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Mini-thyroidectomy technique: impact of volume of the thyroid gland

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ABSTRACT

Background: The classical Kocher incision for thyroid surgery has been the gold standard for more than a century. The present study was conducted to determine the impact of the size of the thyroid gland in planning the length of thyroidectomy incision.

Patients and Methods: This study included 60 patients with benign thyroid disease, indicated for thyroidectomy and admitted to the Department of Surgery, Alexandria University Main Hospital, Egypt, from December 2015 to January 2017. Patients were distributed into 2 Groups of 30 patients each. Patients in Group 1 underwent mini-thyroidectomy, while those in Group 2 underwent conventional thyroidectomy. Data collected prospectively included demographics, the body mass index (BMI), neck circumference (NC), volume of the thyroid gland as measured by two-dimensional ultrasound (US-TV), the duration of operation (DO), the length of the incision (LI), pathological diagnosis, postoperative complication and postoperative cosmetic outcome (POSAS score) were recorded.

Results: The mean length of the incision was significantly shorter in Group 1 patients in comparison to Group 2 (3.4 cm versus 7.7 cm, respectively) ($p<0.001$), and the mean operative time in Group 1 was significantly shorter than that in Group 2 (51.8 ± 12.52 min versus 69.17± 12.20 min, respectively) ($p<0.001$). The cosmetic outcome in Group 1 (POSAS score =19.41±8.06) was significantly better than in Group 2 (POSAS score =25.79 ± 11.45) ($p<0.001$).

Conclusion: Mini-thyroidectomy is a fast-practical procedure, with excellent cosmetic outcome. Preoperative thyroid volume can be used to determine the appropriate incision length.

Key words: Min-thyroidectomy, thyroid volume, incision length

INTRODUCTION

Over the last years, many different minimally invasive procedures have been proposed for the treatment of thyroid and parathyroid diseases, the primary aim being to improve the cosmetic results [(1)]. Nevertheless, the concept of surgical invasiveness cannot be limited to the length or to the site of the skin incision, it must be extended to all structures dissected during the procedure.

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Therefore, minimally invasive thyroidectomy should properly be defined as operations through a short and discrete incision that permits direct access to the thyroid or parathyroid gland, resulting in a focused dissection. In addition, duration of the operation, postoperative pain, complication and success rates, and long-term outcome should also be taken into account to assess surgical invasiveness[(2)] This description includes open surgery with a midline or lateral approach, video-assisted with cervical or extra-cervical incision and endoscopic thyroidectomy techniques.[(3,4)] The aim of this work was to study the size of the thyroid gland as a factor of planning the length of thyroidectomy incision.

PATIENTS AND METHODS

Patients:

The present study was conducted between December 2015 and January 2017, on 60 patients who were admitted to the Surgical Department, Head and Neck and Endocrine Surgery Unit (HNESU), Alexandria University Main Hospital, Egypt. Patients were distributed into two Groups of 30 patients each. Patients in Group 1 underwent mini-thyroidectomy, while those in Group 2 underwent conventional thyroidectomy. Data collected prospectively included demographics, incision length, duration of operation, diagnosis. Patients with thyroid cancer, recurrent thyroid disease, and retrosternal goiter were excluded from the study.

Methods:

All patients were subjected to history-taking, clinical examination and laboratory investigations that included thyroid function tests (TSH, T3, and T4), complete blood count, prothrombin time and activity, and renal function tests (serum creatinine and urea). The body mass index (BMI), neck circumference (NC), volume of the thyroid gland as measured by two-dimensional ultrasound (US-TV), the duration of the operation (DO), the length of the incision (LI), pathological diagnosis and postoperative complication were recorded.

Surgical technique:

Group-1*:* Patients were placed in supine position. Under general anesthesia, a transverse incision (2.5-4.5cm) was made between the cricoid cartilage and the suprasternal notch along the skin crease **(**Figure-1**).**

Figure-1. A (2.5-4.5cm) skin incision.

