ISSN- O: 2458 - 868X, ISSN–P: 2458 – 8687
Index Copernicus Value: 68 . 16
PubMed - National Library of Medicine - ID: 101731606

International Journal of Medical Science and Innovative Research (*IJMSIR*)
IJMSIR : A Medical Publication Hub
Available Online at: www.ijmsir.com
Volume – 4, Issue – 5, October - 2019, Page No. : 216 - 228

Comparative Study on The Effect of Iodinated Contrast Media on Serum Thyroxin Level In Patient Undergoing Brain Computed Tomography Scan.

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Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

Thyroxin is produced from the follicular cells of the thyroid gland. Iodine is bound to a tyrosine residue in the thyroglobulin molecule in the production of thyroxin making iodine an important component in thyroxin synthesis. This study is to evaluate thyroxin levels in iodinated contrast enhanced brain computed tomography.

Materials and Method

A Cohort study design was adopted. The study was carried out from March 2018 to March 2019 with 124 patients using a 64 slice GE Optima Computed Tomography machine for the brain scan. After Pre-contrast images, contrast media (ioxehol) was administered and thereafter the post-contrast images obtained. Total Thyroxin (T4) Enzyme Immunoassay Test KIT was used to evaluate the thyroxin levels before, immediately after and seven days post-examination. Participant's age, sex and BMI were also recorded. The data collected was analyzed using SPSS windows version 22.0 statistical software (SPSS Inc, Chicago, Illinois, USA). Paired-sample t-test and Pearson correlation models were used to test significance between means and evaluate correlation between variables respectively.

Results

The mean thyroxin level (±SD) among iohexol administered patients were 6.53±1.58µg/dl, 7.39±1.28µg/dl and 7.36±1.31µg/dl for the baseline, Immediate post-contrast and 7 days post-examination respectively. Thyroxin levels increased after iohexol administration with marginal reduction on the 7th day. There was no increase in thyroxin levels among the non-contrast administered group.

Conclusion

Marginal but transient elevation in the serum thyroxin level was noted with the administration of iohexol among patients undergoing brain CT. Therefore, thyroid disorders should be evaluated before the administration of iodinated contrast media.

Keywords: Thyroid gland, thyroxin, ioxehol, iodinated contrast, Computed tomography, Port Harcourt.

Introduction

Background of the Study

The rising prevalence of thyroid disorders is becoming a source of concern especially with the increasing use of iodinated contrast-enhanced imaging. Therefore, there is a need to evaluate the changes in serum thyroxin hormone levels in these patients after undergoing contrast-enhanced brain Computed Tomography (CT). Computed Tomography is an ionizing radiation-based imaging modality, which can provide images of internal body organs such as bones, soft tissue and blood vessels with a good tissue and image contrast according to the Radiologic Society of North America (RSNA) report [1]. This imaging modality is required for diverse clinical conditions especially brain images. During most imaging especially brain imaging iodinated contrast agent is been introduced into the body to enhance tissue contrast [2].

The thyroid gland is an endocrine organ that is shaped like a butterfly and is anterolateral to the trachea and extends from the thyroid cartilage of the trachea superiorly to the sixth tracheal ring inferiorly [3,4]. It is derived embryologically from the pharyngeal pouches (first and second) and is made up of two lateral lobes joined by the isthmus in the midline [4]. The thyroid is also a very sensitive organ that increases in size and action during puberty, pregnancy whereas during menstrual cycles its size and shape changes [4].

The thyroid gland produces two types of hormones namely thyroxin (T4) and triiodothyronine (T3) [5]. Ninety-five per cent of the thyroid hormone produced is thyroxin whereas five per cent is triiodothyronine [5]. The thyroid gland produces these hormones following its stimulation by thyroid-stimulating hormone (TSH) secreted by the pituitary gland located at the base of the brain [5]. The action of the pituitary gland is controlled by the hypothalamus which monitors the amount of circulating serum thyroid hormones [5, 6]. The thyroxin (T4) hormone (3, 5, 3, 5-tetraiodothyronine) is a tyrosine-based hormone that is primarily responsible for the regulation of metabolism [5]. Thyroid hormones are produced from the follicular cells of the thyroid gland [6]. Its production is regulated by the thyroid-stimulating hormone which is secreted by the thyrotrophs of the anterior pituitary gland. 3, 5, 3, 5-tetraiodothyronine is produced by attaching iodine atoms to the tyrosine ring structures of tyrosine molecules and it contains four iodine atoms [6] as shown in see figure 1. T3 and T4 are identical but T3 has one less iodine atom per molecule compared to T4 [7], and T4 is converted to T3 in target tissues because T3 is 3 to 5 times more active [3, 7]. In the metabolism of thyroxin, iodine plays a vital role in the reaction cascade [6]. Therefore exogenous iodine administration should be considered to have biological effects in organs and could alter the thyroid gland hormone production (thyroxin levels) and function [3,6]. Iodine is a very important component in the synthesis of thyroxin hormone [6]. By a process called iodide trapping, iodide is actively absorbed from the bloodstream and concentrated in the thyroid follicles [5]. In this process, sodium is also transported with iodide [5, 6].

