Patterns of blood pressure and pulse pressure in patients with thyroid disorder in a Tertiary Health Center in South West Nigeria

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Abstract

Background: Thyroid disorders rank second among the diversity of endocrine diseases. Thyroid impairments have been implicated as a potential risk factor for blood pressure and pulse pressure disorders, with potential risk factors for future cardiovascular events. This study aims to determine the pattern of blood pressure and pulse pressure in patients with thyroid disorders.
Methodology: This is a retrospective descriptive study conducted in an endocrinology outpatient clinic. One hundred subjects who satisfied the inclusion criteria were recruited consecutively. Data analysis was done using Microsoft Excel and the statistical package for social sciences (SPSS version23). A p-value <0.05 was considered statistically significant for all analyses.
Result: The average age of the subjects was 45.8 ± 15.1. The female to male ratio in the study was 9:1.Hypertensive patients were 37%, whereas 65% presented with hyperthyroidism, 21% hypothyroidism, 9% euthyroidism, 3% subclinical hyperthyroidism, and 2% subclinical hypothyroidism. The largest majority 62(62.0%) of the subjects had high pulse pressure (> 50mmhg)), among those who had high pulse pressure, 1(1.6%) had subclinical hypothyroidism, 2(3.2%) had subclinical hyperthyroidism. 2(3.2%) presented with euthyroidism, 14(22.6%) had hypothyroidism, and, 43(69.4) had hyperthyroidism. Overall percentage percentage of autoimmune disorders in patients with thyroid dysfunction was 30%. There was a significant association between thyroid disorders and autoimmune disorders.
Conclusion: The study revealed that thyroid disorders are highly prevalent among Yoruba, South-Western Nigeria with preponderance of female occurrence. Hypertension and increased pulse pressure were associated with hyperthyroidism and autoimmune diseases while low, normal BP and pulse pressure were associated with subjects with hypothyroidism, though not statistically significant.

Schémas de tension artérielle et de pression différentielle chez les patients atteints de troubles thyroïdiens dans un centre de santé tertiaire du sud-ouest du Nigéria

Résumé
Contexte de l'étude : Les troubles thyroïdiens occupent la deuxième place parmi la diversité des maladies endocriniennes. Les troubles thyroïdiens ont été impliqués comme un facteur de risque potentiel de troubles de la pression artérielle et de la pression différentielle, avec des facteurs de risque potentiels d'événements cardiovasculaires futurs. Cette étude vise à déterminer le profil de la pression artérielle et de la pression différentielle chez les patients atteints de troubles thyroïdiens.
Méthode de l'étude : Il s'agit d'une étude rétrospective descriptive réalisée dans une consultation externe d'endocrinologie. Cent sujets répondant aux critères d'inclusion ont été recrutés consécutivement. L'analyse des données a été réalisée à l'aide de Microsoft Excel et du logiciel statistique pour les sciences sociales (SPSS version 23). Une valeur de p < 0,05 a été considérée comme statistiquement significative pour toutes les analyses.
Résultat de l'étude : L'âge moyen des sujets était de 45,8 ± 15,1. Le ratio femme/homme dans l'étude était de 9 :1. Les patients hypertendus étaient au nombre de 37 %, tandis que 65 % présentaient une hyperthyroïdie, 21 % une hypothyroïdie, 9% une euthyroïdie, 3 % une affection subclinique Français hyperthyroïdie et 2 % hypothyroïdie subclinique. La plus grande majorité 62 (62,0 %) des sujets avaient une pression différentielle élevée (> 50 mmhg)), parmi ceux qui avaient une pression différentielle élevée, 1 (1,6 %) souffrait d'hypothyroïdie subclinique, 2 (3,2 %) souffraient d'hyperthyroïdie subclinique. 2 (3,2 %) présentaient une euthyroïdie, 14 (22,6 %) souffraient d'hypothyroïdie et 43 (69,4) souffraient d'hyperthyroïdie. Le pourcentage global de troubles auto-immuns chez les patients atteints de dysfonctionnement thyroïdien était de 30 %. Il y avait une association significative entre les troubles thyroïdiens et les troubles auto-immuns.
Conclusion : L'étude a révélé que les troubles thyroïdiens sont très répandus chez les Yorubas du sud-ouest du Nigéria, avec une prépondérance de cas chez les femmes. L'hypertension et l'augmentation de la pression différentielle étaient associées à l'hyperthyroïdie et aux maladies auto-immunes, tandis qu'une pression artérielle basse et normale et une pression différentielle étaient associées à des sujets souffrant d'hypothyroïdie, bien que cela ne soit pas statistiquement significatif.

