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Research Article

Thyroid function in hypertensives in South-South Nigeria

Iya E. Bassey[1]*, Rebecca M. Gali[2], Okon E. Essien[3], Alphonsus E. Udoh[1], Bukola Emordi[4], Uwem O. Akpan[1]

[1]Department of Medical Laboratory Science, Faculty of Allied Medical Sciences, College of Medical Sciences, University of Calabar, Cross River State, Nigeria
[2]Department of Medical Laboratory Science, College of Medical Sciences, University of Maiduguri, Borno State, Nigeria
[3]Department of Internal Medicine, Faculty of Medicine and Dentistry, College of Medical Sciences, University of Calabar, Cross River State, Nigeria
[4]Department of Chemical Pathology, University of Calabar Teaching Hospital, Calabar, Cross River State, Nigeria

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***Correspondence:**
Dr. Iya E. Bassey,
E-mail: iyantui@yahoo.com

ABSTRACT

Background: Hypertension is the most common cardiovascular disease afflicting humans. It has been reported that hypertensive patients may have a tendency for impaired thyroid function but, these results have not always been confirmed. The aim of this study therefore was to determine the serum level of thyroid hormones in hypertensive subjects and any possible relationship between serum thyroid hormone levels and hypertension.
Methods: Blood samples were consecutively obtained from One hundred and seventy (170) consenting subjects. One hundred were hypertensive subjects while seventy subjects were normotensive controls. Triiodothyronine (T3), Thyroxine (T4) and Thyroid stimulating hormone (TSH) were analyzed using ELISA kits. Data was analyzed using student "t" test and analysis of variance. The difference was considered statistically significant at $p < 0.05$.
Results: The mean serum TSH value for hypertensive subjects was 3.01±2.42 µIu/ml and was significantly higher ($p<0.0001$) than that of the normotensive subjects (1.74±0.92 µIu/ml). Female hypertensive subjects had significantly higher (3.34±2.74 µIu/ml) mean TSH than the female normotensives with mean value of 1.79±0.86 µIu/ml ($p<0.002$). Mean TSH value for male hypertensive subjects was 2.78±2.4 µIu/ml and was significantly higher ($p<0.007$) than that of male normotensive subjects (1.72±0.96 µIu/ml). There were no significant differences in the mean serum T3 and T4 levels of hypertensives compared to the normotensives.
Conclusions: It is concluded that the hypertensive subjects in this study required significantly higher ($p<0.05$) stimulation input, as measured from the level of thyroid stimulating hormone, to maintain the same level of thyroid hormones as their normotensive counterparts.

Keywords: Thyroid hormones, Hypertension, Subclinical hypothyroidism

INTRODUCTION

Hypertension is the most common cardiovascular disease afflicting humans. It is an important public health challenge because of the associated morbidity and mortality.[1] The pooled prevalence of hypertension from 2000 to 2009 in Nigeria was 22.5 percent.[2] Hypertension is defined as a systolic blood pressure (SBP) of 140 mm Hg or more, or a diastolic blood pressure (DBP) of 90 mm Hg or more, or taking antihypertensive medication.[3]

It is a well known fact that globally, black adults have among the highest rates of hypertension, with an increasing prevalence. Although white adults also have

an increasing incidence of high BP, they develop this condition later in life than black adults and have much lower average BPs. In fact, compared to hypertensive white persons, hypertensive black individuals have a 1.3-fold higher rate of nonfatal stroke, a 1.8-fold higher rate of fatal stroke, a 1.5-fold higher mortality rate due to heart disease, and a 4.2-fold higher rate of end-stage renal disease.[4] High blood pressure may affect all organs but most especially the kidneys, brain and heart. Symptoms associated with hypertension include dizziness, headaches, palpitations, restlessness, nervousness and tinnitus. Hypertension is often referred to as the "silent killer" and can quietly damage the body for years before symptoms develop.[5] Thyroid hormones influence cardiovascular function[6] and modulate the vascular response.[7] It has been reported that hypertensive patients may have a tendency for impaired thyroid function[8] but, these results have not always been confirmed.[9-11] The aim of this study therefore was to determine the serum level of thyroid hormones in hypertensive subjects determine any possible relationship between serum thyroid hormone levels and hypertension.

