Original Research Article

ECHOCARDIOGRAPHIC EVALUATION OF PATIENTS WITH GOITER IN A NIGERIAN TERTIARY HOSPITAL

ABSTRACT

Background: Goiter is endemic in iodine deficient areas of the world including Nigeria. Cardiovascular disorder is a cause of morbidity in patients with thyroid diseases. These cardiovascular disorders are more likely to be found in patients with hypothyroid or hyperthyroid goiter. Large euthyroid goiter can potentially compromise respiration with potentials for secondary cardiac changes. Despite these, echocardiography is not a routine assessment of these patients. This study set out to determine the baseline cardiac function in a cohort of patients with endemic goiter using echocardiography.

Materials and Methods: A comparative study of One hundred goiter patients presenting consecutively at the out-patient clinic of a tertiary hospital and 50 age and gender matched healthy non-goitrous control subjects. They all had thyroid function tests, cardiovascular evaluation and echocardiography done.

Results: The mean ages of the goiter and the control groups were 46.92 $\pm$ 13.85 and 46.58 $\pm$ 11.62 years respectively (P=0.8510). The goiter population comprised 12 males and 88 females while the control group had 6 males and 44 females. 47% of the goiter subjects were hyperthyroid, while 44% and 9% were euthyroid and hypothyroid respectively. All the control subjects were euthyroid.

Systolic and diastolic dysfunction were seen in 18% and 24% of the goiter group respectively, compared to 2% and 5% of the control group (P<0.0001). Hyperthyroid and hypothyroid subgroups had higher rates of both systolic and diastolic dysfunction. Systolic dysfunction was seen in 6.4%, 4.5% and 100% of the hyperthyroid, euthyroid and hypothyroid subgroups respectively while diastolic dysfunction was seen in 23.4%, 9.2 and 100% of the subgroups. Prevalence of systolic and diastolic dysfunction in the euthyroid and control subjects were 4.5% vs 2% (P=0.1228) and 9.2% vs 5% (P=0.2018).

Conclusion: This study concluded that cardiac dysfunction is common in both hypothyroid and hyperthyroid goiter population while the prevalence of cardiac dysfunction in the euthyroid population is not influenced by the presence of goiter.

This may suggest that routine echocardiography is unnecessary in patient with euthyroid goiter.

Keywords: Goiter, Hyperthyroid, Euthyroid, Hypothyroid, Echocardiography, Cardiac function, Thyroid function test.

RUNNING TITLE: CARDIAC FUNCTION OF GOITER PATIENTS IN NIGERIA

INTRODUCTION

Goiter is defined as a palpable and/or visible enlargement of the thyroid gland, an endocrine organ located in the anterior neck. [1] The enlargement of the thyroid gland may present clinically as hyperthyroid, hypothyroid or euthyroid states. [1]

The thyroid gland produces thyroid hormones from the stimulatory effect of the thyroid stimulating hormone (TSH). These thyroid hormones, (Triiodothyronine (T3) and tetraiodothyronine (T4)), have both positive chronotropic and inotropic effects on the cardiovascular system thus influencing the cardiac work load, heart rate, cardiac rhythm and the ventricular systolic as well as diastolic function. [2, 3] The heart is very sensitive to the effects of thyroid hormone excess or deficiency thus the overproduction (hyperthyroidism) and underproduction (hypothyroidism) of thyroid hormones in thyroid disorder have been associated with varying abnormalities of cardiac function and structure. [2, 3]

Goiter is endemic in many parts of Africa and thyroid disorders have been shown to be the second most common endocrine disorders in endocrine clinics in Nigeria. [4,5] While Iodine deficiency is the commonest aetiology of goitre in the developing countries [5] , autoimmune disease seems to be the leading cause of goitre in developed world however recent evidence suggested an increasing prevalence of autoimmune disease as aetiology of thyroid disease among Africans. [6,7] This is important because some autoimmune diseases have cardiac manifestations in addition to the affectation of the thyroid gland, thus these subset of patients may have cardiac symptoms aside the thyroid related symptoms. [8, 9]

