocardiogram was placed immediately before echocardiography began.Then transthoracic echocardiogram in all its modes (M, 3D and colour Doppler) were performed using a commercially available ultrasound system (Toshiba andSonyace).The patients were examined insupine position and left lateral decubitus using standard parasternal long axis, short axis and apical views. All measurements and recordings were obtained by the same observer according to the recommendations of the American Society of Echocardiography. The following measurements had been obtained in each case:

1. Inter ventricular septal thickness and left ventricular posterior wall diameter
2. Aortic root diameter
3. Left atrial diameter
4. Ejection fraction
5. left ventricular systolic diameter
6. left ventricular diastolic diameter

Data had been analyzed using statistical software program SPSS version 20.The continous data was analyzed using Independent student t-test to compare between the diabetic and controls. P-values > 0.05 were considred significant.

RESULTS

A total of 113 diabetic patients and 130 health individual (controls) had been evaluated with echocardiography. The age of the study population ranged between 20-85 years old. The gender distribution was demonstrated in figure 1. Figure 2 showed distribution of age groups among gender of the study population and most of the patients located between the age group of 50-60 years old. To compare between the diabetic patients and controls we used independent student t-test. The p-values < 0.05 were considered significant. In table 1 all the measured parameters were statatistcally significat. In table 2 the majority of the ech parameters were not statistically significant except the dimension of the left atrium which was significantly higher in diabetic patients tha controls (p-value =014).