Iodine is bound to a tyrosine residue in the thyroglobulin molecule following a reaction with the enzyme thyroperoxidase leading to the formation of monoiodotyrosine (MIT) and diiodotyrosine (DIT) [6,7]. Sodium iodide symporter (NIS) is expressed by the thyrocytes at their basolateral membrane [6,8]. In a reaction catalyzed by thyroid peroxidase (TPO) iodide is organized into tyrosyl which is a residue of thyroglobulin (TG). The Thyroglobulin (TG) which contains monoiodothyronine, diiodothyronine, triiodothyronine and thyroxine are stored in colloid until T3 and T4 are released into the blood [6,8].

Thyroxin is formed by the combination of two moieties of diiodotyrosine [7]. The normal thyroid hormone global reference levels are TSH (0.5–5.0mU/L), T3 (95-190ng/dl) and T4 (5-11 µg/dl) whereas the normal reference ranges in Rivers State University Teaching Hospital are TSH (0.4-4.0µiu/mL), T4 (5-13µg/dL) and T3 (0.6-1.9ng/mL) [3].

Iohexol is the iodinated radiographic contrast medium administered during brain computed tomohraphy scan in the Department of Radiology. Its structure is shown in figure 2. It is a nonionic, water-soluble substance with a molecular weight of 821.14 and contains 46.36% of iodine [9]. It has an osmolality of 1.1 to 3.0 times that of plasma (285mOsm/kg water) or cerebrospinal fluid (301mOsm/kg water) [10,11]. Iohexol allows for radiographic visualization following the opacification of organs. Iohexol is poorly bound to serum albumin, and also has a low affinity for serum and plasma protein. It does not show significant metabolism, or biotransformation occurs after administration [10,11]. About 90% is excreted within the 24 hours, with a maximum urine concentration within the first hour of administration. Blood levels concentration fall rapidly within 5 to 10 minutes of administration whereas the intravascular concentration shows a half-life is about 20 minutes [10,11]. Adverse effects of the administration of iohexol include transient contrast-induced toxic encephalopathy, restlessness, tremors, hypoesthesia and should be administered with caution in patients with thyrotoxicosis, renal impairment, combined renal/hepatic disease, multiple myeloma, anuria, pheochromocytoma, as well as severe arterial/venous disease [10,11].

According to Van der Molen et al [12], patients with the risk of thyroid diseases have thyrotoxicosis when exposed to excess free iodide in the blood. The amount of iodine in the form of free iodide in iodinated contrast medium solutions could be of significant risk for patients [12]. Patients with Graves' disease, multinodular goitre with thyroid autonomy, as well as elderly patients are at risk of developing thyroid disorder especially thyrotoxicosis after the administration of iodinated contrast medium [12].

Excessive exposure to iodine may lead to Iodine induced hyperthyroidism which is a thyrotoxic condition known as Jod-Basedow phenomenon [13]. This condition (Jod-Basedow) is associated with Hashimoto’s thyroiditis, autoimmune thyroid disease as well as areas with iodine deficiency [13].

A study by Hanaghan, et al., (1979)[14] to show the effect of radiographic contrast media on thyroid hormones in the serum revealed a significant apparent change in serum thyroid hormone concentration. The study showed that there was an early rise and a later falls in the serum triiodothyronine after 3 and 21 days respectively. According to Sun Y lee, et al [15], the incidence of thyroid dysfunction in the United States following the administration of iodinated contrast medium is not known however there is an increase in the risk due to the increasing use of CT scans.