These cardiovascular abnormalities may vary widely from mild to severe. [2,3] Both thyrotoxicosis and hypothyroidism could present with increased cardiac mass, dilated ventricles, normal or depressed global systolic function as well as functional valvular regurgitation. [10-13]

Exertional dyspnoea, palpitation, orthopnoea, pedal swelling and other clinical features of heart failure have previously been described in patients with thyroid diseases while arrhythmias most especially atrial fibrillation were common reasons for high mortality and extended hospital admissions in patient with thyrotoxicosis. [14-17] Cardiac failure had also been shown to be a common cardiovascular manifestation of thyrotoxicosis and myxoedema. [18] Hypothyroidism many times predispose to dyslipidaemia which is a potent cardiovascular risk factor predisposing to ischemic heart disease and its attendant ischemic cardiomyopathy. [13] Thyrocardiac disease had been used to describe various cardiac complications associated with thyrotoxicosis. [17]

Though euthyroid goiter population have normal thyroid hormones, they have been noted to present with pressure symptoms that may obstruct their airway with potential for secondary cardiovascular diseases. [9, 19] Airway obstruction with consequent cardiovascular changes had been shown in cohorts of obesity and obstructive sleep apnoea. [20] Cardiac assessment of this euthyroid population is therefore necessary.

Echocardiography is a non-invasive procedure that plays a major role in the diagnosis of cardiac pathology especially those associated with structural changes. [21] Echocardiography is also essential in

the follow up of patients during and after medical, irradiation or surgical therapy. [21] The availability and affordability of this procedure is improving in Nigeria and Africa as a whole.

Thyroidectomy is the mainstay of surgically treating euthyroid goiter therefore [19] routine pre-operative cardiovascular assessment of these patients with echocardiography is reasonable to reduce intra- and post-operative mortality. [19] However, echocardiography has not been adopted as a consensus in the pre-operative assessment of patients being worked up for thyroid surgery despite the aforementioned potentials of adverse cardiovascular changes.

There is paucity of study in our locality on cardiac changes in goitre patients using echocardiography, therefore the objective of this study is to assess the structural abnormalities associated with thyroid dysfunctional states and evaluate if there are significant differences in the systolic and diastolic function of the three biochemical spectrum of goitre. This study will strengthen the need or otherwise of routine preoperative echocardiography in goiter patients.

MATERIALS AND METHODS.

This study recruited 100 consenting adult patients with goiter presenting consecutively at the Surgery and Endocrinology specialty Clinics of the Obafemi Awolowo University Teaching Hospital Complex, Ile-Ife as well as 50 age and gender matched healthy controls recruited from the Hospital community. Ethical approval was sought and obtained from the institutional ethics and research committee (ERC/2013/04/01).

All the participants underwent full medical assessment, thyroid function tests, TFT, (free triiodothyronine (fT3), tetraiodothyronine (fT4) and sensitive thyroid stimulating hormone (sTSH) as well as echocardiography. TFT was done using Enzyme immunoassay test kit of Cusabio Biotech Company Limited, USA. The normal reference range for fT3, fT4 and sTSH were 1.4-4.2pg/ml, 0.8-2.0ng/dl and 0.5-5.6IU/ml respectively.

Thyroid function test was used to classify them into 4 groups: hypothyroid (those who have goiter and low fT_3, low fT_4 and elevated sTSH), hyperthyroid (those who have goitre and elevated fT_4 and fT_3 and low sTSH), euthyroid goitre (those who have goitre and normal fT_3, fT_4 and sTSH) and the control groups (the healthy control group who had no goitre and had normal fT_3, fT_4 and sTSH).

Echocardiography was done on all subjects with standard Vivid 7 Dimension ultrasound imaging system using the 5S adult transthoracic probe with transducer frequency of 2.2 to 5.0MHz of General Electrics (GE) Medical Systems. Images were acquired in M-mode, two-dimensional (2D) and doppler (pulsed wave, continuous wave, colour flow and tissue doppler) with simultaneous ECG recordings according to the recommendations of American society of echocardiography. [22] Leading edge to leading edge measurement taken and averaging of three consecutive cycles was done. Systolic and diastolic functions of the ventricles, valvular regurgitation, wall dimensions, chamber size and pericardial effusion were assessed. The echocardiographic examinations were interpreted by two cardiologists.