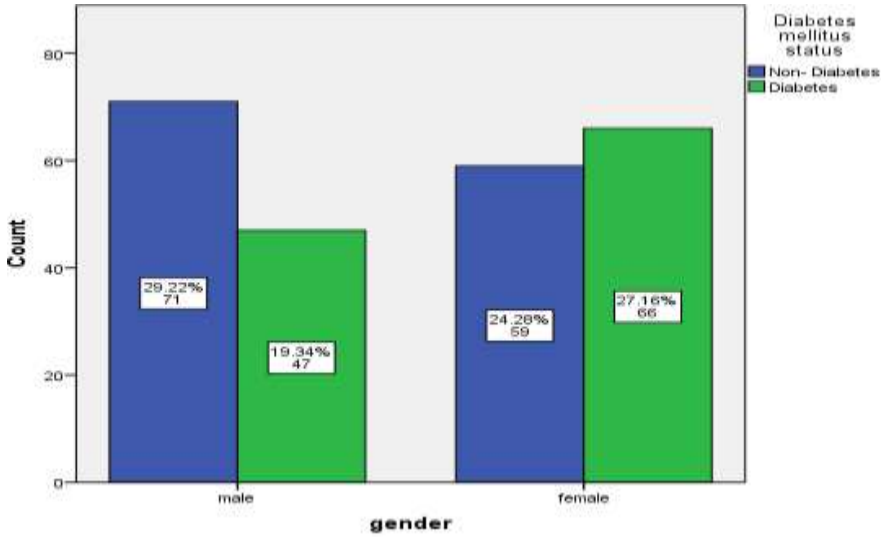

Fig 1: Gender and diabetes in the study population

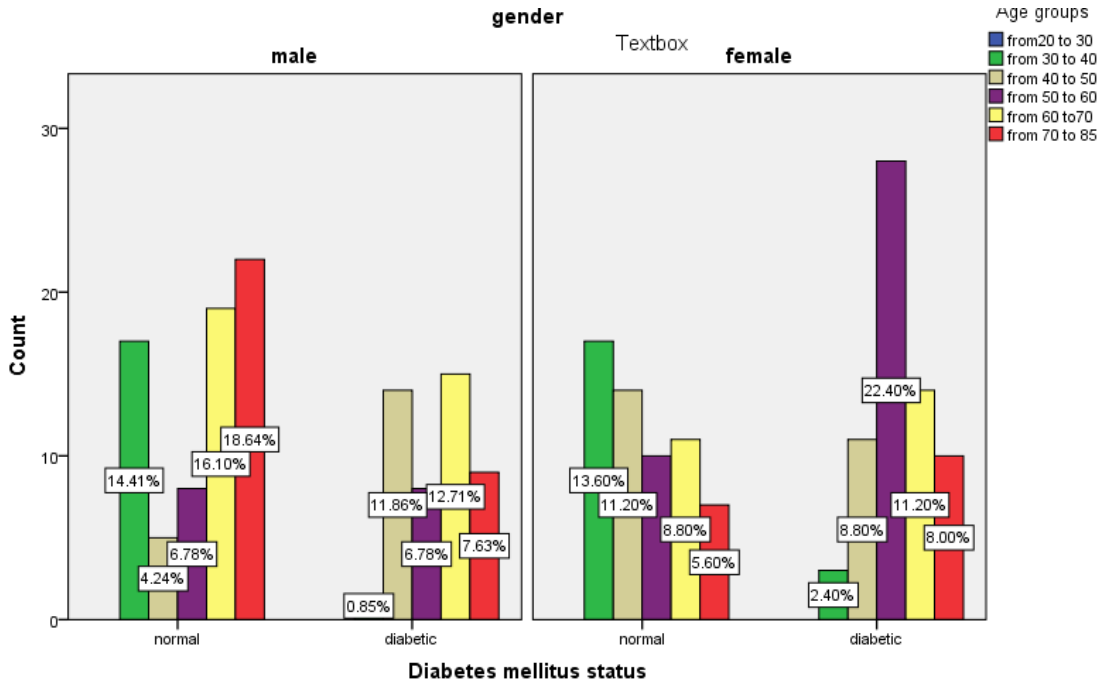

Fig 2: Distribution of age groups among gender of the study population

Table-1: The measurements of echocardiographic findings (cm) in diabetics and controls.

Parameter	characteristic	n	mean	Std. Deviation	p-value
body mass index	Non-diabetes	130	23.19	4.663368	.001
	diabetes	113	25.37	5.419364	
Interventricularseptal thickness	Non-diabetic	130	11.06	1.825	0.00
	diabetic	113	12.08	1.983	
Left ventricular posterior wall Diameter	Non-diabetic	130	10.39	1.558	0.00
	diabetic	113	9.61	1.404	
Aortic root diameter	Non-diabetic	130	28.37	3.775	0.02
	diabetic	113	29.25	4.148	

Table- 2: The measurement of ejection fraction, left atrial dimension and left ventricle dimensions in diabetic and controls.

Parameter	characteristic	n	mean	Std. Deviation	p-value
Left atrial diameter(systole)	Non-diabetes	130	33.99	5.374	.014
	diabetes	113	35.47	4.106	
Ejection fraction	Non-diabetes	130	62.20	8.881	. 957
	diabetes	113	62.14	7.981	
Left ventricular systolic dimension	Non-diabetic	130	45.61	5.57	0.839
	diabetic	113	45.47	5.51	
Left ventricular diastolic dimension	Non-diabetic	130	29.71	5.890	0.730
	diabetic	113	29.47	5.263	

DISCUSSION

Over the last 2 decades, echocardiography (EC) is the most common invasive imaging modality that provides accurate and detailed information about morphology and function of the heart. The echocardiography provides reference values which represents the normal range with which exaggerated values may indicate abnormalities. In the current study, we observed most of the measurements were lie in the normal range in diabetes and control group when compared to the global measurements. We found no study about the reference values of EC findings in Sudanese. In literature, the reference values of left ventricle (LV) diastolic dimension was 3.7-5.5 cm, LV systolic dimension was 2.0-4.0 cm [21]. In this study we found LV diastolic dimension was 29.71 cm in nondiabetics and 29.47 in diabetic patients which were both located in the normal global range and there was no significant difference (p-value = 0.730).The measurements of LV systolic and diastolic dimensions were not significantly difference in diabetic and non-diabetes (p-value = 0.839). In previous studies the LVD was significantly different in diabetic patients whose mean age 10 years old [22].Another study results was agreed with our findings. In Zhi et al study the LV diastolic dimension was 4.6 ± 0.5cmin diabetics and 4.5 ± 0.4cm in normal group which were both statistically not significant [23].