METHODS

Study design and subject selection

This case control study was carried out at the Hypertension clinic of the University of Calabar Teaching Hospital (UCTH), Calabar, Cross River State, Nigeria. This work was conducted in accordance with the World Medical Association's Declaration of Helsinki12 and its later amendments. The purpose and nature of the research was explained each participant and informed consent was obtained before recruitment into the study. A standard questionnaire was given to them to obtain information from the subjects about their age, family history, dietary and physical lifestyle. Consecutive sampling method was used. All the subjects were forty (40) years of age and above. Patients who had a known history of diabetes mellitus, eclampsia, Graves' disease, goiter, those on chronic medications for any disease condition other than hypertension as well as pregnant women were excluded from the study. Hypertension was defined as an average blood pressure above 140/90 mmHg on at least three different occasions or those already on treatment for hypertension. Anthropometric indices such as height and weight of the subjects were also measured and body mass index calculated.

One hundred (100) hypertensive patients (58 males and 42 females) of Nigerian origin with confirmed hypertension attending University of Calabar Teaching Hospital Hypertension clinic were recruited as test subjects. Seventy (70) age-matched non-hypertensive apparently healthy subjects (46 males and 24 females) also of Nigerian origin living in Calabar metropolis and its environs were recruited as control subjects.

Sample collection

Blood samples (5 ml) were aseptically collected from each subject into a plain sample bottle and allowed to clot at room temperature. The samples were then centrifuged and the sera separated into serum bottles and stored frozen until assayed.

Measurement of anthropometric indices and blood pressure

Weight and height of each subject were measured. The measurement of weight in kilograms was done using a weighing balance and measurement of height (in metres) was done using a stadiometer. Body mass index (BMI) was computed as the ratio of weight (kilograms) to the square of height (meters).The blood pressure was measured on the right arm with a mercury sphygnomanometer (Cuffsize 12.5 X 40 cm) with the patient in a seated position and after a 5 minutes rest. The systolic and diastolic blood pressures were recorded.

Assays

TSH, T3 and T4 were analyzed using ELISA kits obtained from DRG International Incorporated, East Mountain Side, USA. The serum total T3 and T4 assays were performed as described by Schall et al, 1978[13] and TSH as described by Uotila et al, 1981[14].

Statistical analysis

This was done using the PAWstatistic 18, a statistical package from SPSS Inc, California, USA. The results were expressed as Mean ± SD. The data was analyzed by Student's t-test and analysis of variance (ANOVA). Post-hoc analysis was done using Fischer's least significant difference (LSD). The level of significance was set at 95% confidence interval, where a two-sided p-value less than 0.05 ($p<0.05$) was considered as statistically significant.

RESULTS

There were no significant differences ($p>0.05$) in the mean serum T_3 and T_4 levels of hypertensives compared to the normotensives. However, the mean value of TSH of the hypertensives was significantly higher ($p<0.0001$) than that of the normotensives. As expected, the mean values of systolic and diastolic blood pressures were also significantly higher ($p<0.0001$) in hypertensives when compared to normotensives (Table 1).

A comparison on blood pressure and thyroid function parameters in hypertensives and normotensives based on gender showed significant variations in T_3 ($p=0.002$), T_4 ($p=0.024$), TSH ($p<0.0001$), Systolic BP ($p<0.0001$), Diastolic BP ($p<0.0001$) among the groups (Table 2).

Table 1: Mean blood pressure and thyroid function parameters in hypertensive and normotensives.