A left ventricular ejection fraction (LVEF) <50% was classified as LV systolic dysfunction and a LVEF >75% was termed enhanced LV systolic function. Diastolic function was assessed by the peak early (E; meters per second) and late (A; meters per second) mitral inflow velocities and grade 1 diastolic dysfunction was defined as an E/A ratio <1.0, grade 2 as E/A ratio >1.0 with reversed tissue Doppler velocities, grade 3 as E/A >2.0 but reversible with valsalva maneuver while grade 4 was defined as E/A >2.0 but not reversible. Normal right ventricular systolic function was define as Trans annular plane systolic excursion (TAPSE) > 1.6cm while value less than this was considered impaired right ventricular function. [22]

Data were analysed using the statistical product and service solutions (SPSS) version 20.0 software (SPSS Inc, Chicago, IL). Descriptive statistics were computed for continuous variables and frequency tables were generated for categorical variables. The continuous variables were expressed as means ± standard deviation while categorical data were calculated as percentages. Differences between two continuous variables were gotten with the independent Students t-test and one-way analysis of variance (ANOVA) with Duncan post hoc test for differences among 3 or more continuous data. The differences between categorical data were derived by the Chi-square (X^2) test. The pearson coefficient test was used to test

the correlation between different variables. Level of statistical significance was defined as *a p* value ≤ 0.05 and a confidence interval of 95%.

RESULTS

A total of 100 goiter patients and 50 healthy controls completed this study. The age and gender demographics are as shown in Table 1. The distribution of the study population based on thyroid function test is also shown in Table 1.

Table 1: Demographic characteristics of the study population.

Variables	Goiter	Control	P-value
Age (years)			
Mean+SD	46.92 ± 13.85	46.92 ± 13.85	0.85
Range	18-83	18-71	0.86
Age group (years)			
<20	6	6	1.00
20-40	32	32	1.00
40-60	48	48	1.00
>60	14	14	1.00
Sex			
Male	12	12	
Female	88	88	
Distribution based on thyroid function			
Hypothyroid goiter	9		
Euthyroid goiter	44		
Hyperthyroid goiter	47		
Control	50		

Table 2 showed the Two-dimensional and M-mode echocardiographic parameters of the study population. Mild pericardial effusion was seen in 44% of the hypothyroid patients while 8.5%, 4.5% and 5% of the hyperthyroid, euthyroid and the control groups respectively also had mild pericardial effusion. The pericardial effusion rates in the hypothyroid group was significantly more than the other subgroups (P=0.01). The differences in the echocardiographic parameters of the euthyroid goiter sub-group and the control group were not statistically significant.

Both hyperthyroid and hypothyroid subgroups had significantly different echocardiographic parameters when compared to the euthyroid and control groups. The only exception to this was the right ventricular internal dimension, RVID (p=0.23). The RVIDi (RVID index for Body surface area) was however significantly higher in the hyperthyroid group.

Table 2: Two-dimensional and M-mode echocardiographic parameters of the study population.