INTRODUCTION

Thyroid disorders represent a substantial proportion of endocrine disease entities that are seen regularly in the medical outpatient's clinics worldwide. Thyroid impairment is recognized as a risk factor for developing hypertension and pulse pressure changes accelerate cardiovascular complications. [1,2,3] Thyroid impairments are multifaceted in origin. The impact of this group of disorders on cardiovascular function is numerous and occur through different mechanism and pathways depending on the type of the disorder.

Hypothyroidism involves several categories of clinical conditions including subclinical hypothyroidism, overt hypothyroidism and myxedema.[4] Hypothyroidism is known to cause dysregulation in cardiac function, increase in systemic vascular resistance and further increase in the prevalence of hypertension but its treatment may normalize blood pressure in some patients.[5] Studies have shown that sub-clinical abnormalities in serum TSH levels have a detrimental effect on cardiovascular function and there is a relationship between sub-clinical hypothyroidism and hypertension[6]

Hyperthyroidism on the other hand, increases metabolic rate, increases cardiac output, widens the pulse pressure and decreases systemic vascular resistance. [7] A previous study noted that hyperthyroidism through the adrenergic effect of triiodothyronine (ft3) causes elevated pulse pressure. [8]

Interestingly, a study suggested further research to know the benefit of treating sub-clinical thyroid disorders on the cardiovascular outcome in the elderly and peri-menopausal women.[9] Hypothyroidism is known to cause diastolic hypertension in approximately 30% of patients with reduced cardiac contractility and resultant low pulse pressure.[10]

Findings from a study revealed that thyroid disorders are associated with hypertension in about 1% of people.[11] Studies on the effect of sub-clinical hyperthyroidism are fewer than those of sub-clinical hypothyroidism. Sub-clinical hypothyroidism has been associated with blood pressure changes, but with conflicting data.[12, 13] Generally, studies on the association between pulse pressure and thyroid disorder are scarce however, a study in south west Nigeria has shown a significant higher pulse pressure in subjects with hyperthyroidism than control and the euthyroid group. This study therefore seeks to examine patterns of blood pressure and pulse pressure in patients with thyroid disorder.

MATERIALS AND METHODS

A retrospective descriptive study in a tertiary health centre. A total number of 100 adult patients attending the endocrinology out- patient clinic within 1-year period (November 2022 to February 2023) were recruited consecutively by convenience sampling. Study subjects were adult patients diagnosed with thyroid disorders and were on appropriate medications following laboratory evidence of thyroid function test. Autoimmune disorder was defined as presence of thyroid peroxidase autoimmune antibodies, thyroid stimulating hormone receptor antibodies and or thyroglobulinantibodies in serum of a patient known to have thyroid disorder. Critically ill patients, previously known hypertensive patients on medications before diagnosis of thyroid disorders and patients with other co-morbidities were excluded from this study before the onset given by the tertiary health centre. The study ensured adherence to all ethical principles. Confidentiality of the subjects was maintained. There was no informed consent because its a retrospective study with confidentiality maintain and approval was gotten from the ethical body (REF NO: LREC/06/10/1983 Data were socio-demographic data, biochemical indices, imaging studies and clinical information.

Data Analysis

We used the statistical package of social sciences (SPSS)version 23 for data analysis. Collected data were analysed and presentation done by frequency distribution. Relevant means, percentages and suitable figures were generated. A 95% confidence was used for the determination of significance of probabilities, and significant p-value < 0.05.