Several contrast-induced thyroid dysfunctions are said to be transient, however serious medical conditions such as atrial fibrillation and myxedema coma may occur in the elderly. It is interesting to note that most patients undergoing computed tomography or other radiologic investigations were not evaluated for thyroid function before the administration of iodinated contrast media. This in conjunction to paucity of documentation regarding the effect of iodinated contrast medium on serum thyroxin level among patients undergoing brain CT patients in our environment has informed the evaluation of the changes in serum thyroxin hormone levels in these patients after undergoing contrast administered brain Computed Tomography scan.

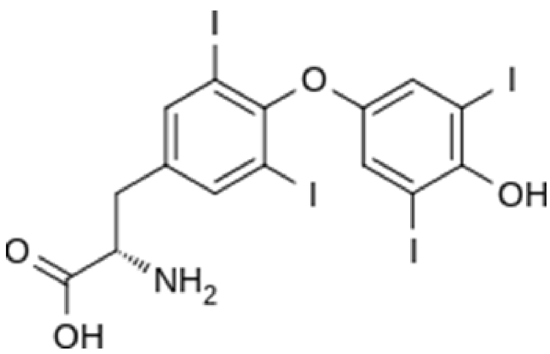

Figure1: The structural formula of thyroxin (T4) adopted from Wikipedia https://en.wikipedia.org/w/index.php?title=Thyroid Hormones.17th September 2016.

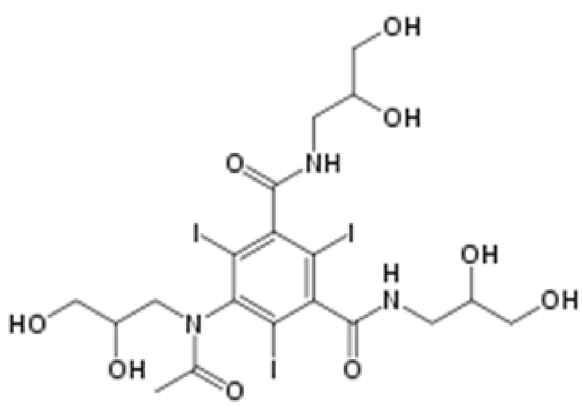

Figure 2: The structural formula of iohexol adopted from Wikipedia https://en.wikipedia.org/wiki/Iohexol#/media/File:Iohexol.svg.

Materials and Method

A Cohort study design was adopted. The study was carried out from March 2018 to March 2019 in the CT suite of Radiology Department in Rivers State University Teaching Hospital Port Harcourt, Rivers State in Nigeria. Patient referred for computed tomography scan of the brain that meets the inclusion criteria were adopted for the study. In line with the Helsinki declaration, ethical approval was obtained from the ethical committee of the Rivers State Health Research Ethics Committee. All the participants in the study provided informed consent.

The target population was patients referred for a brain CT scan examination. The population of One hundred and seventy-nine (179) being the number of brain CT examination from January to December 2018 was used to the estimated sample population yielding a sample one hundred and twenty- four (124) which was derived from the Yamane formula[17].

After obtaining informed consent participants were requested to change and wear a gown. The weight and height were measured then the Body Mass Index was obtained by dividing the weight (kg) by square of the height (m2). A 64 slice helical GE Optima CT machine having current quality control measurements and calibration was used. The examination was done with the patient in the supine position on the CT gantry table, according to standard protocols for brain CT. The patient was centred as such that the external auditory meatus (EAM) is at the centre of the gantry. Straps and pillows were used to stabilize patient neck position during the examination.

A scanogram of the brain was first obtained and later the brain images obtained caudo-cranially from the Top of C1 lamina through to about 2-3cm above the vertex. After the pre-contrast images, the contrast media (ioxehol trade name Omnipaque 300mg/mL) was administered through the pump injector and the post-contrast images were acquired. The dose administered was 1mg/kg bodyweight. The images were then printed out in hard and soft copies. The patients were monitored for a few minutes before they are allowed to leave the CT suite.

The standard assay procedure documented by Total Thyroxin (T4) Enzyme Immunoassay Test KIT catalogue number BC -1007 is the adopted method used by the chemical pathology unit of Rivers State University Teaching Hospital. The Serum thyroxin level measurements were assayed by ELISA – Enzyme Immunoassay using Total Thyroxin (T4) Enzyme Immunoassay Test KIT. In the test kit, 96 wells of sheep anti-T4 coated microliter plates, Zero buffer, enzyme conjugate concentrate, enzyme conjugate diluent, TMB reagent, stop solution and a T4 reference standard containing 0, 2, 5, 10, 15 and 25ug/dl are provided.

