Study the Changes of Thyroid Hormones Levels Following Major Urological Surgery

Fayhaa M. Khaleel*

Ihsan A. AL-Shammari** Noor N. Oda*

Received 10, September, 2013 Accepted 29, September, 2013

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:

thyroid gland The secretes two significant hormones, thyroxin 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 thyroid leading to 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).

*Chemistry Dept. College of Science for Women, Baghdad University. Baghdad, Iraq **AL_Yurmok Hospital, Urology Dept. Baghdad, Iraq.

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 emergency cases. trauma, 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 reveres triiodothyronine (rT3) (CUSABIO, China kit) the blood samples was collected one dav preoperative, and one dav postoperative. Each kit was supplied with instruction for hormone assay by ELISA (USA). Analysis of data was out using the carried available statistical package of **SPSS-18** Packages (Statistical 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 and T4 reduced significantly Т3 (P < 0.05), while the reduction in TSH not significantly (P>0.05) was 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 rT3level 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,
intraop	oerat	ive, o	ne day, ar	nd tv	vo days after	r surger	·y				

Time of T4 measurements (n=50)	Mean±SD	(Range)
T4 ($\mu g/dl$) Before one day	16.50±5.83	(1.0-25.0)
T4 (μ g/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 i	n Mean±SD	levels of	serum	TSH	before,	intraopera	itive,
one day, and two days a	fter surgery						

Time of TSH measurements (n=50)	Mean±SD	(Range)
TSH (mlU/l) Before one day	3.68±2.36	(0.75-13.68)
TSH (mlU/l) intraoperative	10.24 ± 5.28	(2.83-25.47)
TSH (mlU/l) After one day	3.12±1.74	(0.79-7.50)
TSH (mlU/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

Mean± SD	(Range)
226.40±69.63	(120.0-440.0)
234.08±55.54	(130.0-350.0)
	0.433
	Mean± SD 226.40±69.63 234.08±55.54

* Significant at (P>0.05)





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 T4decrease 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 that can affect stresses) thyroid function in many ways[6,3,7]. Ali FEDAKAR1 et al.^[4] 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 be largely attributed can to а 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 pancreatectomy). Whipple's 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 Proinflammatory 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].

References:

- 1-Zhang J, Lazer MA.2000.The mechanism of action of thyroid hormones. Ann Rev Physiol. 62:439-466.
- 2-Caldwell, KL, Jones, R, Hollowell, JG. 2005. Urinary iodine concentration: United States National Health and Nutrition Examination Survey 2001-2002. Thyroid; 15:692.
- 3- Elaine Rahal Rodas Messias1, José Otávio Costa Auler Jr, TSA2, Maria José Carvalho Carmona, TSA3. 2007. Evaluation of serum levels of thyroid hormones in myocardial revascularization. Rev Bras Anestesiol. 57(5): 489-499.
- 4- Ali Fedakar1, Dilek Yazici, Fusun GÜzelmerlÇ, Volkan Temel, Orhan Findik1,Mehmet Balkanay, Hasan Sunar1.2011.Changes in thyroid function tests in patients undergoing cardiac surgery and patients in the intensive care unte. Anatol J Clin Investig; 5(1):1-6.
- 5- Broughton, John. 2008.reverse triiodothyronine. Wikipedia: The missing Menaual: 502.
- 6-Marina michalaki, Apostolos G. Vagenakis, Maria Makri, Fotios kalfarentzos, and Venetsana Kyriazopoulou.2001.Dissociation of the early decline in serum T3 concentration and serum IL-6 rise and TNF_ in nonthyroidal illness syndrome induced by abdominal surgery. The Journal of Clinical Endocrinology & Metabolism. 86(9):4198–4205.
- 7-Gary P. Zaloga, M.D., Bart Chernow, M.D., F.A.C.P., Robert C. Smallridge, M.D.,Russell Zajtchuk, M.D., Kathryn Hall-Hargraves, Boyer, M.D., Ronald M.D.,C. Raymond Lake, M.D., PH.D., Kenneth D. and Burman,

M.D. 1985. A longitudinal evaluation of thyroid function in critically surgical patients. Ann. Surg.201 (4); 456-464.

