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كلية التـــراث الجامعة

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thyroid hormone estimation in chronic renal disease patients utilizing the ichroma2 device

تقدير هرمونات الغدة الدرقية للأشخاص المصابين بأمراض الكلى المزمنة بواسطة جهاز

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Abstract: The kidneys naturally control the secretion of thyroid hormones and control metabolism and decay. Chronic kidney disease leads to many relapses and complications in the body, including hypothyroidism, hyperlipidemia, and cardiovascular disease. The aim of the current study is to examine thyroid hormones for people with chronic kidney disease. To detect thyroid dysfunction by the ichroma2 device. This study included 40 people with chronic kidney disease and 40 people without kidney disease who attended Al-Yarmouk Teaching Hospital. Blood was drawn from all people with chronic kidney disease and from normal people who did not have the disease. Chronic kidneys in order to measure urea, protein, creatinine, albumin, and (T3, T4, TSH). The results of this study showed a significant increase in the levels of urea, protein, creatinine, and albumin (TSH, T4, T3) for people with chronic kidney disease compared to normal people who do not have kidney disease. We conclude from this study that people with kidney disease have an overactive thyroid gland

Keywords: the renal, Thyroid gland, Statistical test, CKD, ichroma2 device

1.Introduction

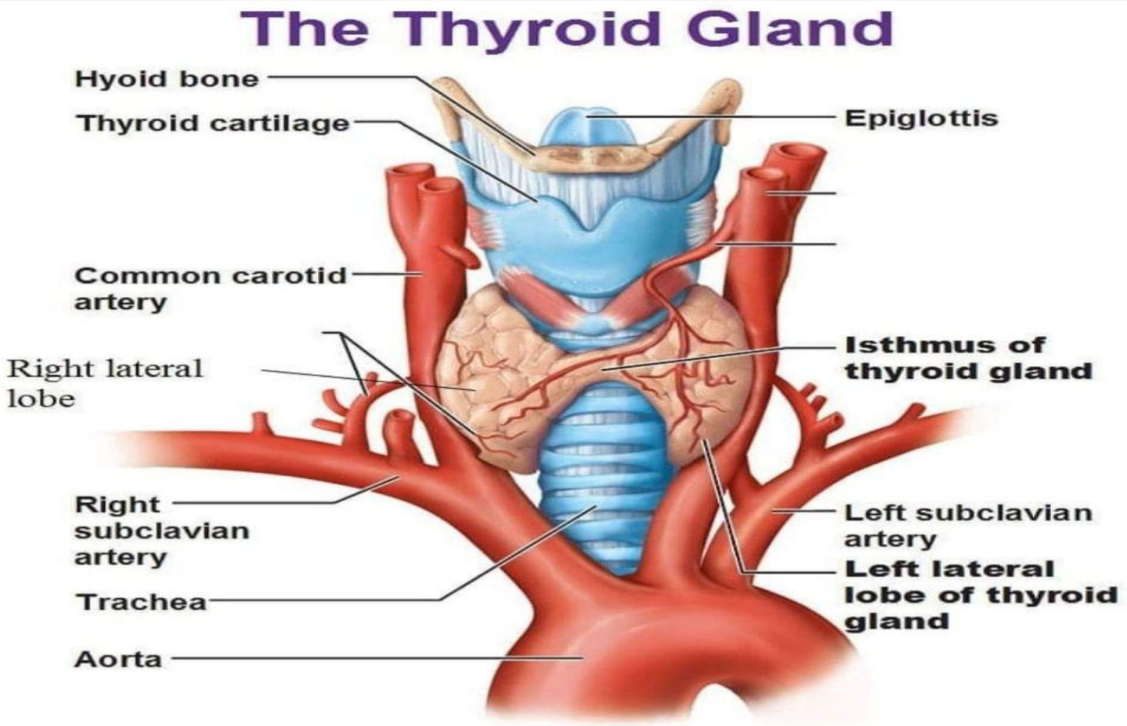
The multiple activities of the kidneys, which are essential for life and health, make them a crit ical organ. The main job of the kidneys is to regulate the amount and pace of urine output whi le removing harmful compounds from the bloodstream through the production of urine. The k idneys may also control blood pressure and keep the balance of fluids and electrolytes (1).A c ondition known as renal failure occurs when the kidneys are unable to remove metabolic wast e products from the blood, including electrolytes, fluid, and the pH balance of extracellular fl uids. Systemic illness, neurological problems without a renal etiology, and renal disease migh t all be the primary causes. Acute and chronic renal failure are two different types of renal fail ure (2). The occurrence of kidney damage or impaired kidney function for at least three mont hs is known as chronic kidney disease (CKD) (3).A growing number of people are experienci ng CKD, which is a global public health issue. Between 5 and 10% of adults worldwide curre ntly have CKD, and each year, millions of people die too soon from problems associated with the disease (4).According to a statistical report from the Iraqi Ministry of Health, the percent age of the top ten causes of death for females by renal disease was 6.2 and for males was 54 i n 2010, within the top twenty causes of death for females were 6.56 and for males were 551 i n 2012, and within the top ten causes of deaths for females were 6.1 and 7.6 in 2017, respecti vely, excluding the Kurdistan region, Al-Anbar, and Salah AL-den.