The platysma was divided and the superior and inferior flaps were raised, the strap muscles were separated longitudinally and the gland was exposed **(**Figure-2**).** The isthmus was freed completely from trachea and divided. The medial margin of the upper pole of one thyroid lobe was exposed and the branches of superior thyroid artery and vein were exposed and divided as close to the upper pole as possible **(Figure-3).** Thyroidectomy was then performed according to the conventional technique. The incision length was measured by a ruler **(**Figure-4**).**

Group-2*:*: Patients were operated upon using conventional thyroidectomy technique. After closure of the wound, the length of the incision was measured by a ruler and pathological examination of the surgically removed specimen of the thyroid gland was done.

Figure-2. Exposure of thyroid gland by mini-thyroidectomy.

Figure-3. Ligation of the superior thyroid artery close to the upper pole.

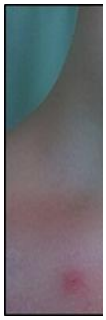
Figure-4. Incision length was measured by a ruler.

Postoperative care and assessment:

Hormonal replacement therapy was started after pathological examination of the surgically removed specimen of the thyroid gland, by Levothyroxine (L-T4)[6] and the patients were followed-up at 2 weeks for assessment of the wound condition and detection of complications. The patients were followed-up one month later by assessment of serum T3, T4 and TSH to control the dose of thyroid hormone. The Patient and Observer

Scar Assessment Scale (POSAS) [7] was the objective method used for assessment of the surgeon and patient satisfaction of the wound condition **(**Figures 5 and 6**)**.

Figure-5. Mini-thyroidectomy one month post-operation.



Figure=6. Conventional thyroidectomy one month post-operation.

Statistical analysis:

Data were analyzed using SPSS software package version 20.0**. (**Armonk, NY: IBM Corp).[7,8] Qualitative data were described using number and percent. Quantitative data were compared using the student t test. Comparison between the two groups regarding categorical variables was done using the Chi-square (X^2) test. When more than 20% of the cells have expected count less than 5, correction for Chi-square was conducted using Monte Carlo correlation (MC). Comparison between more than two groups was done using F-test (ANOVA). A "p" value of <0.05 was considered to be statistically significant [8,9].

Table-1. Comparison of preoperative data between the two studied groups.

Demographic data	Group 1 (n= 30)		Group 2 (n= 30)		Test of significance	
	N	%	N	%		
Gender						
Female	30	100.0	30	100.0	X^2 =7.745	p = 0.405
Male	0	0.0	0	0.0		
Age (years)						
Range	26.0 – 60.0		26.0 – 60.0		t = 0.843	p = 0.403
Mean ± SD	39.90 ± 10.45		42.23 ± 10.99			
Body mass index (kg/m^2)						
Range	19.0 – 33.0		19.0 – 33.0		t = 1.442	p = 0.155
Mean ± SD	27.47 ± 3.74		25.90 ± 4.63			
Neck circumference (cm)						
Range	28.0 – 34.0		28.0 – 34.0		t= 1.152	p = 0.255
Mean ± SD	30.88 ± 1.28		31.43 ± 2.30			
Thyroid volume (cm^3)						
Range	33.0 – 80.0		81.0 – 106.0		t =13.513	p < 0.001
Mean ± SD	56.23 ± 11.88		89.13 ± 6.06			

RESULTS

The present study included 60 female patients. The mean age of patients in Group 1 was 39.90 ± 10.45 years as compared to 42.23 ± 10.99 years in group 2 (t =0.843, p =0.403). The mean body mass index (BMI) in Group 1 patients was slightly higher than that in Group 2 (27.47 ± 3.74 versus 25.90 ± 4.63, respectively) (t =1.442, p =0.155). The neck circumference of patients in group 1 was similar to that in Group 2 (30.88 ± 1.28 cm, and 31.43 ± 2.30 cm, respectively) (t =1.152, p = 0.255). The volume of the thyroid gland in Group 1 patients ranged from 33.0 – 80.0 cm^3 with a mean of 56.23 ± 6.388 cm^3. It was significantly higher in patients that belonged to Group 2, and ranged between 81.0 cm^3 –106.0 cm^3 with a mean of 89.13 ± 6.06 cm^3 (t =13.513, p <0.001) **(**Table-1**)**.