- 8- Redondo M, Rubio V, de la Pena A, and Morell M.1997. The effects of the degree of surgical trauma and glucose load concentration on thyrotropin, growth hormone and prolactin under enflurane anesthesia. Horm Metab Res 29:66– 69.
- 9- R. W. G. Prescott, P. P. B. Yeo, M. J. Watson, I. D. A. Johnston, J. G. and D. C. Ratcliffe. Evered'. 1979.Total and free thyroid hormone concentrations after elective surgery. Journal of Clinical Pathology. 32: 321-324.
- 10- Shu-hsun Chu, Tien-Shang Huang, Rong-Bin Hsu, Shoei-Shen Wang and Chiu-Jung Wang. 1991.Thyroid hormone changes cardiovascular surgery and clinical implications. Ann Thorac Surg; 52:791-796.
- 11-Manorama Singh. (2003) Stress Response and Anaesthesia .Indian J.Anaesth; 47(6):427-434.
- 12- Ioannis Ilias, Marinella Tzanela , Irini Mavrou , Evangelia Douka d Petros Kopterides ,Apostolos Armaganidis ,Stylianos Orfanos, Georgia Kostopanagiotou, Anastasios Macheras , Stylianos Tsagarakis ,Ioanna Dimopoulou .2007. Thyroid Function Changes and Cytokine Alterations following Major Surgery, Neuroimmunomodulation; 14:243–247.
- 13- Boelen A, Kwakkel J, Platvoet-ter Schiphorst M, Baur A, Kohrle J and Wiersinga WM 2004a.Contribution of interleukin-12to the pathogenesis of non-thyroidal illness. Horm Metab Res. 36(2): 101–106.
- 14- Maria H Warner and Geoffrey J Beckett. 2010. Mechanisms behind the non-thyroidal illness syndrome: an update. J Endocrinol. 205(1), 1– 1.

دراسة التغيرات في مستويات هورمونات الدرقية المتزامن مع الجراحات الكبرى

فيحاء مقداد خليل * احسان على الشمري * * نور نايف عوده *

*قسم الكيمياء /كلية العلوم للبنات/ جامعة بغداد. **مستشفى اليرموك/قسم البولية ،بغداد،العراق

الخلاصة:

أجريت هذه الدراسة لتقييم تأثير العمليات الجراحية الكبرى على هورمونات الدرقية والهورمون المحفز اللدرقية . 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.و تناه الجراحة،بعد يوم من الجراحة،وبعد يومين من اجراء الجراحة، وتناه هرمون الدرقية (T3, T4) قبل يوم من اجراء الجراحة،و اثناء الجراحة،بعد يوم من الجراحة،وبعد يومين من اجراء الجراحة،وبعد يومين من اجراء الجراحة.و اثناء الجراحة،بعد يوم من الجراحة،وبعد يومين من اجراء الجراحة،وت هرمون الدرقية (لاتعكاسي (rT3) قبل يوم من الجراحة،و بعد يوم من الجراحة بوصلت الدراسة الى ان مستويات كل من الانعكاسي (rT3) قبل يوم من اجراء الجراحة،و بعد يوم من الجراحة بوصلت الدراسة الى ان مستويات كل من (20.5) الخل الجراحة، و بعد يوم من الجراحة بوصلت الدراسة الى ان مستويات كل من (20.5) المراحة الجراحة، و بعد يوم من الجراحة بوصل الدراحة الى ان مستويات كل من (20.5) المراحة الجراحة، و بعد يوم من الجراحة الكراحة و تعديم من الحراحة بينخفض((T3, T4, TSH)) معنويا (20.5) المراحة، و بعد يوم من الجراحة بينخفض(13, T4, T5H) معنويا (20.5) (20.5) معنويا (20.5) معنوي لمستوى(T3) معنويا (73, T4, TSH) و غير معنوي لمستوى(T3) معنوي(T3) (20.5) (20.5) و خال الجراحة الخبراحة الخبراحة المعنويا (20.5) معنويا (20.5) معنوي لمستوى(T3) معنويا (20.5) معنويا (20.5) معنويا (20.5) معنويا (20.5) معنوي (20.5) معنوي لمستوى(T3) معنويا (20.5) معنوي لمستوى(T3) معنويا (20.5) معنويا (20.5) معنويا (20.5) معنويا (20.5) معنوي لمعنوي لمستوى(T3) معنويا (73, 74) و خال و خال معنويا (20.5) معنوي (20.5) معنويا (20.5) معنوي (20.5) معنوي لمامية النتائم مم الحامية التغيرات تعود لي مانويا (20.5) معنويا (20.5) معنوي ما مام مراء الجراحة معنوي م مالميان معنوي (20.5)