People with decreased renal function are getting more and more common, making CKD a sev

ere health issue. Endstage renal disease (ESRD), rapid anemia, thyroid dysfunction, and dysli pidemia are among the consequences of CKD progression that are linked to an increased risk of death And disorders of the heart (CVD).
The progression of renal illness can cause kidney failure, which calls for dialysis or a kidney t ransplant to sustain life (5).

Thyroid hormones

An endocrine gland with two lobes located in the neck is called the thyroid. By an isthmus, linked. Under the Adam's apple, near the front of the neck, is where it is located (Figure 1). The thyroid gland, one of the most important endocrine system organs, weighs between 15 and 25 g.(6).The thyroid gland is the first endocrine gland to develop in a person; it starts to form towards the end of the fourth week and starts producing hormones around the middle of the third month. The thyroid's typical blood flow rate is around 5 ml/g per minute and 1 liter per hour(7).
Thyroid hormones are secreted by the thyroid gland and largely affect protein synthesis, development, and metabolic rate. Iodine and tyrosine are used to make triiodothyronine (T3) and thyroxine (T4), the thyroid hormones.The hormone calcitonin, which contributes to calcium homeostasis, is also produce d by the thyroid (8).



Gross anatomy of the thyroid gland, anterior view

Thyrotropin releasing hormone(TRH),which is generated by the brain,controls thyroid hormo ne output by secreting thyroid_stimulating hormone(TSH)from the anterior pituitary gland(9) Several disorders have the potential to impact the thyroid. The most prevalent cause of hypert hyroidism, Graves' disease, an autoimmune illness, is when the thyroid gland generates exces sive levels of thyroid hormones. Hypothyroidism, on the other hand, is a condition marked by inadequate thyroid hormone production. Iodine insufficiency is the most prevalent cause wor

ldwide. Development requires the production of thyroid hormones, and a lack of iodine can re sult in hypothyroidism (10),
In individuals suspected of having thyroid problems, regular blood T3 monitoring is not curre ntly done (only T4 is assessed). A quarter of hypothyroidism patients have low normal T3 rea dings.
Tests the FT4 levels must be done in conjunction with TSH testing in several clinical conditio ns. The pituitary_thyroid axis is mostly disrupted or unstable in clinical conditions when mon itoring of both blood TSH and FT4 is necessary.
In the growth, development, and functioning of the kidney, thyroid hormones are crucial. It is well known that, through a process that is not completely understood, hypothyroidism lowers and hyperthyroidism raises the kidney-to-body weight ratio. On the other side, congenital renal abnormalities are more common in kids with congenital hypothyroidism. These results confirm that thyroid hormones have a significant role in early development. The balance of water and electrolytes in various bodily compartments is also influenced by thyroid activity. The kidney is a crucial target organ for TH activities and plays a part in the control of TH metabolism and disposal. The inability to expel an oral water overflow coincides with the decline in TH activity. This impact is caused by a decline in the GFR rather than a partial inhibition of vasopressin synthesis or a reduction in the re-absorptive capacity in the renal tubule's dilutor segment (11).

2.Materials and Methods

The Yarmouk Hospital hosted this trial from November 2021 to January 2022. forty patients with chronic kidney disease and forty healthy controls were enrolled in the study to evaluate thyroid function and renal function. excluding any patients who have a history of endocrine, hepatic, cardiac, or diabetes.
Each patient and healthy control had a 5-ml sample of venous blood drawn using sterile, disposable syringes. The blood sample was centrifuged for 10 minutes to separate the serum after being allowed to clot at room temperature. Following serum processing, the following measurements of T3, T4, TSH, urea,creatinine,total protein,and albumin levels were made(12).
Statistical test: applying student's T-test to comparison difference between control and patients groups. All results set as mean + SD.

