ISSN: 2755-0206

Journal of Pathology Research Reviews & Reports

SCIENTIFIC Research and Community

Case Report

Open Access

The Influence of Preoperative Thyroid Gland Volume On Intraoperative Time and Postoperative Complications for Total Thyroidectomy Patients

Abdullah Ghafouri[1]*, Hassan Hawsawi[2], Abdulaziz Alanzi[3] and Suzan Alzaidi[4]

[1]Corresponding Author: ORL-HNS Consultant in King Fahad Armed Forces Hospital, Jeddah, Saudi Arabia

[2]Hassan Hawsawi, MD, Department of ORL-HNS in King Abdulaziz University, Jeddah, Saudi Arabia.

[3]ORL-HNS Resident, King Abdulaziz Medical City, Jeddah, Saudi Arabia

[4]ORL-HNS Consultant in King Fahad Armed Forces Hospital, Jeddah, Saudi Arabia

ABSTRACT

Objective: To determine the influence of preoperative thyroid gland volume on intraoperative time and postoperative complications for total thyroidectomy patients in a militaty tertiary hospital.

Design: A cross-sectional analysis for data collected retrospectively from 106 consecutive patients who underwent thyroid surgery for various thyroid diseases at King Fahad Armed Forces Hospital in Saudi Arabia, between January 2015 and December 2019.

Methods: A total of 106 patients (96 Female = 90.6% and 10 males = 9.4 %). Thyroid gland volumes were calculated preoperatively using ellipsoid model. FNA was done per American thyroid association guidelines. The patients underwent total thyroidectomy for benign and malignant thyroid conditions. The intraoperative time was measured starting from the skin incision till wound closure. Patients were followed for perioperative complications. The intraoperative time was correlated with preoperative ultrasonographic sizes of the thyroid glands. Independent sample t-Test done to compare mean US volumes in patients with complications and patients without complications.

Results: The average thyroid gland volume was 43.48 ml the largest volume was 189.454 ml and the lowest volume was 1.46 ml. The average intraoperative time was 2 hours with longest time was 4 hours in a case with thyroid gland volume of 159.9 ml and the shortest intraoperative time was 1 hour and 1 minute in a case with thyroid gland volume of 58.44 ml. Total number of complications was 14 =13.2%. 1 case (0.9%) of expanding hematoma which required surgical drainage on a patient with thyroid gland volume of 34.59 ml, 7 cases (6.6%) of permanent hypocalcemia observed on patients with thyroid gland volumes of (9.16,14.21,19.81, 31.4, 37.57, 53.8, 159 ml). 4 cases (3.8%) of transient unilateral vocal fold immobility observed in patients with thyroid gland volumes of (11.55, 12.94, 26.98, 74.81ml) and 2 cases (1.9 %) of transient bilateral vocal folds immobility observed in patients with thyroid gland volumes of (60.53, 82.99 ml).

Conclusion: The larger preoperative thyroid gland volume the longer operative time. Preoperative thyroid gland volume showed no significant influence on perioperative complications. Hence reviewing preoperative ultrasonographic thyroid gland volume may help the surgeon and operative staff preparations for larger cases.

***Corresponding author**

Abdullah Ghafouri, Corresponding Author: ORL-HNS Consultant in King Fahad Armed Forces Hospital, Jeddah, Saudi Arabia. E-mail: dr_ghafouri2006@hotmail.com

Received: December 12, 2021; **Accepted:** December 17, 2021; **Published:** January 20, 2022

Keywords: Thyroid, Thyroidectomy, Ultrasound Volume, Intraoperative Time, Postoperative Complications

Introduction

Total thyroidectomy is a common surgical procedure used to manage benign and malignant thyroid conditions [1-5]. Although there are different approaches to conduct thyroidectomy like endoscopic assisted thyroidectomy or robotic assisted thyroidectomy, conventional open thyroidectomy remains the mainstay procedure [6]. Despite better understanding of this procedure surgeons assume that large thyroid gland size may contribute to more difficult thyroidectomy (DT) [7-10]. Preoperative prediction of difficult thyroidectomy surgery may result in taking precautions, improve scheduling and minimize perioperative complications. Most difficult thyroid cases prediction is based on subjective references therefore multiple studies

were conducted to determine objective parameters (age, BMI, gender, vascularity, friability, mobility/fibrosis and thyroid gland volumes) they showed inconsistent results [11-16]. Ultrasound (US) nowadays is the main imaging tool to assess thyroid gland. It provides different aspects regarding thyroid gland volumes, nodules characteristics and thyroid gland vascularity [17-20]. In 2008 Karabeyoglu et al conducted a study in turkey to assess US utility as an objective assessment of difficult thyroidectomy using perioperative complications as an outcome [12]. It showed that preoperative thyroid gland volume is important factor in regard to complications, intraoperative time was not considered in this study [12]. In our study the aim was to see the influence of preoperative thyroid gland volumes on difficulty of thyroidectomy using intraoperative time and post-operative complications as outcomes [21,22].