RESULTS

The mean age of the subjects was 45.8 ± 15.1years, majority the subjects were female 90(90.0%) Two(2.0%) of the subject presented with subclinical hypothyroidism, 3(3.0%) with sub-clinical hyperthyroidism, Nine(9.0%) presented with euthyrodism, twentyone(21.0%) with hypothyroidism and 65(65.0%) with hyperthyroidism respectively.(table 1). Among the subjects with euthyrodism 1(11.1%) was in stage one hypertension whereas 8 (88.9%) were non hypertensive. Among those who had Hyperthyroidism 15(23.1%) were in stage 1 hypertension, 10(15.4%) were in stage 2 hypertension while 40(61.5%) were non hypertensive. All the subjects who had subclinical hyperthyroidism were in stage 1 hypertension.. Majority 43(66.2%) of the

subjects who had hyperthyroidism also presented with high pulse pressure, 66.7% of those with hypothyroidism also had high pulse pressure. Half of the subjects with subclinical hypothyroidism had normal pulse pressure(Table 3) Among those who reported family history of hypertension, 68% had hypperthyroidism, 19% had hypothyroidism, 5% had subclinical hypothyroidism, 5% had subclinical hyperthyroidism and 3% had euthyrodism. (Fig 2). There was no significant association between thyroid abnormality and hypertension, there was also no significant association between thyroid abnormality and pulse pressure but there was a significant association between thyroid abnormality and autoimmune disease(P= 0.021)table 4.

DISCUSSION

Epidemiologically, popular local studies in Africa and Nigeria ranked thyroid disorders as the second most common endocrine disease, after diabetes mellitus .Thyroid abnormalities correlate with the disease burden, which is typically associated with cardiovascular disease.[2,14] Although the mechanism of occurrence seems unclear ~~yet~~ this study seeks to examine the patterns of blood pressure and pulse pressure in patients with thyroid disorder. Findings from the present study yielded a mean age of 45.8 ± 15.1years which exceeds the mean age submitted in a similar study in southwest Nigeria but is below the values obtained in another study in Ile-Ife, Southwest and Southeast Nigeria respectively. Corroborative works in East Africa, Mogadishu and Somalia supported gave credence to our works.[14,15, 16] The observed epidemiology variabilities are probably associated with racial, hereditary, dietary, cultural and environmental differences. Studies have shown that hilly regional parts of Africa like Western Cameroon and Eastern Nigeria are associated with predominant high risk of developing iodine deficiency thyroid disorder. [17]

In our study, there were more females than males with a ratio of 9:1 which correlates with the studies done in southwest and Southeast Nigeria but does not correlate with the findings in East Africa and North England. [1, 15, 16, 18] Findings from the present study also reveals that the highest majority 78(78.0%) of the subjects who presented with thyroid disorder were the Yorubas. Researchers have reported a correlation between hyperthyroidism and hypothyroidism and cardiovascular events sch as hypertension, which is considered a unique risk factor for cardiovascular disease. In our study, hypertension was noted to have developed in 37% of the subjects after diagnosis of the thyroid disorder, this finding is however not in line with the work documented in southeast Nigeria, Mogadishu, Somalia and in Indian but correlates with the results obtained by Ogbera AO, Kuku S, and Dada O. [1, 16, 19 ,21] In our study, 37% (37) of the participants had hypertension. Among these subjects, 68% had hyperthyroidism, 19% had hypothyroidism, 5% had subclinical hyperthyroidism, 5% had subclinical hypothyroidism, and 3% had euthyroidism. Hyperthyroidism complications are cardiac alongside stroke, cardiovascular hyper coagulopathy, pulmonary embolism and arrhythmias. The pathophysiological roles of T3 hyper-functioning goiter triggers chains of hyper-dynamic cardiac activities, volume overload, increased cardiac systole, increased cardiac energy demands, elevated vascular resistance and increased cardiac output culminating in elevated blood pressure or hypertension. [20].In our study, the rate of occurrence of hypertension in hyperthyroidism 25(38.5%) was higher than those recorded in subjects with hypothyroidism 7(33.3%). This differs from the findings of Ogbera AO, Kuku S, and Dada O, who noted a higher proportion of hypertension in hypothyroidism. [21]This may be because hyperthyroidism has more deleterious effect on the cardiovascular system such as increased cardiac systole, increase vascular resistance and volume overload than hypothyroidism. In the present research, 65% of the participants were found to have hyperthroidism. This percentage is lower than thee findings reported by Ojo OA, Ikem RT, Kolawole BA et al but higher than the results presented by Mohamuud MA, Ibrahhim IG, Ahmed SA et al [16,22]

