

## Study the Changes of Thyroid Hormones Levels Following Major Urological Surgery

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### Abstract:

This study was designed to evaluate the effect of major surgery on thyroid hormones and thyrotropin in patient undergoing major lower abdominal surgery. The study included fifty patients scheduled for elective major lower abdominal surgery, the serum levels of T3, T4 and TSH were determined one day preoperatively, intraoperative, one day postoperatively, two days postoperatively, and rT3 was determined one day preoperatively, and one day postoperatively. We observed that the levels of (T3, T4, TSH) increased significantly ( $P < 0.05$ ) intraoperatively, one day postoperatively the levels of T3 and T4 reduced significantly ( $P < 0.05$ ), while TSH reduced not significantly ( $P > 0.05$ ), and two days postoperatively T4 and TSH returned to increase significantly but T3 not significantly ( $P > 0.05$ ). rT3 increased not significant ( $P > 0.05$ ) in one day postoperatively. It has been proposed these changes due to surgical stress that inhibits peripheral conversion of T4 to T3 by inhibiting peripheral 5'-deiodinase activity, also The absence of pituitary response to changes in serum levels of T3 and T4. According to the results of this study there is a transient abnormality in thyroid function tests in patient undergoing elective major surgery and this abnormality due to surgical stress.

**Key words:** Major surgery, Thyroid hormones, Thyrotropin hormone.

### Introduction:

The thyroid gland secretes two significant hormones, thyroxine and triiodothyronine, commonly called T4 and T3 respectively. Both of these hormones have the profound effect of increasing the metabolic rate of the body. Complete lack of thyroid secretion usually causes the basal metabolic rate (BMR) to fall 40 to 50 percent below normal[1]. rT3 is a molecule that is an isomer of triiodothyronine (T3), It is derived from thyroxine (T4) through the use of [deiodinase](#). The major regulator of thyroid is Thyroid stimulating Hormone (TSH); TSH stimulates a number of processes in the thyroid leading to thyroid hormone secretion[2]. Critical illness, and

surgical stress, has been associated with the changes in thyroid function tests. These changes in the short term are primarily a decrease in (T3) levels. Although a decrease in TSH level is observed, this condition is known as the euthyroid sick syndrome[3,4]. Under stress conditions, the conversion of T4 to T3 is inhibited, thus shunting T4 conversion from T3 towards rT3. Consequently, there is a widespread shutdown in T3 binding across the body [5].

The present study aims to determine the effects of surgical stress on thyroid hormones (T3, T4, and rT3), and Thyrotropine (TSH).

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### Materials and Methods:

For this study, 50 patients (males (36), and (14) females), with age range (35-75) years (Mean±SD 57.5±11.5) had been selected from the urological department of AL- Yurmok Hospital located in the city of Baghdad, Iraq during December 2012 to April 2013 who underwent elective major lower abdominal surgeries (such as Cystectomy, Prostatectomy, and Redo reimplantation of ureter) patients received general and loco-regional anesthesia. Exclusion criteria were infants and adolescent, pregnant, a history of thyroid disease and thyroid surgery, uncontrolled diabetes, uncontrolled hypertension, history of trauma, emergency cases, acute myocardial infraction, and liver disease with derangement of liver function. All patients were in stable control general conditions.

Venous blood samples were collected from each patient one day preoperative, intraoperative, one day postoperative, and two days postoperative, for measuring thyroxin (T4)(Human, Germany kit), triiodothyronine (T3) (Human, Germany kit), and thyrotropin (TSH) (Human, Germany kit), and for measuring revers triiodothyronine (rT3) (CUSABIO, China kit) the blood samples was collected one day preoperative, and one day postoperative. Each kit was supplied with instruction for hormone assay by ELISA (USA). Analysis of data was carried out using the available statistical package of SPSS-18 (Statistical Packages for Social

Sciences –version 18 "PASW" Statistic).