Table-2. Comparison of postoperative data between the two studied groups.

Operative data	Group 1 (n= 30)		Group 2 (n= 30)		Test of significance	
Incision length (cm)						
Range	2.50 – 4.5		7.0 – 10.0		t = 16.927	p < 0.001
Mean ± SD.	3.4 ± 0.78		7.71 ± 0.79			
Duration of operation (min)						
Range	20.0 – 80.0		50.0 – 90.0		t = 5.420	p < 0.001
Mean ± SD.	51.87 ± 12.52		69.17 ± 12.20			
Diagnosis	N	%	N	%		
Multinodular goiter	19	63.3	20	66.7		
Colloid goiter	4	13.4	3	10.0		
Hashimoto's disease	3	10.0	3	10.0		
Controlled toxic goiter	3	10.0	3	10.0		
Thyroid adenoma goiter	1	3.3	1	3.3		

MC: **Monte Carlo** for Chi square test for comparing between the two groups

Table-3. Relation between Incision length with thyroid volume and diagnosis in Group 1.

Thyroid volume (cm^3)	N	Incision length (cm)		Test of significance	
		Min – Max	Mean ± SD		
20 – 40	4	2.5 – 3.0	2.79 ± 0.48	F = 34.944	p < 0.001
40 – 60	21	3.0 – 3.5	3.09 ± 0.29		
60 – 80	5	3.5 – 4.5	4.10 ± 0.17		
Diagnosis				F = 3.732	p = 0.024
Multinodular goiter	19	3.5 – 4.5	3.47 ± 0.33		
Colloid goiter	4	2.5 – 3.0	3.13 ± 0.33		
Controlled toxic goiter	3	2.50 – 3.70	3.07 ± 0.60		
Hashimoto's disease	3	3.0 – 4.5	3.47 ± 0.33		
Thyroid adenoma	1#	4.0			

#: one case was excluded from the comparison
F, p: F and p values for ANOVA test
*: Statistically significant at p < 0.05

The length of the incision was significantly shorter in the Group 1 patients in comparison to Group 2 (3.4 versus 7.7 cm, respectively) (t = 16.927, p < 0.001). Operative time in Group 1 was significally shorter than that in Group 2 (51.8 ± 12.52 versus 69.17± 12.20 minutes, respectively) (t = 5.420, p < 0.001). Pathological diagnosis was similar between both groups with MNG being the most common diagnosis as shown in **(Table-2).**

For further analysis, patients in Group 1 were distributed according to the thyroid volume as follows; 4 patients (13.3%) had a thyroid volume of less than or equal to 40 cm^3, the mean incision length was 2.7 cm ± 0.48 cm. In 21 patients (70.05%) with a thyroid volume between 40 and 60 cm^3, the mean incision length was 3.0 cm ± 0.29 cm. In 5 patients (16.65%) with a thyroid volume between 60 and 80 cm^3, the mean incision length was 4.10 ± 0.57 cm. Diagnosis and pathology had no direct influence on LI, but it could be relevant in an indirect way, because of their influence on VT **(Table-3).**

The mean POSAS score of patients in Group 2 was significally higher in comparison to Group 1 (25.79 ± 11.45 versus 19.41 ± 8.06, respectively) (P < 0.001).

DISCUSSION

Because the nature of surgery is an aggressive form of therapy, surgeons have always tended to reduce the invasiveness of their procedures in order to limit pain and discomfort for their patients. It is widely recognized that smaller incisions with minimal disruption of tissue planes promote more rapid wound healing and yield more cosmetic and functional surgical results. Minimal incision thyroid surgery is one of these newer methods that provide a short and discrete incision that permits direct access to the thyroid gland with a short operative time and acceptable cosmetic outcome, for patients and the surgeon, without the