The blood samples were collected under aseptic technique by venipuncture from a visible superficial vein into a plain sample bottle that does not contain anticoagulant. The blood samples were obtained immediately before the sonogram, immediately after the scan and seven days after the scan. The blood samples were allowed to clot and the serum was separated by centrifugation. A serum sample was then carefully withdrawn into a pre-labelled tube. The samples were assayed using the standard assay procedure as documented by Total Thyroxin (T4) Enzyme Immunoassay Test KIT catalogue number BC -1007. In the assay, the reaction leads to a colour change and the T4 level is read out. The T4 level is directly proportional to the colour intensity of the test sample. After the colour development stops the absorbance at 450nm is read with the microtiter reader.

The patients were categorized into 2 groups. Those administered with contrast and those that were not administered with contrast. All values obtained were collated and documented into the tabulated datasheet and analyzed accordingly. Other variables such as age, height and weight were also obtained and documented. A descriptive statistical tool was used to determine central tendencies while a paired- sample t-test was used to obtain significance between means. Pearson correlation coefficient was also used to evaluate the correlation between variables using the Statistical Package for Social Sciences (SPSS) windows version 22.0 statistical software (SPSS Inc, Chicago, Illinois, USA). The results obtained were also presented in tables, charts and graphs.

Result

The 124 patients were grouped into iohexol administered and none iohexol administered patients. 92 patients were administered with iohexol while 32 patients were not. Among the contrast administered group 52 are males while 38 were females. Out of the 32 patients that underwent non-contrast enhanced brain CT scan (figure 3), 20 were males and 12 were females (figure 3). The mean age is 58.61+8.54 with a range age of 38 and 74 years (figure 4). The BMI distribution of patients revealed that 44(48%) patients have normal BMI while 40(43%) were overweight and 8(9%) were obsessed as shown in figure 5. Concerning the BMI the number of patients with normal BMI was higher than that of overweighed and obsessed patients in both and non-contrast administered patients (figure 5, table 1 and table 2).

The mean (+SD) baseline (before contrast administration) thyroxin level among iohexol (contrast media) administered patients was 6.53±1.58µg/dl. Meanwhile the Immediate post and 7days post-investigation thyroxin levels were 7.39±1.28µg/dl and 7.36±1.31µg/dl respectively (table 1). The immediate post-investigation mean thyroxin level (7.39±1.28µg/dl) was higher than the baseline and 7days post-investigation mean thyroxin levels (table 1). This reveals that there was an increase in the serum thyroxin hormone levels after the administration of contrast which reduced marginally at the 7th day (table

1). As shown in table 1 (contrast administered group), 58-67years age group had the highest baseline thyroxin level (6.89±2.04µg/dl), whereas the highest mediate and 7 days post-investigation thyroxin level were in age group 68-77years (6.83±1.25µg/dl and 7.74±1.19µg/dl respectively) . Regarding BMI of the contrast administered patients, it is shown in table 1 that patients with normal BMI has the highest baseline and immediate post-investigation thyroxin levels (6.66±1.61µg/dl and 7.46±1.10µg/dl respectively) while the overweight persons recorded the highest 7 days post-investigation thyroxin level (7.53±1.50µg/dl).

Among the non-contrast administered patients the mean thyroxin level among were 7.23±1.20µg/dl, 6.33±1.08µg/dl and 6.32±.92µg/dl for the baseline, Immediate and 7 days post-investigation thyroxin levels respectively (table 3). The mean (+SD) thyroxin level among the males was higher than that of the females among those that were not administered with contrast media. The mean thyroxin level among males was 6.94±2.15, 7.72±1.39 and 8.17±1.06 whereas that of the females was 6.25±1.08, 7.15±1.16 and 7.56±1.18 for the baseline, Immediate and 7 days post-investigation thyroxin levels respectively (table 2).

As shown in table 3 the paired mean thyroxin levels difference among contrast administered patients revealed that the paired mean thyroxin levels difference between the baseline and immediate post-investigation mean thyroxin levels was -.85543±1.54409 (mean difference + SD). The paired mean thyroxin levels difference between the baseline and the 7-day post-investigation thyroxin levels was -.82174±1.68365 (mean difference ± SD) whereas, the mean difference between the immediate post and 7 days post-investigation thyroxin levels was .03370±1.358179 (mean difference ±SD)

Paired T-test revealed a significant statistical difference between the mean thyroxin hormone levels between baseline and immediate post-investigation and 7 days post-investigation mean thyroxin levels at a confidence level of .000 (Table 3). The paired mean difference among the non-contrast administered group was .895312, .904687 and .009375 respectively. Whereas, the Paired T-test revealed that there is no significant statistical difference between the mean thyroxin hormone levels among (non-contrast administered group) the paired groups (table 3).