In the current study the measurements of aortic root, posterior ventricular wall thickness, and intraventricular septal (IVS) thickness and ejection fraction were obtained. The aortic root diameter in this study was 28.37 cm in diabetes and 29.25cm in non-diabetic which was statistically significantly higher in diabetic than non-diabetic (p-value = 0.02). This result was agreed with Chen et al who reported that the mean aortic root dimensions were significantly smaller in diabetic than healthy group ($p < 0.05$)[24]. In present study, the LV posterior wall thickness and IVS thickness were significantly higher in diabetic patients than nondiabetic (p-value= .00) and these findings were consistent with Thuesen study who reported that both the posterior wall thickness and the IVS thickness were increased in diabetic patients compared to controls[25].

In current study diabetic patients showed significant higher left atrium (LA) dimensions than control group, p-value =.014. This result is consistent with Atas study [26] who demonstrated that LA maximum and minimum volumes were significantly higher in diabetic patients compared with controls. Left ventricular ejection fraction is another parameter that had been measured. It was observed there was no statistical significant difference between diabetes and controls (p-value = 0.957) although in previous studies there was significant difference. In Niklas study the ejection fraction was significantly higher in diabetic patients than controls (p-value = 0.001). In our study the sample size is not large enough and included young patients (20 years old) and this may affect the result of ejection fraction to be not significant. The findings of this study confirmed that diabetes had significant impacts on the morphology and function of the heart. Large sample size is needed to confirm the initial results of this study.

Limitation of the study

The study faces several problems that may influence the results. The most important problem there is reference values for heart echocardiographic parameters in Sudanese people, so it is difficult to establish final results regarding the impact of diabetes on heart. Secondly, most patients did not recognize the history and duration of diabetes. The sample size is not large enough to generalize the results.

CONCLUSION

The diabetes mellitus type-2 has apparent impact on left atrial dimension, left posterior wall thickness, intraventricular thickness and aortic root diameter. The ejection fraction and dimensions of the left ventricle in systole and diastole were not statistically significant different in diabetic patients and controls according to this study.

REFERENCES

1. Sicree R, Shaw J, Zimmet; The Global Burden: Diabetes and Impaired Glucose Tolerance. Diabetes Atlas, IDF., International Diabetes Federation: Brussels, 2009; 4.