Ichroma2 device

the development of an immunofluorescence analyzer for the detection of serious illnesses as cardiovascular, cancer, diabetes, infection markers, infectious diseases, and hormonal imbalances. It offers quantifiable answers with a very quick turnaround time, enabling clinicians to make choices quickly and improving patient care.The most complex immunoassay tests may now be performed with complete precision and speed by any clinical laboratory thanks to thedevelopment of the i-Chroma Il reader.i-Chroma™ Il reader can perform a wide range of clinical biomarkers including tumor markers (PSA, CEA, IFOB and AFP), Diabetes (HBalc, Micro Albumin & Cystatin C), Hormones (T3,T4, TSH, FSH, LH, Prolactin, Progesterone, hCG, Testosterone, AMH, and Cortisol), Infection (CRP, PCT & ASO), Infectious Diseases (HBsAg, HCV, Dengue, Rota Virus & Influenza), Rheumatoid Arthritis (RF & Anti-CCP), Cardiac Markers (Tn I, CK- MB, Myoglobin, hsCRP, D-Dimer & pro-BNP) and gastrointestinal (Calprotectin and H.pylori). Others include ferritin and vitamin D.As new clinical biomarkers are discovered and introduced into clinical practice, the i-Chroma Il reader's expandable memory allows it to be readily modified to meet the new test settings. Hospital management can avoid making irrational additional capital investments thanks to this functionality. i-Chroma Il reader is appropriate for a major.As a backup instrument or in a

hospital lab with reliable power. However, the reader has a dry cell battery compartment, making it even more useful in places with inadequate energy connectivity. This enables the reader to be utilized nearby the patients' homes POCT.

An in-vitro diagnostic tool called the ichromaTM II detects the concentration of analytes in blood, urine, or other samples in a quantitative or semi-quantitative manner. Compared to the ichromaTM gadget of the first generation. IchromaTM II has been enhanced by the addition of a number of new features, including a new touch screen display, user interface, and sophisticated optical system, which offers the user a wide range of tests. Additionally, ichromaTM II was created to enhance wireless connection connectivity and data input efficiency through distinct devices that may be purchased separately. Additionally, an SD card may now be used to update programs quickly. Additionally, using batteries increases portability. One of the main benefits of point-of-care testing (POCT) tools

Technical Specifications

1-Dimensions:276mm (W) X 220mm (L) X 91mm (H)
2-Power:DC 12V/5A
AC/DC Adaptor
Input: 100-240V 50/60Hz, 1.5A
Output: DC 12V/5A
Battery: DC 1.5V X 4ea
3-Display:7 inch touch color LCD
4-Motor:Stepper Linear Actuators(5V, 0.34A)
5-Communication ports:USB 4 ports, LAN Port, USB OTG port
6-Output:LCD, Built-in Printer6-Output:LCD, Built-in Printer

3.Results

A non-significant age difference between the control group (43 plus/minus 0.57) years and patient participants (45 plus/minus 0.33) years is seen in table 1's data. Additionally, urea and creatinine mean levels were considerably higher in the sick group compared to the control group. In contrast to the control group, the patient group had a highly significant drop in total protein and albumin levels

Table 1: Descriptive characteristics of the study groups.

Parameters	Control group	Patients group	P-value
Age (Yrs)	45±0.33	43± 0.57	>0.05
Urea (mg/dl)	30.97 ± 5.1	118.1±1.52	<0.001

Creatinine(mg/dl)	**0.88 ± 0.1**	**5.33±0.23**	**<0.001**
Total protein (mg / d * l)	**7.60±0.43**	**6.37 ± 1.67**	**<0.01**
albumin (mg / d * l)	**43.11 ± 4.88**	**30.88± 5.1**	**<0.001**

P-values <0.05 was considered statistically significant

Results in table (2) show that as compared to the control group, TSH and T4 levels in the sick group were significantly higher. Additionally, the T3 level has decreased significantly more in the sick group than in the control group.