Pearson's correlation among the contrast administered group, showed a positive correlation between pre-contrast and immediate post contrast thyroxin hormone levels with a Pearson's correlation coefficient (r) of 0.486 within a confidence interval of 0.01 (p value of 0.01) as shown in table 4. A positive correlation was also observed between immediate post contrast and 7 days post examination thyroxin hormone levels with a Pearson's correlation coefficient (r) of 0.4661 within a confidence interval of 0.01 (p value of 0.01) as also shown in table 4. Meanwhile, Pearson's correlation among the non-contrast administered group revealed a positive correlation between immediate post-examination thyroxin hormone levels and 7 days post-examination thyroxin hormone levels with a Pearson's correlation coefficient (r) of 0.601 within a confidence interval of 0.01 (p value of 0.01) as shown in table 5. There was no correlation between pre-examination thyroxin levels with that of immediate post-examination thyroxin levels or 7 days post-examination thyroxin levels (table 5). Among this same group there was also there was no correlation between age and thyroxin hormone levels, or BMI and thyroxin hormone levels.

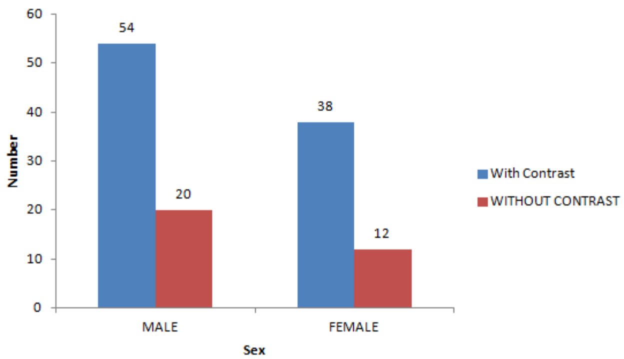

Figure 3: Showing the sex distribution of patients

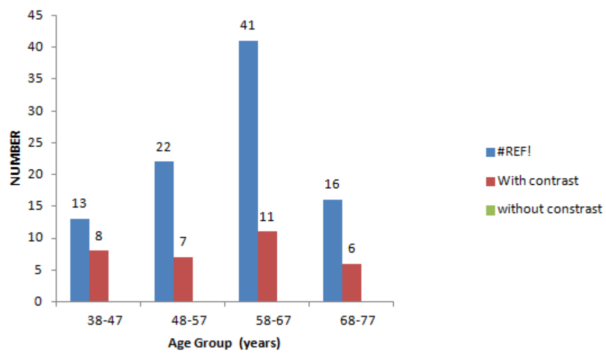

Figure 4 : Showing the Age distribution of patients

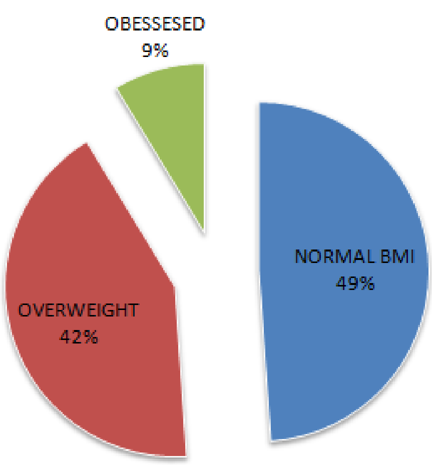

Figure 5: Showing the contrast BMI distribution of patients

Table 1: Composite serum thyroxin hormone levels of patients

VARIABLE AGE GROUP (Years)	N	Pre-Scanning T4 level (µg/dl)	Immediate post-scanning T4 level (µg/dl)	7 days post-scanning T4 level (µg/dl)
38-47	13	6.46±0.80	7.33±1.31	6.92±1.18
48-57	22	5.95±0.82	7.33±0.85	7.07±1.21
58-67	41	6.89±2.04	7.66±1.43	7.50±1.41
68-77	16	6.49±1.31	6.83±1.25	7.74±1.19
TOTAL	92	6.53±1.58	7.39±1.28	7.36±1.31
BMI				
Normal	45	6.66±1.61	7.46±1.10	7.28±1.21
Overweight	39	6.46±1.59	7.42±1.48	7.53±1.50
Obese	8	6.23±1.49	6.84±1.12	6.96±0.73
SEX				
MALE	52	6.68±1.84	7.50±1.36	7.81±1.17
FEMALE	40	6.34±1.13	7.25±1.17	6.76±1.25