Parameters	Hyperthyroid N=47	Euthyroid N=44	Hypothyroid N=9	Control N=50	P value
Peri. Eff n(%)	4 (8.5)	2 (4.5)	4 (44.4)[f]	5 (5)	<0.001
LAD (cm)	3.66±0.47[a]	3.36±0.60	3.93±0.50[c]	3.37±0.53	0.001
LADi (cm/M^2)	2.13±0.32[a]	1.78±0.35	1.90±0.25[c]	1.87±0.33	<0.001
AOD (cm)	2.99±0.44	2.72±0.37	3.19±0.45[f]	2.77±0.35	0.001
AODi (cm/M^2)	1.74±0.32[e]	1.44±0.21	1.54±0.23	1.44±0.22	<0.001
IVSD (cm)	1.20±0.13[e]	0.93±0.13	1.03±0.13	0.99±0.10	<0.001
LVPWD (cm)	1.18±0.11[e]	0.93±0.13	1.00±0.09	0.97±0.10	<0.001
LVPWS (cm)	1.69±0.26[e]	1.34±0.28	1.28±0.13	1.47±0.25	<0.001
RVID (cm)	1.72±0.39	1.64±0.38	1.87±0.49	1.64±0.34	0.23
RVIDi (cm/M^2)	1.00±0.26[e]	0.87±0.22	0.90±0.25	0.91±0.21	0.04
LVIDD (cm)	4.40±0.65	4.45±0.59	5.13±0.78[f]	4.39±0.56	0.01
LVIDDi (cm/M^2)	2.56±0.40	2.36±0.36	3.47±0.39[f]	2.44±0.38	0.01
LVIDS (cm)	2.66±0.64	2.80±0.50	4.09±0.74[f]	2.77±0.53	<0.001
LVIDSi (cm/M^2)	1.55±0.39	1.49±0.29	1.97±0.38[f]	1.54±0.32	<0.001
LVM (g)	174.51±33.66[a]	122.23±28.79	172.00±44.73[c]	129.06±23.57	<0.001
LVMi (g/M^2)	101.25±19.97[a]	64.89±16.29	82.98±22.41[c]	71.68±14.38	<0.001
RWT	0.27±0.05[e]	0.21±0.04	0.20±0.04	0.22±0.04	<0.001
TAPSE(cm)	2.13±6.32[a]	1.78±3.35	1.20±4.25[c]	1.87±3.33	<0.001

KEY: a=p≤0.05 for hyperthyroid vs euthyroid and control; **b**=p≤0.05 for hyperthyroid vs hypothyroid; **c**=p≤0.05 for hypothyroid vs euthyroid and control; **d**=p≤0.05 for euthyroid vs control; **e**=p≤0.05 for hyperthyroid vs euthyroid, control and hypothyroid; **f**=p≤0.05 for hypothyroid vs euthyroid, control and hyperthyroid; **Peri. Eff**=pericardial effusion**; LAD**=left atrial diameter; **LADi** = left atrial diameter index**; AOD**=Aortic root diameter**; AODi**=aortic root diameter index**; IVSD**=interventricular septal thickness in diastole**; LVPWD**=left ventricular posterior wall thickness in diastole**; LVPWS**=left ventricular posterior wall thickness in systole**; RVID**=right ventricular internal dimension **; RVIDi**=right ventricular internal dimension index**; LVIDD**=left ventricular internal dimension in diastole**;LVIDDi**=left ventricular internal dimension in diastole index**; LVIDS**=left ventricular internal dimension in systole**; LVIDSi**=left ventricular internal dimension in systole index**; LVM**=left ventricular mass**; LVMi**=left ventricular mass index**; RWT**=relative wall thickness**; TAPSE=trans annular plane systolic excursion.**

Table 3 showed a significantly higher left ventricular ejection fraction (LVEF) and fractional shortening (LVFS) in the hyperthyroid group (p<0.001).

Table 3: Left ventricular systolic function parameters of the study population.

Parameters	Hyperthyroid	Euthyroid	Hypothyroid	Control	P value
SV (ml)	91.03±43.97	89.77±35.29	143.25±56.96[f]	88.90±37.14	0.002
SI (ml/M^2)	52.77±25.40	49.28±19.32	69.02±27.82[f]	49.43±21.45	0.078
CO (L/min)	9.62±4.69[e]	7.15±2.79	8.49±3.39	6.97±3.39	0.001
CI(L/min/M^2)	5.57±2.70[e]	3.80±1.54	4.09±1.66	3.87±1.92	<0.001
LVEF (%)	72.47±9.64[e]	65.21±8.09	48.44±7.73	65.35±8.70	<0.001
LVFS (%)	41.58±8.78[e]	35.89±6.02	24.67±4.53	36.05±6.36	<0.001