Sub-clinical hyperthyroidism exerts a cardiac dysautonomia, causing altered cardiac morphology with consequent impairment of systolic and diastolic functions and these abnormalities manifest in the setting of chronic and low TSH, normal T3and T4 with deleterious effects on the heart. [23,24] In the current study, 3% of the subjects had subclinical hyperthyroidism; this exceeds the value obtained in the study conducted in north England. [18,35] This may be because the prevalence of subclinical hyperthyroidism is epidemiologicaly higher in the black and Asian than Europeans. Further in our study we also found out that 2(66.7%) of the subjects who had subclinical hyperthyroidism had hypertension while 1(33.3%) of the subjects who came up

subclinical hyperthyroidism was not hypertensive . These findings are inconsistent with the results from North Nigeria, which reported rates of 1.2% for hypertension and 1.6% for normotension [1,25]. Hypothyroidism complicates the heart in different ways for example it can lead to pericardial effusion, tamponade and biventricular heart failure from poor systolic pressure and pulse pressure. This condition is usually associated with significant clinically low levels of T3 and T4.[26] Our study found a prevalence of 21% of hypothyroidism among thyroid dysfunction patients, which is above the result obtained in a similar study in south west Nigeria but below the result~~ed~~ presented in Mogadishu [15,16] The present study also found out that 2% presented with subclinical hypothyroidism, this is clearly less than the result published by Mohamud MA et and Jabbar A et al in previous studies [16,18]. The result obtained in the current research showed that 33.3% of the subjects who came up with hypothyroidism were hypertensive, while none of the subjects who had sub-clinical hypothyroidism had hypertension. Our study submitted that 9% of the subjects had euthyroidism, out of which 1(11%) was hypertensive.

Our study showed that the largest majority 62(62.0%) of the subjects had high pulse pressure (> 50 mm/hg) This finding is not in line with the result obtained in Indian by Berad A, Chaudhari S, and Chafekar N, who reported 73% of the subjects with hyperthyroidism presented with pulse pressure > 40mmHg [27]. In the present study thirty-six (36.0%) of the subjects had normal pulse pressure (30– 50) mmHg whereas 2% had low(<30mmHg) pulse pressure. There was no statistically significant association between thyroid disorder and pulse pressure. Our study reported a proportion of 67% of subjects with goiter. This is lower than the findings of Ojo and co-researcher in south west Nigeria, but higher than the results documented by Onyinruika AN and Jaja T in corresponding works in other parts of Africa-Southern Nigeria [22,28,29]. This may be due the differences in the sampe size and age variabity between both studies

Hashimoto's thyroiditis and Graves' disease have also been implicated in the abnormalities of pulse pressure and blood pressure when there are absolute derangements of antibodies against the thyroglobulin, thyroid peroxidase, or thyrotropin receptor auto-antigens.This can be explained by endothelial cell TSH receptor which induces down regulation of anti inflammatory factors, angiogenesis and leukocyte adhesion. [30] The current study submitted an overall percentage prevalence of 30% autoimmune disorder in thyroid dysfunction, with; this exceeds the overall prevalence obtained in Tunisia, Ethiopia, and Libya is but lower than the findings from the result obtained in Athens Greece, [31,32,33,34] This may be due to differences in study location and racial factors. Our findings reveal~~s~~ that 29.2% of the subjects who had hyperthyroidism presented with autoimmune disorder, 50% of those with subclinical hypothyroidism had autoimmune disorder whereas all the subjects with sub-clinical hyperthyroidism came up with autoimmune disorder. Thyroid disorders and autoimmune disorders have a (P=0.02). Findings from our study also showed that 27.4% of subjects with high pulse pressure presented with autoimmune disorder, while the severity of hypertension among subjects with autoimmune disorder was 43.3%. Incidentally, autoimmune disorder, pulse pressure, and hypertension had no significant. association

CONCLUSION

The study showed that severity of hypertension and elevated pulse pressure were associated more commonly with hyperthyroidism and autoimmune disorders which can complicate cardiovascular morbidity and mortality. Incidentally, there was no significant statistical relationship among subjects with thyroid disorders, pulse pressure and hypertension.