Table 2: showing the distribution of serum thyroxin hormone concentration of non-contrast administered patients

VARIABLE AGE GROUP (Years)	N	Pre-Scanning level (µg/dl)	Immediate post-scanning T4 level (µg/dl)	7 days post-scanning T4 level (µg/dl)
38-47	8	7.01±1.20	6.26+0.65	6.34+0.48
48-57	7	7.56±0.66	6.14+0.90	6.14+0.66
58-67	11	7.55+1.37	6.25 + 1.37	6.15+1.26
68-77	6	6.53+1.28	6.78 + 1.24	6.83+ 0.88
TOTAL	32	7.23±1.20	6.33±1.08	6.32±.92
BMI				
Normal	16	7.41± 0.93	6.58± 1.05	6.36± 0.65
Overweight	14	7.19± 1.48	6.16± 1.12	6.26±1.23
Obese	2	6.00± 0.57	5.50± 0.71	6.50± 0.14
SEX				
MALE	20	6.72±0.92	6.05±0.94	6.08±0.79
FEMALE	12	7.47±1.06	6.02±0.95	6.23±0.76

Table 3: showing paired mean difference between Pre-contrast/pre examination and immediate post contrast thyroxin levels and immediate post contrast and 7 days post contrast mean thyroxin levels

Variable	Paired Differences Mean	Std. Deviation	t	df	Sig. (2-tailed)
Contrast population					
Pair 1	-.85543	1.54409	-5.314	91	.000
Pair 2	-.82174	1.68365	-4.681	91	.000
Pair 3	.03370	1.35817	.238	91	.812
Non contrast population					
Pair 1	.895312	1.405540	3.603	31	.001
Pair 2	.904687	1.486518	3.443	31	.002
Pair 3	.009375	.901024	.059	31	.953

Pair 1 Baseline and immediate post investigation thyroxin levels

Pair 2 Baseline and 7 days post investigation thyroxin levels

Pair 3 Immediate post and 7days post-investigation thyroxin levels

Table 4: Pearson's correlation between age, BMI, and thyroxin hormone levels among contrast administered patients.

Variable	Correlation	AGE	BMI	T4_1	T4_2	T4_3
AGE	Pearson Correlation	1	.261*	.075	.022	.221*
	Sig. (2-tailed)	.097	.012	.476	.832	.035
	N	92	92	92	92	92
BMI	Pearson Correlation	.261*	1	-.120	-.198	-.050
	Sig. (2-tailed)	.012		.256	.059	.636
	N	92	92	92	92	92
Pre-contrast	Pearson Correlation	.075	-.120	1	.430**	.331**
	Sig. (2-tailed)	.476	.256		.000	.001
	N	92	92	92	92	92
IMMEDIATE	Pearson Correlation	.022	-.198	.430**	1	.450**
	Sig. (2-tailed)	.832	.059	.000		.000
	N	92	92	92	92	92
7 DAYS	Pearson Correlation	.221*	-.050	.331**	.450**	1
	Sig. (2-tailed)	.035	.636	.001	.000	
	N	92	92	92	92	92

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 5: Pearson's Correlation Between Age, BMI, and Thyroxin Hormone Levels Among Non-Contrast Administered Patients. .

Variable	Correlation	AGE	BMI	T4_1	T4_2	T4_3
AGE	Pearson Correlation	1	.330	.003	.020	.066
	Sig. (2-tailed)		.065	.985	.914	.718
	N	32	32	32	32	32
BMI	Pearson Correlation	.330	1	-.256	-.301	.029
	Sig. (2-tailed)	.065		.157	.095	.877
	N	32	32	32	32	32
Pre-contrast	Pearson Correlation	.003	-.256	1	.244	.037
	Sig. (2-tailed)	.985	.157		.178	.841
	N	32	32	32	32	32
Immediate	Pearson Correlation	.020	-.301	.244	1	.601**
	Sig. (2-tailed)	.914	.095	.178		.000
	N	32	32	32	32	32
7 DAYS	Pearson Correlation	.066	.029	.037	.601**	1
	Sig. (2-tailed)	.718	.877	.841	.000	
	N	32	32	32	32	32

**. Correlation is significant at the 0.01 level (2-tailed).

Discussion

Most patients undergoing computed tomography as well as other radiologic investigations are administered with iodinated contrast media like iohexol to enhance tissue and image contrast. When introduced into the body (iohexol) prior to an investigation, it makes tissues in the body show differently on the images and helps distinguish selected areas of the body from surrounding tissue [2]. This eventually improves the visibility and clarity of specific organs or tissues [2]. The rising prevalence of thyroid disorders especially thyroid cancer [17] has been a source of concern especially with the rising use of iodinated contrast-enhanced imaging investigations [17].