Methodology

Study design: A retrospective cross- sectional study has been conducted on a total of 106 consecutive patients (96 Female = 90.6% and 10 males = 9.4 %).

Study populations: All patients with benign and malignant thyroid conditions were included in the study. Patients with retrosternal thyroid extension, previous thyroid surgeries or cervical lymphadenopathy were excluded from the study. The study was approved by local research and ethics committee of King Fahd Armed Forces Hospital, Jeddah (Approval number: REC 328). Informed consent was waived due to the retrospective nature of the study.

Preoperatively all patients underwent ultrasonography for determining thyroid gland volume using the formula:

V (ml) = 0.479 x D x W x L (cm). As D: stands for depth, W: width and L: length All patients underwent preoperative nasopharyngoscopy to determine vocal folds mobility. FNA done based on ATA 2015 guidelines [23]. Patients demographics including age, gender and BMI were documented preoperatively. All surgical procedures were conducted by the same surgeon the intraoperative time was calculated from the skin incision till wound closure. Postoperatively the patients were stayed in the hospital for at least 24 hours adjusted calcium levels were measured every 6 hours. An adjusted calcium reference range (8.5-10.2 mg/dl) was used a value below 8 was considered hypocalcaemia. The parathyroid hormone was measured post operatively and again one week after at follow up visit. Permanent hypocalcemia was defined as persistent low PTH and Calcium for 1-year period. A permanent vocal fold paralysis was identified as immobile vocal fold for 1-year period. Permanent vocal fold immobility was defined as persistent vocal fold immobility for 1 year from the time of surgery whereas transient vocal fold immobility was defined as return of vocal fold function within 1 year from the time of surgery. Hematoma was defined as significant post-operative collection that required surgical intervention. Final histopathology reports were reviewed taking into consideration the main pathology beside presence and absence of thyroiditis features.

Analysis

Once data were collected a pearson correlation coefficient done between US volumes and intraoperative times. Independent sample T-test was done to compare mean US volumes in patients with postoperative complications and patients without complications. P value of <0.05 was considered statistically significant.

Results

A total of 106 patients were included in the study (Table1). 90.6% (n=96) were female patients and 9.4 % (n=10) were male patients. The average age was 47 years, the youngest patient was 19 years old and the eldest patient was 83 years old. The mean BMI was 31.8 **kg/m²** , the highest was 50 **kg/m²** the lowest was 16.4%. 71.7% (n=76) of the patients were euthyroid, 7.5% (n=8) were hyperthyroid and 20.8% (n=22) were hypothyroid. Mean thyroid gland volume was 43.48 ml the largest volume was 189.454 ml and the lowest volume was 1.46 ml. 38 (35.8%) patients had normal thyroid gland vascularity based on US, 66 (62.3%) had higher thyroid gland vascularity and 2 (1.9%) had decrease thyroid gland vascularity. Fine needle aspirations based on Bethesda classification [24]. showed Bethesda I 3.8 % (n=4), Bethesda II 50% (n=53), Bethesda III 10.4 % (n=11), Bethesda IV 18.9 % (n=20), Bethesda V 14.2%, (n=15) and Bethesda VI 2.8 % (n=3). The average intraoperative time was 2 hours with longest time was 4 hours in a case with thyroid gland volume of 159.9 ml and the shortest intraoperative time was 1 hour and 1 minute in a case with thyroid gland volume of 58.44 ml. Total number of perioperative complications were 13 =12.3 %. 1 case (0.9%) of expanding hematoma which required surgical drainage on a patient with thyroid gland volume of 34.59 ml , 7 cases (6.6%) of permanent hypocalcemia observed on patients with thyroid gland volumes of (9.16,14.21,19.81, 31.4, 37.57, 53.8, 159 ml), 4 cases (3.8%) of transient unilateral vocal fold immobility observed in patients with thyroid gland volumes of (11.55, 12.94, 26.98, 74.81) and 2 cases (1.9 %) of transient bilateral vocal fold immobility observed in patients with thyroid gland volumes of (60.53 and 82.99). Postoperative histopathology results showed multinodular goitre in 52.8% (n=56), lymphocytic thyroiditis 6.6% (n=7), papillary thyroid cancer 27.4% (n=29), follicular thyroid cancer 1.9 % (n=2), Hurthle cell carcinoma 0.9% (n=1), follicular adenoma 7.5 % (n=8), Non- invasive follicular thyroid neoplasm with papillary like nuclear features 2.8 % (n=3).