Conflicts of interest: The authors declare no conflicts of interest.

Authors contribution: Dada AO conceptualized the study and was the project lead. Aminu MA supervised the data collection, sample analysis and revision of the discussion. Okunowo BO wrote the revised manuscripts and did the data analysis.

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Table 1: Demographic characteristics of the subjects

Variable	Frequency N= 100	Percentage (%)
Age Group (Years)		
= 45	56	56.0
46 - 65	35	35.0
66 - 85	9	9.0
Age range	**19 - 82**	
Mean ± SD	**45.8 ± 15.1**	
Sex		
Male	10	10.0
Female	90	90.0
Marital Status		
Married	75	75.0
Single	18	18.0
Widowed	7	7.0
Religion		
Christianity	72	72.0
Islam	28	28.0
Tribe		
Yoruba	78	78.0
Igbo	12	12.0
Others	10	10.0
Occupation		
Civil Servant	1	1.0
Self employed	71	71.0
Unemployed	28	28.0

Table 2: Clinical characteristics associated with thyroid disorders among the subjects

Variable	Freq (N= 100)	Percentage (%)
Presence of Hypertension		
Yes	37	37.0
No	63	63.0
Stage of Hypertension(n=37)		
Stage 1	23	62.2
Stagge 2	14	37.8
Presence of Goiter		
Yes	67	67.0
No	33	33.0
Thyroid Abnormality		
Euthyroidism	9	9.0
Hyperthyroidism	65	65.0
Hypothyroidism	21	21.0
Subclinical hyperthyroidism	3	3.0
Subclinical hypothyroidism	2	2.0
Pulse Pressure		
Normal	36	36.0
Low	2	2.0
High	62	62.0
Mean ± SD	**55.4± 13.4**	
Autoimmune Disorder		
Yes	30	30.
No	70	70.0