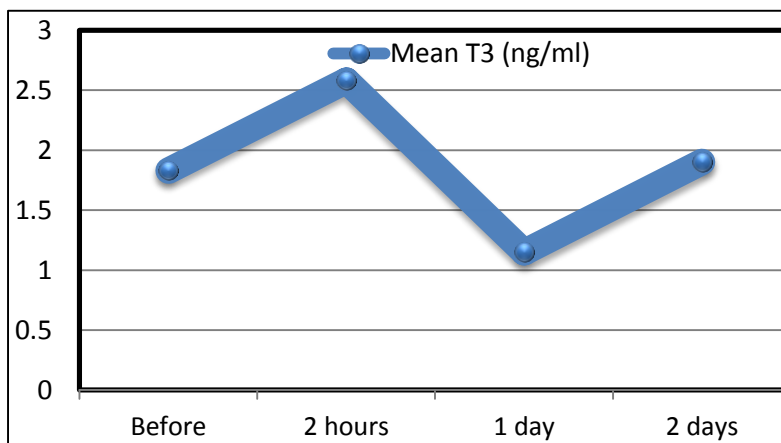
### Results:

The mean serum T3, T4, and TSH levels were increased intraoperative significantly ( $P<0.05$ ) from the baseline value, one day postoperative T3 and T4 reduced significantly ( $P<0.05$ ), while the reduction in TSH was not significantly ( $P>0.05$ ) compared with preoperative value, then two days postoperative these hormones return to increase significantly ( $P<0.05$ ) with T4 and TSH but not significantly ( $P>0.05$ ) with T3. See tables and figures (1, 2, 3), The mean serum rT3 level was not significantly ( $P>0.05$ ) increased one day postoperatively see table and figure (4) :

**Table (1) The changes in Mean±SD levels of serum total T3 before, intraoperative, one day, and two days after surgery**

Time of T3 measurements (n=50)	Mean±SD	(Range)
T3 (ng/ml) Before one day	1.83±0.70	(1.0-3.80)
T3 (ng/ml) intraoperative	2.58±1.02	(0.90-5.0)
T3 (ng/ml) After one day	1.15±0.70	(0.20-2.80)
T3 (ng/ml) After two days	1.90±0.85	(0.30-3.80)
P value comparing Before x intraoperative		0.0001*
P value comparing Before x After 1day		0.0001*
P value comparing Before x After 2day		0.682

\* Significant at ( $P>0.05$ )

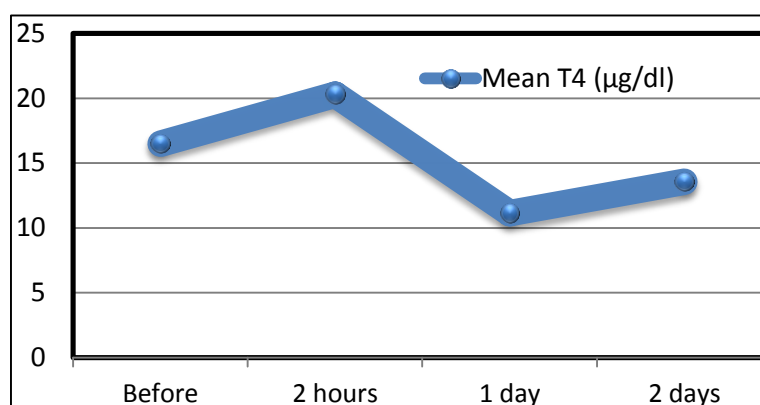


**Fig. (1) The changes in Mean±SD levels of serum total T3 before, intraoperative, one day, and two days after surgery**

**Table (2) the changes in Mean±SD levels of serum total T4 before, intraoperative, one day, and two days after surgery**

Time of T4 measurements (n=50)	Mean±SD	(Range)
T4 (µg/dl) Before one day	16.50±5.83	(1.0-25.0)
T4 (µg/dl) intraoperative	20.29±4.78	(2.20-26.80)
T4 (µg/dl) After one day	11.15±6.68	(1.30-23.60)
T4 (µg/dl) After two days	13.56±8.04	(1.0-29.70)
P value comparing Before x intraoperative		0.001*
P value comparing Before x After 1day		0.0001*
P value comparing Before x After 2day		0.027*

\* Significant at (P>0.05)