Parameters	Hypertensives	Normotensives	Calc. "t"	Crit. "t"	p value
Age (yr)	53.3±10.01	51.1±10.29	1.39	1.98	0.166
T_3 (ng/dl)	141.5 ± 58.45	154.0 ± 45.38	1.56	1.98	0.135
T_4(µg/dl)	8.89 ± 3.10	9.60 ± 2.41	1.67	1.98	0.110
TSH (µIU/ml)	3.01 ± 2.42	1.74 ± 0.92	4.78	1.98	<0.0001
Systolic BP (mmHg)	161.9 ± 13.07	114 ± 10.75	25.9	1.98	<0.0001
Diastolic BP (mmHg)	93.4 ± 12.4	76.9 ± 7.6	10.7	1.98	<0.0001
n	100	70			

Mean ±SD

Table 2: Effect of gender on blood pressure and thyroid function parameters in hypertensives and normotensives.

Parameters	Male Hypertensives	Female Hypertensives	Male normotensives	Female normotensives	Calc. "f"	Crit. "f"	p-value
Age (yr)	53.3±10.23	53.5±9.76	51.8±10.13	49.9±10.70	0.820	3.059	0.484
T_3 (ng/dl)	148.09 ± 69.61	128.09 ± 58.24	167.17 ± 42.15	128.75 ± 41.11	209.407	3.059	0.002
T_4(µg/dl)	9.25 ± 3.05	8.39 ± 3.20	10.12 ± 2.28	8.59 ± 2.37	32.372	3.059	0.024
TSH (µIU/ml)	3.34 ± 2.44	2.78 ± 2.74	1.72 ± 0.96	1.79 ± 0.86	6.511	3.059	0.000
Systolic BP (mmHg)	162.02 ± 9.81	161.88 ± 14.37	113.04 ± 10.09	117.08 ± 10.09	5.325	3.059	0.000
Diastolic BP (mmHg)	94.11 ± 16.74	92.81 ± 8.58	77.39 ± 8.3	76.04 ± 6.08	3.231	3.059	0.000
n	58	42	46	24			

Mean ±SD

Table 3: Comparison of thyroid function parameters in male and female hypertensives and normotensives using post hoc analysis.

Groups	Parameter	Mean Difference	Std Error	p-value
Male hypertensives vs female hypertensives	T_3 (ng/dl)	23.112	10.479	0.029
Male hypertensives vs male normotensives	TSH (µIU/ml)	1.0602	0.3847	0.007
	Systolic BP (mmHg)	48.836	2.405	<0.0001
	Diastolic BP(mmHg)	15.419	2.119	<0.0001
Male hypertensives vs female normotensives				
	TSH (µIU/ml)	0.9859	0.4730	0.039
	Systolic BP (mmHg)	44.796	2.956	<0.0001
	Diastolic BP(mmHg)	16.769	2.605	<0.0001
Female hypertensives vs male normotensives				
	TSH (µIU/ml)	1.6207	0.4159	<0.0001
	Systolic BP (mmHg)	48.980	2.600	<0.0001
	Diastolic BP(mmHg)	16.728	2.291	<0.0001
Female hypertensives vs female normotensives				
	TSH (µIU/ml)	1.5464	0.4986	0.002
	Systolic BP (mmHg)	44.940	3.117	<0.0001
	Diastolic BP(mmHg)	18.077	2.746	<0.0001
Male normotensives vs female normotensives				
	T_3 (ng/dl)	-38.424	13.024	0.004
	T_4 (µg/dl)	-1.5322	0.7032	0.031

The post-hoc analysis showed that only the mean T3 of the male hypertensives was significantly higher (p= 0.029) than that of female hypertensives. When the parameters of male hypertensives were compared with that of male and female normotensives and female hypertensives with male and female normotensives, there were no significant differences (p>0.05) in the mean serum T3 and T4 levels. But, TSH, systolic and diastolic blood pressures of the hypertensives were significantly higher (p<0.05) than that of the normotensives. When the parameters of the male normotensives were compared with that of female normotensives (Table 3), the mean T3 and T4 values for the male normotensives was significantly higher (p<0.004; p<0.031) than those of the female normotensives. There was no significant difference (p>0.05) in the mean values of TSH and systolic and diastolic blood pressures (Table 3).