15.1 % (n=16) showed features of thyroiditis on histopathology whereas 84.9% (n=90) showed no histopathological evidence of thyroiditis. Pearson correlation coefficient done between US volumes and intraoperative time which showed a statistically gland vascularity based on US, 66 (62.3%) had higher thyroid gland vascularity and 2 (1.9%) had decrease thyroid gland vascularity. Fine needle aspirations based on Bethesda classification [24]. showed Bethesda I 3.8 % (n=4), Bethesda II 50% (n=53), Bethesda III 10.4 % (n=11), Bethesda IV 18.9 % (n=20), Bethesda V 14.2%, (n=15) and Bethesda VI 2.8 % (n=3). The average intraoperative time was 2 hours with longest time was 4 hours in a case with thyroid gland volume of 159.9 ml and the shortest intraoperative time was 1 hour and 1 minute in a case with thyroid gland volume of 58.44 ml. Total number of perioperative complications were 13 =12.3 %. 1 case (0.9%) of expanding hematoma which required surgical drainage on a patient with thyroid gland volume of 34.59 ml , 7 cases (6.6%) of permanent hypocalcemia observed on patients with thyroid gland volumes of(9.16,14.21,19.81, 31.4, 37.57, 53.8, 159 ml), 4 cases (3.8%) of transient unilateral vocal fold immobility observed in patients with thyroid gland volumes of (11.55, 12.94, 26.98, 74.81) and 2 cases (1.9 %) of transient bilateral vocal fold immobility observed in patients with thyroid gland volumes of (60.53 and 82.99). Postoperative histopathology results showed multinodular goitre in 52.8% (n=56), lymphocytic thyroiditis 6.6% (n=7), papillary thyroid cancer 27.4% (n=29), follicular thyroid cancer 1.9 % (n=2), Hurthle cell carcinoma 0.9% (n=1), follicular adenoma 7.5 % (n=8), Non- invasive follicular thyroid neoplasm with papillary like nuclear features 2.8 % (n=3).

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15.1 % (n=16) showed features of thyroiditis on histopathology whereas 84.9% (n=90) showed no histopathological evidence of thyroiditis. Pearson correlation coefficient done between US volumes and intraoperative time which showed a statistically found the procedure longer in younger male patients hence, male patients and younger age were predictive for difficult thyroidectomy considering intraoperative time. On the other hand, complications showed not much difference between DT and NDT group [15].

In 2019 D'Orazi et al. developed a 7 parameters score to predict difficult thyroidectomy. The score included "sex, body mass index (BMI), neck length, neck extension, thyroid gland volume, thyroiditis, and increased parenchymal vascularization". The score showed significant correlation with operative time in which operative time was longer in patients with higher score. The score did not predict post-operative complications or length of hospitalization [16].

In the current study we used preoperative US volumes to predict total thyroidectomy difficulty taking on considerations other parameters (age, gender, BMI, US thyroid gland vascularity, thyroid dysfunction, presence or absence of thyroiditis). Preopearive US thyroid gland volume was significantly correlated with operative time. Which is correlated with previous studies. This may help in preoperative planning and operative scheduling [15,16]. However, preoperative US thyroid gland volumes showed no statistically significant relationship with perioperative complications in the contrary to the study done by Karabeyoglu et al on 2008 [12]. Other variables (age, gender, BMI, US thyroid gland vascularity, thyroid dysfunction, presence or absence of thyroiditis) also showed no statistically significant relationship which showed contradicting results in the previous studies [12-16].

There are few limitations with this study. First, despite many studies have been conducted to determine objective predictors of difficult thyroid gland surgeries, these predictors were mainly chosen based on subjective preferences. Second, larger found the procedure longer in younger male patients hence, male patients and younger age were predictive for difficult thyroidectomy considering intraoperative time. On the other hand, complications showed not much difference between DT and NDT group [15].

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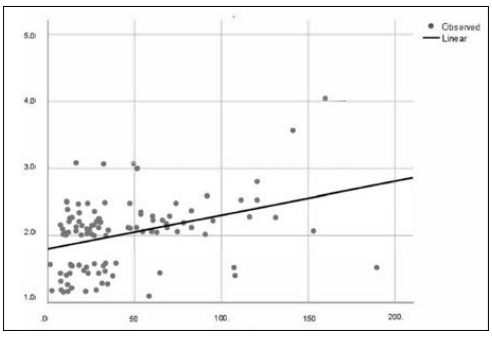
Table 1: Descriptive statistics

N		Minimum	Maximum	Mean	Std. Deviation
Age (years)	106	19	83	47.21	14.192
BMI (Kg/m^2)	105	16.40	50.00	31.86	6.88
US Thyroid Gland Volume (ml)	106	1.46	189.45	43.48	38.42
Operative Time (Hours)	106	1.1	4.04	2.02	.53
Valid N (listwise)	105				

Operative time (hr)



US Thyroid Gland Volume (ml)

Figure 1: Correlation between operative time and thyroid volume

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