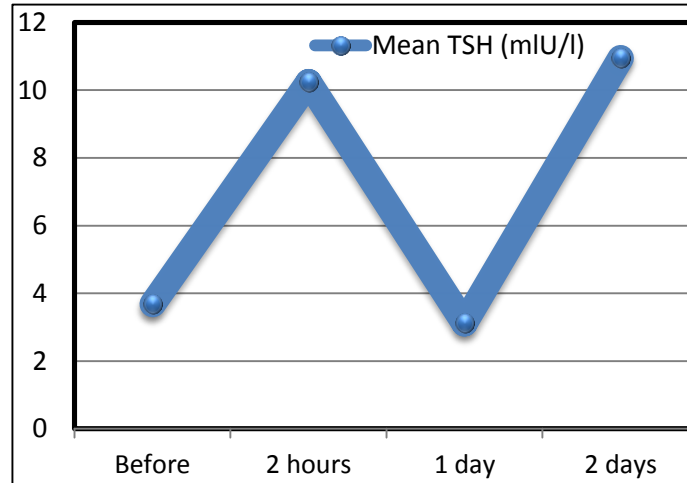


**Fig. (2) the changes in Mean±SD levels of serum total T4 before, intraoperative, one day, and two days after surgery**

**Table (3) the changes in Mean±SD levels of serum TSH before, intraoperative, one day, and two days after surgery**

Time of TSH measurements (n=50)	Mean±SD	(Range)
TSH (mIU/l) Before one day	3.68±2.36	(0.75-13.68)
TSH (mIU/l) intraoperative	10.24±5.28	(2.83-25.47)
TSH (mIU/l) After one day	3.12±1.74	(0.79-7.50)
TSH (mIU/l) After two days	10.95±8.11	(0.001-28.0)
P value comparing Before x After 2hours		0.0001*
P value comparing Before x After 1day		0.092
P value comparing Before x After 2day		0.0001*

\* Significant at (P>0.05)

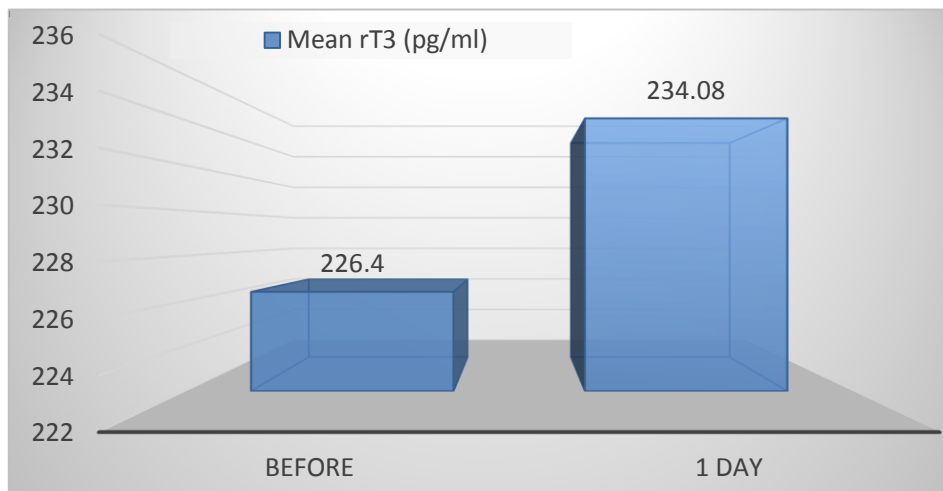


**Fig. (4-5) the changes in Mean±SD levels of serum TSH before, intraoperative, one day, and two days after surgery.**

**Table (4) the changes in Mean±SD levels of rT3 before, and one day after surgery**

Time of rT3 measurements (n=50)	Mean±SD	(Range)
rT3 (pg/ml) Before	226.40±69.63	(120.0-440.0)
rT3 (pg/ml) After one day	234.08±55.54	(130.0-350.0)
P value comparing Before x After 1day		0.433

\* Significant at (P>0.05)



**Fig.(4) the changes in Mean±SD levels of rT3 before, one day after surgery**

**Discussion:**

In the current study the T3 and T4 levels changed affected by surgery as shown in table (1) and (2). There are several studies that reported changes in T3 and T4 after different types of surgeries and at different times, Marina Michalaki et al.[6] showed in study on patients underwent elective abdominal operation that the T3 levels decreased after 2h, 24h after surgery and continued in this decrease until 42h, while T4 results ranged between raising and decline. Elaine et al [3] showed in study on patients underwent elective myocardial revascularization that T3 and T4 levels decreased at the end of the surgery and in the first postoperative day, T3 continued decrease in second postoperative day but T4 increased. The current study disagrees with those studies after a few hours of the operation, but it agrees with them that T3 and T4 decrease after one day of operation, and that T4 returned to the baseline value in the second postoperative day. The decline in T3 may due to acute nonthyroidal surgical illness that inhibits peripheral conversion of T4 to T3 by inhibiting peripheral 5'-deiodinase activity, which decreases T3 production and rT3 metabolic clearance, and also due to Glucocorticoids (that their levels are increased in surgical and other stresses) that can affect thyroid function in many ways[6,3,7]. Ali FEDAKAR1 et al.<sup>[4]</sup> explained that the etiology of non thyroidal illness syndrome (NTIS) has been attributed to a decreased peripheral deionization of T4 to its active compound T3 This is later accompanied by an altered hypothalamic-pituitary regulation, which is evidenced by a decreased hypothalamic TRH mRNA expression In the patients. In the present study T4 levels increased may be due to an increase in serum TSH [8, 6], and it can be largely attributed to a