2. UNAIDS: Report on the global AIDS epidemic. 2010, Geneva: UNAIDS.
3. World Health Organisation: WHO Global Tuberculosis Control Report 2010. 2010, WHO: Geneva Google Scholar
4. World Health Organisation: World Malaria Report 2010. 2010, WHO: GenevaGoogle Scholar
5. Saydah SH, Eberhardt M.S, Loria C.M, Brancati F.L; Age and the burden of death attributable to diabetes in the United States. Am J Epidemiol. 2002; 156 (8): 714-9.
6. Brown WV; Microvascular complications of diabetes mellitus: renal protection accompanies cardiovascular protection. Am J Cardiol. 2008; 102 (12A): 10L-13L.
7. Kornum JB, T R, Riis A, Lervang HH, Schønheyder HC, Sørensen HT; Diabetes, glycemic control, and risk of hospitalization with pneumonia: a population-based case-control study. Diabetes Care. 2008; 31(8):1541-5.
8. Thomsen RW, H H, Lervang HH, Johnsen SP, Schønheyder HC, Sørensen HT; Risk of community-acquired pneumococcal bacteremia in patients with diabetes: a population-based case-control study. Diabetes Care. 2004; 27 (4): 1143-7.
9. Thomsen RW, H H, Lervang HH, Johnsen SP, Schønheyder HC, Sørensen HT; Diabetes mellitus as a risk and prognostic factor for community-acquired bacteremia due to enterobacteria: a 10-year, population-based study among adults. Clin Infect Dis. 2005; 40 (4): 628-31.
10. Jeon CY, Murray MB; Diabetes mellitus increases the risk of active tuberculosis: a systematic review of 13 observational studies. PLoS Med. 2008; 5 (7): e152-10.1371.
11. Rudan I, Boschi-Pinto C, Biloglav Z, Mulholland K, Campbell H; Epidemiology and etiology of childhood pneumonia. Bull World Health Organ. 2008; 86 (5): 408-16.
12. Seale AC, Mwaniki M, Newton C.R, Berkley J.A; Maternal and early onset neonatal bacterial sepsis: burden and strategies for prevention in sub-Saharan Africa. Lancet Infect Dis. 2009; 9 (7): 428-38.
13. Seale, A. C., Mwaniki, M., Newton, C. R., & Berkley, J. A. (2009). Maternal and early onset neonatal bacterial sepsis: burden and strategies for prevention in sub-Saharan Africa. The Lancet infectious diseases, 9(7), 428-438.
14. Mayanja BN, Todd J, Hughes P, Van der Paal L, Mugisha J.O, Atuhumuza E *et al.;* Septicaemia in a population-based HIV clinical cohort in rural Uganda, 1996-2007: incidence, aetiology, antimicrobial drug resistance and impact of antiretroviral therapy. Trop Med Int Health. 15 (6): 697-705.
15. Reddy EA, Shaw AV, Crump JA; Community-acquired bloodstream infections in Africa: a systematic review and meta-analysis. Lancet Infect Dis. 10 (6): 417-32.
16. Steen TW, Aruwa JE, Hone NM; The epidemiology of adult lung disease in Botswana. Int J Tuberc Lung Dis. 2001; 5 (8): 775-82.
17. Lonnroth K, Castro K.G, Chakaya J.M, Chauhan L.S, Floyd K, Glaziou P *et al.;* Tuberculosis control and elimination: cure, care, and social development. Lancet.2010; 375 (9728): 1814-29.
18. Sobel BE; Optimizing cardiovascular outcomes in diabetes mellitus. Am J Med 120(Suppl 2).2007; S3–S11.
19. Gaede P, Pedersen O; Intensive integrated therapy of type 2 diabetes: implications for long-term prognosis.2004; Diabetes 53(Suppl 3):S39–S47.
20. Walker AM, Patel PA, Rajwani A, Groves D, Denby C, Kearney L *et al.;* Diabetes mellitus is associated with adverse structural and functional cardiac remodelling in chronic heart failure with reduced ejection fraction. Diabetes & Vascular Disease Research 2016; 1-10.
21. Dr. Mamotabo R. Matshela; Second in a series on diabetes and the heart: diabetic cardiomyopathy - mechanisms and mode of diagnosis. E-journal of Cardiology.2016; 14, N° 15. Available from: http://www.escardio.org/Guidelines-&-Education/Journals-and-publications/ESC-journals-family/E-journal-of-Cardiology-Practice/Volume-14
22. Available From: http://www.echocardiographer.org/Reference%20Values.html . Accessed on: 28 June 2016.
23. Kama P, Magdy F lsmaie P, Ousama AS Bin Zheidan; Evaluation of Right and Left Ventricular Systolic and Diastolic Function in Patients with Type I Diabetes Using Echocardiography and Tissue Doppler Imaging. Suez CanalUniv Med J. 2008; 11 (1): 65 -74.
24. Zhi You Fang, Satoshi Yuda, Vinah Anderson, Leanne Short, Colin Case, Thomas H, Marwick; Echocardiographic Detection of Early Diabetic Myocardial Disease. Journal of the American College of Cardiology.2003;41(4): 1
25. Chen XF, Wang JA, Lin XF, Tang LJ, Yu WF, Chen H *et al.;* Diabetes mellitus: is it protective against aortic root dilatation? Cardiology. 2009; 112(2):138-43.
26. Thuesen L1, Christiansen JS, Mogensen CE, Henningsen P; Left ventricular wall mass and wall thickness in insulin dependent diabetic patients without clinical signs of ischaemic heart disease.Ann Clin Res. 1988; 20 Suppl 48:7-9.
27. Atas H, Kepez A, Atas DB, Kanar BG, Dervisova R, Kivrak T, Tigen MK; Effects of diabetes mellitus on left atrial volume and functions in normotensive patients without symptomatic cardiovascular disease. J Diabetes Complications. 2014; 28(6):858-62.