KEY: a=p≤0.05 for hyperthyroid vs euthyroid and control; **b**=p≤0.05 for hyperthyroid vs hypothyroid; **c**=p≤0.05 for hypothyroid vs euthyroid and control; **d**=p≤0.05 for euthyroid vs control; **e**=p≤0.05 for hyperthyroid vs euthyroid, control and hypothyroid; **f**=p≤0.05 for hypothyroid vs euthyroid, control and hyperthyroid; **SV=**stroke volume**; SI=**stroke index**; CO=**cardiac output**; CI=**cardiac index**; LVEF=**left ventricular ejection fraction**; LVFS**=left ventricular fractional shortening.

Tables 4 and 5 showed summary of the left ventricular systolic function and the doppler echocardiographic parameters of the study participants respectively. The valvular regurgitation seen across the groups were mild functional regurgitation with no structural abnormalities noted across the valves.

Table 4: Summary of the left ventricular systolic function of the study population.

	Hyperthyroid N (%)	**Euthyroid N (%)**	**Hypothyroid N (%)**	**Control N (%)**
Enhanced	18 (38.3)	4 (9.1)	0	3 (6)
Normal	26 (55.3)	38 (86.4)	0	46 (92)
Reduced	3 (6.4)	2 (4.5)	9 (100)	1 (2)
Total	47 (100)	44 (100)	9 (100)	50 (100)

Table 5: Doppler echocardiographic findings of the study population.

Parameters	Hyperthyroid	Euthyroid	Hypothyroid	Control	P value
MV E vel (m/s)	0.78±0.20	0.76±0.15	0.70±0.20	0.71±0.15	0.09
MV A vel (m/s)	0.65±0.15[e]	0.58±0.12	0.61±0.25	0.59±0.10	0.01
MV E/A	1.23±0.33	1.36±0.32	1.33±0.70	1.34±0.35	0.15
Dec Time (ms)	219.02±36.56[a]	199.16±26.97	206.67±64.93[c]	200.10±29.06	0.01
IVRT (ms)	87.36±15.62[a]	79.73±12.94	90.11±32.03[c]	80.15±14.12	0.05
TV E vel (ms)	0.49±0.12	0.54±0.21	0.44±0.11	0.54±0.29	0.42
TV A vel (ms)	0.42±0.13	0.40±0.13	0.51±0.10	0.42±0.15	0.16
TV E/A	1.21±0.31[a]	1.37±0.32	0.87±0.32[c]	1.36±0.29	0.01
e' (cm/S)	11.89±2.12	11.07±2.04	8.33±4.24[f]	11.59±1.70	<0.001
a' (cm/S)	10.79±2.08[e]	9.68±1.78	9.78±4.66	9.72±1.91	0.03
s' (cm/S)	11.40±1.85	10.52±1.55	7.56±2.60[f]	10.12±1.66	<0.001
MV E vel /e'	6.81±2.43	7.55±4.70	13.34±12.01[f]	7.27±1.53	<0.001
e'/ a'	1.12± 0.17	1.14±0.12	0.83±0.08[f]	1.22±0.17	<0.001
MR n(%)	13(27.7)	3 (6.82)	7(77.8)[f]	3 (6)	<0.001
TR n(%)	5(10.6)	2 (4.5)	7(77.8)[f]	2 (4)	<0.001
AR n(%)	7(14.9)	0 (0)	2 (22.2)[f]	0(0)	0.01
PR n(%)	10(21.3)	1 (2.3)	4 (44.4)[f]	1(2)	0.004