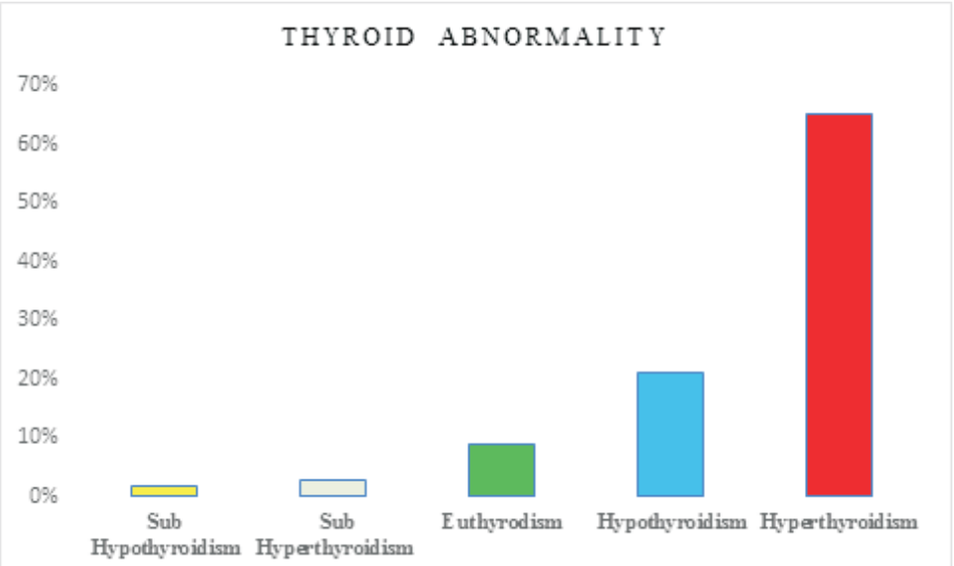

Figure 1: Prevalence of Thyroid Abnormality

Table 3: Prevalence and patterns of Hypertension in thyroid disorder

Variable	Stage 1(freq(%)	Stage 2(freq(%)	Non hypertensive
Euthyrodism	0(00.0)	1(11.1)	8(88.9)
Hyperthyroidism	15(23.1)	10(15.4)	40(61.5)
Hypothyroidism	5(23.8)	2(9.5)	14(66.7)
Subclinical Hyperthyroidism	2(66.7)	0(00.0)	1(33.3)
Subclinical Hypothyroidism	1(50.0)	1(50.0)	0(00.0)
Patterns of Pulse Pressure with Thyroid Abnormality			
Variable	**High(freq(%)**	**Low(freq(%)**	**Normal (freq (%)**
Euthyrodism	2(22.2)	0(00.0)	2(77.8)
Hyperthyroidism	43(66.2)	1(1.5)	21(32.3)
Hypothyroidism	14(66.7)	1(4.7)	6(28.6)
Subclinical Hyperthyroidism	2(66.7)	0(00.0)	1(33.3)
Subclinical Hypothyroidism	1(50.0)	0(00.0)	1(50.0)

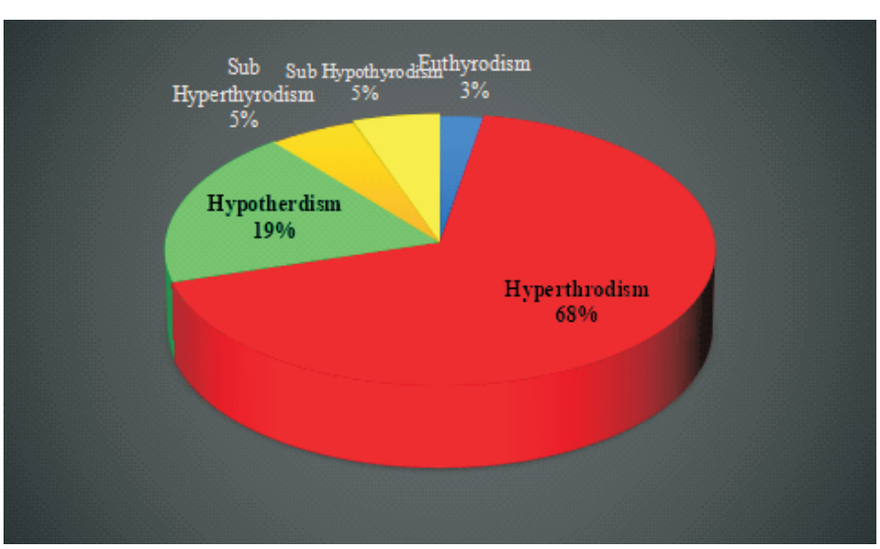

Fig 2: Patterns of family history of patients with Hypertension and Thyroid Abnormality

Table 4 Association between Thyroid Abnormality, Hypertension and Pulse Pressure

	Hypertension(Freq(%)			Pulse Pressure(Freq(%)			
Variable	**No**	**Yes**	**P**	**Low**	**Normal**	**High**	**P**
Thyroid Abnormality			**0..111**				**0.168**
Euthyroidism	8(88.9)	1(11.1)		0(0.0)	7(77.8)	2(22.2)	
Hypothyroidism	14(66.7)	7(33.3)		1(4.8)	6(28.6)	14(66.7)	
Hyperthyroidism	40(61.5)	25(38.5)		1(1.5)	21(32.3)	43(66.2)	
Sub Hyper	1(33.3)	2(66.7)		0(0.0)	1(33.3)	2(66.7)	
Sub Hypo	0(00.0)	2(100.0)		0(0.0)	1(50.0)	1(50.0)	
Association between Hypertension, Pulse Pressure in Autoimmune thyroid disorders							
	Autoimmune (Freq (%)						
	No(n=70)	**Yes (n=30)**					
Thyroid Abnormality			**0.021***				
Euthyroidism	5(56.6)	4(44.4)					
Hyperthyroidism	46(70.8)	19(29.2)					
Hypothyroidism	18(85.7)	3(14.3)					
Sub Hyper	00(00.0)	3(100.0)					
Sub Hypo	1(50.0)	1(50.0)					
Hypertension			**0.262**				
No	46(65.7)	17(56.7)					
Yes	24(34.3)	13(43.3)					
Pulse Pressure			**0.604**				
High	45(72.6)	17(27.4)					
Low	1(50.0)	1(50.0)					
Normal	24(66.7)	12(33.3)					

Sub Hyper= Subclinical Hyperthyroidism, Sub Hypo=Subclinical Hypothyroidism,
*** = Statistically significance**