Table 2: Hormonal data in patients and control groups

Parameters	**Control group**	**Patients group**	**P-value**
TSH (MIU/ml)	**2.73 ± 0.33**	**4.96± 1.72**	**>0.001**
T3 (pnm/l)	**6.06 ±1.39**	**5.96 ± 1.82**	**<0.001**
T4 (pnm/l)	**10.35 ± 3.1**	**13.57 ± 2.86**	**<0.001**

P-values <0.05 was considered statistically significant

4.Discussion

The many metabolic pathways inside human biochemical responses depend heavily on thyroid hormones. Any change in the blood thyroid hormone levels directly affects the metabolism of many organs, including the kidney, and modifies the normal metabolic route of numerous organs (13). The healthy functioning and physiological development of the kidneys depend critically on thyroid hormones, hence thyroid diseases have a direct negative impact on renal function. Low serum T4 levels are a symptom of hypothyroidism, and T3 or T4 levels are mostly lowered. Because of this, TSH is biosynthesized in quantities that are above the "high range of normal value" (14).

The hyperthyroidism found in the current investigation was thyroid dysfunction in CKD patients. Compared to other research, we discovered a greater frequency of thyroid dysfunction in CKD patients. T3, the most metabolically active thyroid hormone, can be lowered in ESRD patients even when TSH levels are adequate. While thyroid gland synthesis of T3 is normal and T3 clearance rates are normal or lowered, like in other non thyroidal disorders, decreased T3 levels in ESRD patients are mostly caused by the decreased peripheral tissue conversion of T4 into T3 (15).

We found high significance for TSH across CKD, which suggests that TSH level rises as renal impairment progresses (which is indicated by a decrease in GFR). These outcomes concur with Song SH's conclusions (16). In a study in Saudi Arabia, there was a significant decrease in levels of serum totalT3, total T4 and total protein and albumin levels in CKD patients when compared with the controls. There was a significant increase in the level of TSH in the CKD patients compared with the controls .

This study does have some drawbacks. First, the exclusion criteria did not take into account how nutrition (calorie intake or dietary composition) affected thyroid hormone status. Finally, because this study was retrospective in nature, we were unable to accurately capture the co-morbidities of the patient and the rationale for the thyroid function test visit.

5. Conclusions & Recommendations

Thyroid gland dysfunction was present in CKD patients (hypothyroidism). And this research revealed that CKD patients had a significant prevalence of low T3 syndrome. Furthermore, even with a normal TSH level, serum T3 levels were linked to the severity of CKD.

According to the results presented in this work, the study recommends the following:

1. More research is needed to determine whether thyroid function in CKF is associated with blood pressure and cardiovascular disease.
2. Patients whose renal function is failing should have their thyroid function evaluated.

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تقدير هرمونات الغدة الدرقية للأشخاص المصابين بأمراض الكلى المزمنة بواسطة جهاز2ichroma

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الكلى تتحكم بشكل طبيعي في إفراز هرمونات الغدة الدرقية وتتحكم في الايض والتفسخ .امراض الكلى المزمنة تؤدي إلى العديد من الانتكاسات والمضاعفات في الجسم منها ضعف الغدة الدرقية وفرط شحميات الدم وأمراض القلب الوعائية.الهدف من الدراسة الحالية هو فحص هرمونات الغدة الدرقية للأشخاص المصابين بأمراض الكلى المزمنة للكشف عن الخلل في الغدة الدرقية بواسطة جهاز .ichroma2
هذه الدراسة كانت تتضمن 40شخصا يعانون من مرض الكلى المزمن و40شخصا من الذين ليس لديهم مرض كلى الذين راجعو مستشفى اليرموك التعليمي .تم سحب الدم من جميع الأشخاص المصابين بأمراض الكلى المزمنة ومن الأشخاص الطبيعيين الذين ليس لديهم مرض كلى مزمن لأجل قياس اليوريا والبروتين والكرياتنين والالبومين و.(T3,T4,TSH)ظهرت نتائج هذه الدراسة زيادة كبيرة في مستويات اليوريا والبروتين والكرياتنين والالبومين(TSH,T4,T3) للأشخاص المصابين بأمراض الكلى المزمنة بالمقارنة من الأشخاص الطبيعين الذين ليس لديهم امراض الكلى .نستنتج من هذه الدراسة أن الأشخاص المصابين بأمراض الكلى لديهم فرط في نشاط الغدة الدرقية

الكلمات المفتاحية: الكلى, الغدة الدرقية, مرض الكلى المزمن, جهاز تحليل هرمونات الغدة الدرقية, اختبار احصائي

[1]الباحثة: هندسة تقنيات الأجهزة الطبية