Among the iohexol administered group, 58-67years age group had the highest baseline thyroxin level (7.12+2.21µg/dl), whereas 38-47years age group has the highest immediate post-contrast thyroxin levels (7.84+1.44µg/dl). The 7th-day post-examination thyroxin level was seen to higher in age group 68-77years (8.28+1.04µg/dl). A similar scenario was observed in the non-contrast administered group where age group 68-77years had the highest immediate post (6.78+1.24) and 7days post-examination (6.83+0.88) thyroxin hormone levels. In both contrast administered and non-contrast administered categories the oldest age group had the highest thyroxin hormone level. Therefore, these results suggest that the thyroxin hormone levels were higher in the older age group. This was contrary to the report by Corsonello et al.,(2010) [18] in a cross-section analysis of FT3 age-related changes in a group of old and oldest-old subjects, including centenarians' relatives, shows that a down-regulated thyroid function has a familial component and is related to longevity revealed a decrease in thyroxin level with increasing age. Similar findings were also documented by Adam et al., (2012)[19] in a study of the thyroid gland and the process of ageing; what is new? The difference in finding between their study and the index study may be due to the study population, longevity and life expectancy.

The baseline mean thyroxin hormone level among iodinated contrast (iohexol) administered patients were 6.53±1.58µg/dl. This was lower than the value obtained after contrast administration (7.39±1.28µg/dl). The value obtained after 7days was higher than the baseline value but marginally lower than the value obtained immediately after the administration of contrast (7.36±1.31µg/dl).

The revers was observed in the non-contrast administered patients where there was a decline in the mean thyroxin level (7.23±1.20µg/dl, 6.33±1.08µg/dl and 6.32±.92µg/dl) for the baseline, immediate post and 7days post-investigation thyroxin levels respectively. This shows that there was an increase in the serum thyroxin hormone levels after the administration of iodinated contrast media. Notwithstanding, the rise in thyroxin hormone levels after the administration of the pharmacologic agent iohexol, the thyroxin hormone levels remained within normal limits.

The study by Özkan et al., (2013) [13] to evaluate the long-term effects of iodinated radiographic contrast media used for coronary angiography on the thyroid function in 101 euthyroid patients revealed a thyroxin levels of 1.14±0.16µg/dl, 1.17±0.17µg/dl, 1.16±0.17µg/dl for the baseline (pre investigation) , 4 weeks and 8 weeks post examination respectively. This shows that there was a marginal increase in the thyroxin hormone level after the administration of iodinated contrast media until the 4th week and a marginal reduction in the 8th week. However, the marginal reduction at the 8th week was still higher than that of the baseline. Their study (Özkan et al, 2013)[13] also documented that all the patients had values within the euthyroid thyroxin level. The difference in value between their study and the index study may be due to difference in reference ranges as applicable to the study location. Secondly the marginal reduction observed in the study by Özkan et al., (2013)[13] was also in consonance with the index study notwithstanding the duration of study (up to 8 weeks in their study and 1 week in the index study). Both studies therefore share the idea that iodinated contrast media could lead to the elevation of the serum thyroxin hormone levels.

The elevation of the thyroid hormone level was also observed in the study by Hanaghan et al., (1979)[20]. In their study to show the effect of radiographic contrast media on thyroid hormones in the serum revealed a significant apparent change in serum thyroid hormone level. In their study patients with goitre had significantly elevated thyroxin level after 21 days. According to Hehrmann et al[20]., Patients with normal thyroid function and size have only minute changes of thyroid hormones this minute change was attributed to either the volume of autonomous thyroid tissue and the quantity of iodine exposure. Notwithstanding, the documentation in the study by Hehrmann et al [20], all the patients that participated in the index study had a normal thyroid morphology and function