KEY: a=p≤0.05 for hyperthyroid vs euthyroid and control; **b**=p≤0.05 for hyperthyroid vs hypothyroid; **c**=p≤0.05 for hypothyroid vs euthyroid and control; **d**=p≤0.05 for euthyroid vs control; **e**=p≤0.05 for hyperthyroid vs euthyroid, control and hypothyroid; **f**=p≤0.05 for hypothyroid vs euthyroid, control and hyperthyroid; **MV E vel**= early transmitral inflow velocity; **MV A vel**= late transmitral inflow velocity; **MV E/A**= ratio of early to late transmitral inflow velocity; **Dec Time**= early transmitral flow velocity deceleration time; IVRT= Isovolumic relaxation time.**TV Evel**= early transtricuspid inflow velocity; **TV Avel**= late transtricuspid inflow velocity; **TV E/A**=ratio of early to late transtricuspid inflow velocity: **e'** = tissue Doppler early mitral annular relaxation velocity; **a'** = tissue Doppler late mitral annular relaxation velocity; **s'** = tissue Doppler mitral annular systolic velocity; **MV E vel/e'** = ratio of early transmitral inflow velocity to early annular relaxation velocity; **MR=**Mitral regurgitation**; TR=** Tricuspid regurgitation**; AR=** Aortic regurgitation**; PR=** Pulmonary regurgitation**.**

Table 6 showed the summary of the left ventricular diastolic function of the study population.

Table 6: Summary of the Doppler echocardiography assessment of the left ventricular diastolic function of the study population.

	Hyperthyroid	Euthyroid	Hypothyroid	Control
Normal	36 (76.6)	40 (90.8)	0	45 (90)
Grade 1 diastolic dysfunction	10 (21.3)	2 (4.6)	4 (44.4)	5 (10)
Grade 2 diastolic dysfunction	1 (2.1)	2 (4.6)	4 (44.4)	0
Grade 3 diastolic dysfunction	0	0	1 (11.1)	0
Total	47 (100)	44 (100)	9 (100)	50 (100)

DISCUSSION

This study showed that the commonest age of affectation for goiter is the middle age and that goiter is still more prevalent in females as have been documented in previous studies. [4,7,8]

The hypothyroid group had a significantly higher prevalence of pericardial effusion. This prevalence is congruous with previous works that reported pericardial effusion rate of 30 to 80% in the studied hypothyroid population. [23] However, the patients studied in these studies had classic features of myxedema, thus severe diseases. In a recent study, Kabadi et al [23] studied and evaluated 30 subjects with hypothyroidism and found only two subjects with pericardial effusion. The hypothyroid subjects in our study had longer duration of symptoms than the Kabadi cohort which will explain the higher prevalence of pericardial effusion in our subjects. Anah et al reported a large pericardial effusion in a 16 year old patient with Down syndrome who had congenital hypothyroidism. This further suggests that pericardial effusion may be a clinical feature of severe or long standing hypothyroidism. [24]

In this study, LVM and LVMi were significantly higher in both the hypothyroid and the hyperthyroid subjects when compared with the control and euthyroid group. This was comparable to the work of Rodondi et al [25] who found mild left ventricular hypertrophy as a cardiovascular feature of subclinical hypothyroidism in a 5-year cardiovascular health study of subjects with hypothyroidism. A direct relationship was also reported between increasing TSH level and left ventricular mass among hypothyroid patient. [25] Conversely, Hadzovic-Dzuvo et al did not find significant left ventricular hypertrophy (LVH) in their thyrotoxic and hypothyroid subjects probably because the subjects had a short duration of clinical symptoms before treatment was commenced. [26] LVH had been linked to multiple factors including increased workload (both pressure and volume) over long duration. In previous works done locally which used chest X-ray as a marker of LVH, Adetuyibi et al [27] found cardiomegaly in 24% of thyrotoxic patients while Famuyiwa et al [18] reported cardiomegaly in 22%. Echocardiography had been shown to be superior to electrocardiograghy and Chest xray in the diagnosis of cardiac diseases. [21]