need of advanced endoscopic instruments and specialized training.[3,4,10,11] In this study, there was no statistically significant difference in the epidemiological parameters like age, BMI, NC and diagnosis between the two studied groups. Mini-thyroidectomy was chosen when the volume of the thyroid gland was less than or equal to 80 cm^3, while the conventional thyroidectomy was performed, for the patients with thyroid volume greater than 80 cm^3. Docimo et al (2013),[12] performed 982 thyroid operations by three approaches (MIVAT, MI open thyroidectomy and conventional thyroidectomy), the minimally invasive approaches were performed when the volume of the thyroid gland was less than or equal to 80 cm^3, and conventional thyroidectomy was performed for the patients with thyroid gland volume greater than 80 cm^3. Brunaud et al (2003),[13] likewise found that volume was the main independent determinant of incision length for thyroidectomy. Ikeda et al (2006),[14] performed 21 operations by direct mini-incision thyroidectomy through a 3 cm central incision; the mean volume of the tumor by preoperative ultrasonography was 37 ± 7 cm^3.

The mean length of incision (LI) in the current study was significally shorter in mini-thyroidectomy than in conventional thyroidectomy (3.4 versus 7.7 cm, respectively). The thyroid gland was successfully removed through a 3-cm incision in 25 (83.35%) of patients in Group 1. The length of incision in the remaining 5 (16.65%) patients was extended to a 4.5 cm. In the study, which was performed on 89 patients who underwent thyroid operations by Ferzli et al (2001),[15] the incision length ranged from 2.5 to 10 cm (average 4.2 cm). They explained that the size of the thyroid gland was the main reason for extending the incision. Rafferty et al (2006),[16] performed 126 thyroid operations. The thyroid pathology was successfully removed through a 5-cm incision in 65 cases. However, the incision was inadequate for the procedure in the remaining 61 cases, so it was extended up to 10 cm.They explained that the size of the gland was the primary reason for extending the initial incision. Terris et al (2005),[17] reported the mean length of incision for minimally invasive procedures as 4.9 ± 1.0 cm.

In the current study, the mean duration of the operation (DO) by mini-thyroidectomy and by conventional thyroidectomy was 51.87 ± 12.52 minutes, and 69.17 ± 12.20 minutes, respectively. Park et al (2001), [18] reported a time of 57.6 ± 11.7 minutes for the minimally invasive open procedure as compared to 85.2 ± 32.3 minutes for the conventional procedure. In the study conducted by Bellantone and colleagues (2003),[19] the mean operative time for hemi- thyroidectomy was 81 ± 3 min in the video-assisted thyroidectomy and 62 ± 4 min in the conventional thyroidectomy. Perigli et al (2008), [10] reported that the operative time for lobectomy by the minimal incision approach and by the conventional approach was 39.9 minutes and 38.4 minutes, respectively.

In the present study; the length of incision in Group 1 was significantly correlated with VT, NC, and insignificantly correlated to BMI. Brunaud et al (2003),[13] documented that VT and BMI are independent predictors of LI. On the other hand, Consorti et al (2012),[20] documented that LI as a variable was significantly correlated to VT and NC and insignificantly correlated with BMI. In Consorti's opinion, neck circumference is a better candidate than BMI as an element on which to base the decision regarding LI.

In this study, the mean POSAS scores of patients who underwent mini-thyroidectomy was 19.41 ± 8.06 out of a total of 110, with a mean OSAS score of 10.71 out of 50, and a mean PSAS score of 8.70 out of 60, as the smallest possible score of 11 indicates a normal skin and the maximum score 110 indicates the worst scar imaginable.[7,21] These results show that mini-thyroidectomy procedure was more attractive to the surgeon and patient regarding the cosmetic outcome of the incision site. Diagnosis and pathology in this study had no direct influence on LI, but these factors could be relevant in an indirect way, because of their influence on VT.

Based on the data presented, it may be concluded that mini-thyroidectomy is a simple, safe, and fast-practical procedure, with better cosmetic results than conventional thyroidectomy, for benign thyroid enlargements with a small to medium-sized volume. Preoperative thyroid volume measurement can be used to determine appropriate incision length for the mini-thyroidectomy approach. Mini-thyroidectomy, has its limitations, the most important is the volume of the thyroid gland.

Conflicts of Interest

Authors declare that there is no conflict of interests regarding the publication of this paper.

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