progressive discharge of T4 from the liver [9]. While it decreased one day postoperative, the mechanism of low serum T4 levels after surgery is not fully understood, and several factors may be involved, they include a decrease in the serum concentration of T4-binding proteins, a structural or a functional abnormality in T4-binding globulin or a dampening of hypothalamo-hypophyseal-thyroid axis function [10].

The changes in hormones under hypothalamic –pituitary control like (TSH) consider the reflex endocrines response to the injury [11]. The (TSH) level increased intraoperative in this study then it decreased in the first postoperative day, and returned to the preoperative value in the second postoperative day as show in table (3), Ioannis Ilias et al. [12]found the same results in a study on patients underwent elective major abdominal operations, such as (colectomy, total gastrectomy, abdominal aorta aneurysm repair, and Whipple's pancreatectomy), where (TSH) was measured immediately postoperatively, on the 1st and 2nd postoperative days, GARY et al.[7] also reported same results when (TSH) level was measured immediately and one day after the operation for patients who underwent cardiac bypass surgery. It was speculated that the postoperative decreased in (TSH) secretion due to the act of Pro-inflammatory cytokines (that produced peripherally by patients with sepsis, trauma (as surgery) and autoimmune disease) directly on the pituitary thyrotroph to impair TSH release [13]. Also the TSH reduction may be due to both hypothalamic and pituitary (by elevated dopamine levels) gland suppression[4,7,11], The surgical stress stimulates the secretion of cortisol by the adrenal gland, and it could be one of the factors responsible for the

inhibition of the pituitary gland and suppress TSH [3,14].

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## دراسة التغيرات في مستويات هورمونات الدرقية المتزامن مع الجراحات الكبرى

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## الخلاصة:

أجريت هذه الدراسة لتقييم تأثير العمليات الجراحية الكبرى على هورمونات الدرقية والهورمون المحفز للدرقية . ضمت الدراسة (50) مريضا خضعوا لعمليات جراحية كبرى اختيارية (غير طارئة) للجزء البطني السفلي، حيث تم قياس مستويات هورمونات الدرقية (T3, T4) والهورمون المحفز للدرقية (TSH) قبل يوم من اجراء الجراحة، و اثناء الجراحة، بعد يوم من الجراحة، وبعد يومين من اجراء الجراحة. وتم قياس هرمون الدرقية الانعكاسي (rT3) قبل يوم من اجراء الجراحة، وبعد يوم من الجراحة. توصلت الدراسة الى ان مستويات كل من (T3, T4, TSH) تزداد معنويا ب ( $P < 0.05$ ) داخل الجراحة، و بعد يوم من الجراحة ينخفض (T3, T4) معنويا ( $P < 0.05$ ) بينما ينخفض (TSH) غير معنوي ( $P > 0.05$ )، ثم تعود لترتفع (T4, TSH) بعد يومين من الجراحة ارتفاعا معنويا ( $P < 0.05$ ) و غير معنوي لمستوى (T3) ( $P > 0.05$ ). كما لوحظ ان مستوى (rT3) يزداد غير معنويا ( $P > 0.05$ ) بعد يوم من اجراء الجراحة. ان هذه التغيرات تعود الى تأثير الجراحة الذي يثبط تحويل T3 الى T4 وذلك بتنشيط فعالية الانزيم (5'-deiodinase)، وكذلك يعود لغياب استجابة الغدة النخامية للتغيرات في مستويات (T3, T4). وفقا لهذه النتائج تم التوصل الى ان هنالك تغير وجيز في اختبار وظائف الدرقية في المرضى الخاضعين لعمليات جراحية اختيارية كبرى وهذا التغير يعود الى الاجهاد الجراحي.