This study showed a significant difference in the average LVEF and LVFS in the hypothyroid and hyperthyroid groups when compared to the euthyroid and the control groups. The mean ejection fraction of the hyperthyroid group in this study showed enhanced systolic function. This finding was similar to the work of Anakwe et al that found enhanced systolic function in 30% of his hyperthyroid series. [10] Less than 10% of the hyperthyroid group in this study had depressed left ventricular systolic function. Anakwe et al and Danbauchi et al also reported depressed systolic dysfunction in 14% and 10% of their hyperthyroid series respectively. [14, 15] The proportion of the hypothyroid subjects who had depressed systolic function (LVEF < 50%) was however much higher than previous Caucasian study. Kabadi et al [23] found impaired systolic function in 60% of his subjects while all our hypothyroid subjects have systolic impairment. The higher percentage of the subjects with depressed systolic function in our hypothyroid group may not be unrelated to the longer duration of symptoms which may antedate the goiter. Many patients in this environment present late and they may be in overt heart failure at the time of presentation due to the insidious mode of clinical feature of hypothyroidism.

The hyperthyroid subjects in this study showed a significantly higher MV A velocity and a reversal of E/A ratio implying diastolic dysfunction which was similar to the findings in Biondi et al who reported high mean doppler parameters in their hyperthyroid subjects suggesting an increased dynamic state. The markedly increased tissue doppler systolic velocity in this study was also in agreement with the work of Dahl et al. [11] Anakwe et al [10] reported enhanced diastolic dysfunction in 34% of his hyperthyroid subjects. About a quarter of the hyperthyroid subjects in this study had impaired diastolic function. Only a few of the euthyroid and the control subjects had diastolic dysfunction and this maybe age related as it was not significant statistically. Advancing age is a known cause of diastolic dysfunction. [22]

The hypothyroid subjects in our study had lower Doppler velocities with consequent lower MV E/A. Hadzovic-Dzuvo et al [26] also reported lower Doppler parameters in the hypothyroid group of their study which reversed with therapy underscoring the importance of early diagnosis and treatment in preventing cardiac complications. Erkan et al [28] also reported a significantly reduced tissue Doppler velocities in the septal wall (e' and s') among the hypothyroid subjects studied, which is in keeping with the findings among the hypothyroid subjects in this study. Deceleration (DT) and isovolumic relaxation times (IVRT) have been shown to be prolonged in previous works among hypothyroid and hyperthyroid subjects by Mintz et al [29] and Hadzovic-Dzuvo et al [26]. This study also showed significant prolongation in DT and IVRT in the hypothyroid and hyperthyroid cohort while the DT and IVRT of the euthyroid population was not different from that of the control group.

Valvular regurgitations had been shown to a varying degree in previous studies on thyroid dysfunctional states. [14, 25, 28, 29] This study showed that a high percentage of the hypothyroid subjects had valvular regurgitation. In the same vein, all the hypothyroid subjects had diastolic dysfunction, which contrasted sharply with what obtained in other studies done in developed world where far lesser percentages of subjects had diastolic dysfunction. [23, 25, 28] This may be due to the fact that the hypothyroid patients in this study had systolic dysfunction which has been associated with increased incidence of diastolic dysfunction as well as valvular regurgitation. [21] Tielens et al reported diastolic dysfunction in majority of the subjects studied. [13]

Finally, the difference in the cardiac function parameters between the euthyroid population and the control group was not significant even though airway obstruction from large retrosternal goiter have previously been documented to cause cardiac dysfunction. [20] This may suggest that the cardiac dysfunction seen in goiter patients may be due to the thyroid hormones and not necessarily the presence of goiter. Also, specific study designed to assess the cardiovascular function of subjects with giant and retrosternal goiter will be desirable.

CONCLUSION

This study concluded that cardiac dysfunction is common in both hypothyroid and hyperthyroid goiter population while the prevalence of cardiac dysfunction in the euthyroid population is not different from the healthy control group.

Therefore the cardiac dysfunction seen in the euthyroid group is not influenced by the presence of goiter.

This may suggest that routine echocardiography is unnecessary in patients with euthyroid goiter.

AREA OF FUTURE RESEARCH

The echocardiographic features of subjects with giant and retrosternal goiter will be desirable.

ETHICAL APPROVAL

Ethical approval was sought and obtained from the ethics and research committee of Obafemi Awolowo University Teaching Hospital Complex, Ile-Ife, Nigeria (ERC/2013/04/01).

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