This assumption of increase in thyroxin levels with the administration of iohexol was completely contrary to the documentation by Vagenaki et al (1973) [21], in their study on the control of thyroid hormone secretion in normal subjects receiving iodides. In their study (Vagenaki et al, 1973) [21] there was exogenous administration of iodides in the form of potassium iodide to normal male volunteers which revealed significant decrease in serum thyroxine (T4) levels. The average serum T4 concentration during the control period was 6.9±1.8 μg/100 ml mean (±SD). After the administration of 1 drop of potassium iodide twice daily for 11 days there was a small but significant decrease in the serum concentration of T4 which continued following the administration of 5 drops twice daily to the 19 days. Although, the observed changes are within normal limits, the study postulated that, iodides specifically inhibit release of T4 in euthyroid individuals which may have contributed to the slight decrease in serum T4 levels. The variation observed can be due to the difference in the drug (pharmacologic) formulation because the formulation of potassium iodide is quite different from that of Iohexol which is been used as a radiographic contrast media.

Paired Samples Statistics of contrast patients revealed a significant mean difference between the baseline and immediate post contrast mean thyroxin levels (-0.85543, and that between baselines and 7 days post contrast mean thyroxin levels (-.82174). Significant difference was also seen between post-contrast and 7 days post contrast mean thyroxin level (0.03370). The paired samples statistics of contrast administered patients revealed that the mean difference between the baseline thyroxin levels was higher than observed between that of post-contrast and 7days post-contrast. These observations differ among the non-contrast administered patients group. The Paired mean difference among this group (non-contrast administered) was 0.895312, 0.904687 and 0.009375 respectively. The Paired T-test revealed that there is no significant statistical difference between the mean thyroxin hormone levels among this group. The paired samples statistics of contrast administered patients revealed that the mean difference between the baseline thyroxin levels was higher than observed between that of post-contrast and 7days post-contrast

Pearson's correlation among the contrast administered group, demonstrated a positive correlation between baseline and immediate post contrast thyroxin hormone levels with a Pearson's correlation coefficient (r) of 0.486 within a confidence interval of 0.01 (p value of 0.01). A positive correlation was also observed between immediate post contrast and 7 days post examination thyroxin hormone levels with a Pearson's correlation coefficient (r) of 0.4661 within a confidence interval of 0.01 (p value of 0.01). The non-contrast category, there was no correlation between baseline thyroxin levels with that of immediate post-examination thyroxin levels or 7days post-examination thyroxin levels whereas, a positive correlation was established between immediate post-examination thyroxin hormone levels and 7 days post-examination thyroxin hormone levels with a Pearson's correlation coefficient (r) of 0.601 within a confidence interval of 0.01 (p value of 0.01). While Among this same group there was also there was no correlation between age and thyroxin hormone levels, or BMI and thyroxin hormone levels.

Conclusion

The mean (±SD) thyroxin level among iohexol administered patients in the index study were 6.53±1.58µg/dl, 7.39±1.28µg/dl and 7.36±1.31µg/dl for the baseline, Immediate post-contrast and 7 days post-examination thyroxin levels respectively which show an increase in the serum thyroxin hormone levels after the administration of iohexol. This finding was not observed in the non- iodinated contrast administered group. Paired Samples Statistics of iohexol administered patients revealed a significant mean difference between the baseline and immediate post contrast mean thyroxin levels (-0.834167), and that between baselines and 7 days post contrast mean thyroxin levels (-1.265000). Whereas there was no significant statistical difference between the mean thyroxin hormones levels among patient not administered with iohexol.

Pearson's correlation among the contrast administered group, also demonstrated a positive correlation between baseline and immediate post contrast thyroxin hormone levels with a Pearson's correlation coefficient (r) of 0.486 within a confidence interval of 0.01 (p value of 0.01). Meanwhile there was no correlation between baseline thyroxin levels with that of immediate post-examination thyroxin levels or 7days post-examination thyroxin levels among the non-contrast administered group.

The researcher was bedevilled with the challenge of follow up at home, non-evaluation of other thyroid hormones and correlating the effect of other hormones with that of free thyroxin. The change of the researcher to exclude the possible exogenous ingestion of iodinated substances within the period of study was also acknowledged.

However, the effect of iodinated contrast medium on serum thyroxin level among patients undergoing brain CT patients in our environment showed a marginal but transient elevation in the serum thyroxin hormone levels in these patients following the administration of the pharmacologic agent iohexol being an iodinated radiographic contrast media. Not-withstanding the rise in thyroxin hormone levels after the administration. The thyroxin hormone levels remained within normal limits.

Ethical approval: The study was approved by the

Rivers State Health Research Ethics Committee

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