DISCUSSION

In this study, the level of TSH in hypertensive patients was found to be significantly raised when compared with normotensive euthyroid controls. This was not affected by gender. Also, there were no significant differences in T_3 and T_4 levels between the hypertensives and normotensives. This shows that the anterior pituitary in hypertensives works harder to produce more TSH which stimulates the production of T_3 and T_4 to maintain the euthyroid state of the hypertensives. This condition is referred to as subclinical hypothyroidism. Subclinical hypothyroidism is defined as a state of relative thyroid dysfunction, characterized by normal serum levels of thyroid hormones and increased serum thyroid-stimulating hormone (TSH) levels.[6] Reviews of studies on subclinical hypothyroidism suggest that it may have a critical role on deterioration of the atherogenic profile and total cardiovascular risk.[15] Other studies have demonstrated that subclinical hypothyroidism represents an independent risk factor for coronary heart disease.[16-18] It has been suggested by Stabouli et al,[15] and we agree, that patients visiting a hypertension clinic for evaluation of high BP may benefit from the diagnosis of hypothyroidism as the majority of them would avoid antihypertensive treatment.

In the normotensives in this study, the men had significantly higher (p<0.05) levels of thyroid hormones compared to the women in this study. Some authors have attributed this to the fact that in males the higher values of male sex hormones increases the circulating level of thyroxine binding globulin (TBG), which directly leads to increase in circulating level of T4.[19,20] Ahmed et al[20] noticed increased levels of only T4 in men compared to females. Some other studies report no effect of gender on thyroid hormones.[21-23] There was however no significant difference in the TSH of the normotensive men and women. Similar findings were observed by Roelfsema et al [24] and Ahmed et al.[20] A study by Surks and Hollowell[25] however reported higher TSH level in women. The interesting observation is that this gender difference in T_4 levels is not observed in the hypertensives. This may be due to complications of hypertension, the most important being the presence of lower levels of circulating testosterone and androstenedione levels in hypertensive men.[26,27]

A limitation of this study is that we cannot categorically state which of these two conditions (thyroid dysfunction and hypertension) the cause is and which is the effect. However, from our results in this study we have observed that in the hypertensive subjects, there is a picture of sub-clinical hypothyroidism, which if left unattended to may result in thyroid failure.

CONCLUSION

It is concluded that the hypertensive subjects in this study required significantly higher (p<0.05) stimulation input, as measured from the level of thyroid stimulating hormone, to maintain the same level of thyroid hormones as their normotensive counterparts. This suggests that hypertension may induce subclinical thyroid disorder, that and long standing hypertension may lead to thyroid failure.

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REFERENCES

1. Olatunbosun, ST, Kaufman, JS, Cooper, RS, Bella, AF. Hypertension in a black population. Prevalence and biosocial determinants of high blood pressure in a group of urban Nigerians. J Hum Hypertens. 2000;14(4):249-57.
2. Ogah OS, Okpechi I, Chukwuonye II, Akinyemi JO, Onwubere JCB, Falase AO et al. Blood pressure, prevalence of hypertension and hypertension related complications in Nigerian Africans: a review. World J Cardiol. 2012;4(12):327-40.
3. Roger VL, Go AS, Lloyd-Jones DM. Heart disease and stroke statistics--2012 update: a report from the American Heart Association. Circulation. 2012;125(1):e2-e220.
4. Pleis JR, Lucus JW, Ward BW. Summary health statistics for US adults: National Health Interview Survey, 2008. Vital Health Statistics 10. 2009;242.
5. Mayo Clinic Staff. High blood pressure dangers: Hypertension's effect on the body. 2014. http//www.mayoclinic.org. Accessed August 11, 2014.
6. Biondi B, Cooper DS: The clinical significance of subclinical thyroid dysfunction. Endocr Rev. 2008;29:76-131.
7. Danzi S, Klein I. Thyroid hormone and blood pressure regulation. Curr Hypertens Rep. 2003;5:513-20.

8. Gumieniak O, Perlstein TS, Hopkins PN, Brown NJ, Murphey LJ, Jeunemaitre X et al. Thyroid function and blood pressure homeostasis in euthyroid subjects. J Clin Endocrinol Metab. 2004;89:3455-61.
9. Bergus GR, Mold JW, Barton ED, Randall CS. The lack of association between hypertension and hypothyroidism in a primary care setting. J Hum Hypertens. 1999;13:231-5.
10. Walsh JP, Bremner AP, Bulsara MK, O'Leary P, Leedman PJ, Feddema P et al. Subclinical thyroid dysfunction and blood pressure: a community-based study. Clin Endocrinol (Oxf). 2006;65:486-91.
11. Iqbal A, Figenschau Y, Jorde R. Blood pressure in relation to serum thyrotropin: the Tromsø study. J Hum Hypertens. 2006;20:932-6.
12. World Medical Association's Declaration of Helsinki. Recommendations Guiding Physicians in Biomedical Research Involving Human Subjects. Adopted by the 18th World Medical Assembly, Helsinki; Finland, June, 1964, and amended by the 48th General Assembly, Somerset West, Republic of South Africa. 1996.
13. Schall RF, Fraser AS, Hansen HW, kern CW, Teneso HJ. A sensitive manual enzyme immunoassay for thyroxine. Clin Chem. 1978;24(10):1801.
14. Uotila M, Ruoslahti E, Engvall E. Methods. J Immunol. 1981;42:11-5.
15. Stabouli S, Papakatsika S, Kotsis V. Hypothyroidism and Hypertension. Expert Rev Cardiovasc Ther. 2010;8(11):1559-65.
16. Kvetny J, Hedgaard PE, Bladbjerg EM, Gram J. Subclinical hypothyroidism is associated with a low-grade inflammation, increased triglyceride levels and predicts cardiovascular risk in males below 50 years. Clinl Endocrinol (Oxf). 2004;61:232-8.
17. Walsh JP, Bremner AP, Bulsara MK. Subclinical thyroid dysfunction as a risk factor for cardiovascular disease. Arch Intern Med. 2005;165:2467-72.
18. Luboshitzky R, Aviv A, Herer P, Lavie L. Risk factors for cardiovascular disease in women with subclinical hypothyroidism. Thyroid. 2002;12:421-5.
19. Razzak, MA. Effect of Age and Sex on Thyroid Function Tests. Establishment of norms for the Egyptian Population in Developments in Radioimmunoassay and Related Procedures. International Atomic Energy Agency, 1992:353-8.
20. Ahmed Z, Khan MA, Ul Haq A, Attaullah S, Ur Rehman J. Effect of race, gender and age on thyroid and thyroid stimulating hormone levels in North West Frontier Province, Pakistan. J Ayub Med Coll Abbottabad. 2009;21(3):21-4.
21. González-Sagrado M, Martin-Gil FJ Population-specific reference values for thyroid hormones on the Abbott Architect i2000 analyzer. Clin Chem Lab Med. 2004;42:540-2.
22. Kratzsch J, Fiedler GM, Leichtle A, Brügel M, Buchbinder S, Otto L et al. New reference intervals for thyrotropin and thyroid hormones based on National Academy of Clinical Criteria and regular ultrasonography of the thyroid. Clin Chem. 2005;51:1480-6.
23. D'Herbomez M, Jarrige V, Darte C. Reference intervals for serum thyrotropin (TSH) and free thyroxine (FT4) in adults using the Access immunoassay system. Clin Chem Lab Med. 2005;43:102-5.
24. Roelfsema F, Pereira AM, Veldhuis JD, Adriaanse R, Endert E, Fliers E et al. Thyrotropin secretion profiles are not different in men and women. J Clin Endocrinol Metab. 2009;94:3964-7.
25. Surks MI, Hollowell JG. Age-specific distribution of serum thyrotropin and antithyroid antibodies in the US population: implications for the prevalence of subclinical hypothyroidism. J Clin Endocrinol Metab. 2007;92:4575-82.
26. Phillips GB, Jing TY, Resnik LM, Barbagallo M, Laragh JH, Sealey JE. Sex hormones and hemostatic risk factors for coronary heart disease in men with hypertension. J Hypertens. 1993;11699-702.
27. Hughes GS, Mathur RS, Margollus HS. Sex steroid hormones are altered in essential hypertension. J Hypertens. 1989;7:181-7.

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