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Minimally Invasive Flapless Thyroidectomy Versus Conventional Thyroidectomy in Management of Benign Thyroid Disease

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ABSTRACT

The history of thyroid surgery reflects evolution of surgery itself, butshifting focus towards less invasive techniques has resulted in the emergence ofminimally invasive approaches for the thyroid compartment. Objectives: This study wasconducted to determine the safety and efficacy of minimally invasive flaplessthyroidectomy (MIFT) in comparison to conventional thyroidectomy in management ofbenign thyroid disease. Methods: This study included 60 patients with benign thyroiddisease, indicated for thyroidectomy and admitted to Department of Surgery, AlexandriaUniversity Main Hospital, Egypt, from September 2015 to February 2016. Patients weredistributed into 2 groups of 30 patients each. Patients in Group A were submitted toconventional thyroidectomy, while those in Group B were submitted to MIFT. Datacollected prospectively included demographics, the incision length, the time of theprocedure, the intraoperative blood loss, post-operative pain and cosmetic outcome(POSAS score) were recorded. Results: The mean incision length was shorter in GroupB than in Group A (2.65±0.30 cm versus 9.08±0.91 cm respectively) (p<0.001). Themean operative time was longer in Group A than in Group B (109.33±21.44 minutesversus 87.0±33.88 minutes respectively) (p=0.002). The mean volume of intraoperativebleeding in Group A was more than in Group B (82.5±7.51 ml versus 58.83±15.01 mlrespectively) (p<0.001). Post-operative pain assessed using VAS, the mean score was6.91±0.83 in Group A versus 5.79±1.07 in Group B (p<0.001). The cosmetic resultsassessed using POSAS, at day 1, 3 months and 6 months post-operatively. Group A hada mean of 21.43±4.23, 15.87±4.29, and 10.43±4.72 versus 9.93±3.75, 6.73±3.16 and3.73±2.98, respectively (p<0.001). In conclusion, MIFT is a safe and feasiblealternative to conventional thyroidectomy in management of benign thyroid disease,with shorter incision, less bleeding, reduced operative time and better cosmetic results.

Keywords: Minimally invasive, MIFT, incision length, thyroidectomy.

INTRODUCTION

Surgery of the thyroid gland spans the length and breadth of surgery itself. Abul-Qasim (936-1013 AD)(1), Islam's legendary medieval surgeon, is credited with performing the first goiter excision in which the patient just avoided exsanguination, as recorded in his surgical legacy, ‘‘Al-Tasrif’’, in 952 AD. A thousand years later, thyroid surgery is now practiced with effortless efficiency and supreme safety.(1) It is surprising how the history of thyroidectomy becomes lit up as a result of entering the operating theatres by two prominent surgeons. These are Theodor Billroth and Theodor Kocher, who are proclaimed to be the fathers of thyroid surgery.(2)
Driven by patient demand, surgeons have been seeking to preform operations with less pain and better cosmetic results for the patient.(3) Shifting focus of thyroid surgery towards less invasive techniques for better cosmetic results and aesthetic outcomes has resulted in the emergence of minimally invasive approaches for the thyroid gland/compartment.(4)
Having secured the feasibility of the thyroidectomy, surgeons shifted their attention towards the optimization of cosmetic results and diminishment of hospitalization duration as well as of postoperative pain.(5)

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At this point, no one technique for MITS has gained general acceptance; in fact the definition of what comprises a minimally invasive procedure remains controversial. The term itself has been applied to open operations with mid-line and lateral approaches, as well as video-assisted and endoscopic thyroidectomy, which can employ a cervical or extracervical incision. Even among seemingly similar approaches, the definition of minimal in terms of skin incision length can vary from 1.5 to 5 cm. As suggested in a recent editorial, the extracervical endoscopic approaches, whilst they have the advantage of avoiding a cervical incision, require extensive dissection that exceeds that of conventional surgery, and in this regard cannot be considered minimally invasive.(6-10) The cervical approaches, which may or may not utilize video assistance, have been described by many different centers and seem to be safe and feasible for both hemi- and total thyroidectomy.(11)

PATIENTS AND METHODS

Patients:

The present study included 60 consecutive patients suffering from benign thyroid disease, admitted to the Head and Neck and Endocrine Surgery Unit, Surgery Department, Alexandria University Main Hospital, fulfilling the inclusion criteria, during the period from September 2015 to February 2016. Forty eight patients were female and 12 were male, and their age ranged between 7-72 years. Patients were categorized into two equal groups. Group A included Thirty patients were submitted to conventional thyroidectomy (conventional cervicotomy), while patients in Group B were submitted to minimal invasive flapless thyroidectomy (MIFT). Inclusion criteria were limited size of the thyroid gland (less than 7cm in maximal diameter) and no retro-sternal extension. Patients reported larger thyroid glands, retrosternal extension, proved previous thyroiditis, previous surgery or radiotherapy to the neck, proven or suspicion of malignancy by ultrasonography (US/Neck) or by FNAC, were excluded.

Methods:

Preoperatively, all patients were submitted to thorough history-taking, full clinical examination, laboratory investigations, including hormonal assay for T3, T4, and TSH, ultrasonographic examination of the neck and thyroid gland, and ultrasound-guided FNAB when indicated. Using the closed envelop method, patients were randomized into two groups. In Group A, thyroidectomy was performed using the conventional technique, and in Group B, thyroidectomy was performed using MIFT technique.

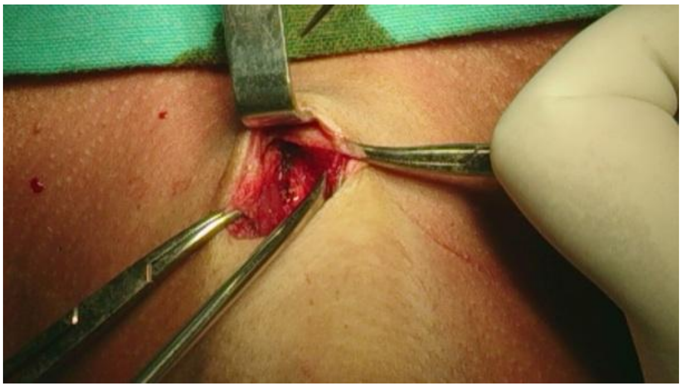
In the operating room, all patients were submitted to general anesthesia and intubation, followed by positioning of the neck in a hyper-extended position using a padded pillow under the shoulders, and a circular one under the patient's head. This was followed by sterilization of the neck from the mid-face above to the nipple-line below including the whole circumference of the neck. Drapping of the patient was done leaving the working field from the lower surface the mandible to the suprasternal notch, covering both sides of the neck. Conventional thyroidectomy using the standard technique was performed in Group A.[12]

Surgical Technique:

In Group B, MIFT procedure started by placing a small incision 2.5-3cm at the upper border of the cricoid cartilage in one of the natural creases of the neck, followed by incision of the platysma along the length of the skin incision. No sub-platysmal flaps were created. Identification of the mid-line of the neck and division of the strap muscles at the mid-line was done (Figure 2) followed by dissection of the plane between the muscles and the anterior surface of the thyroid gland.

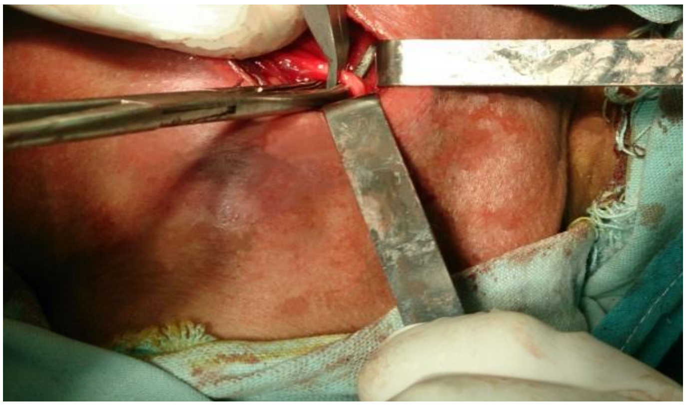
Figure 1: Marking of incision for minimally invasive flapless thyroidectomy (MIFT)

Figure 2: Dissection of mid-line of the neck



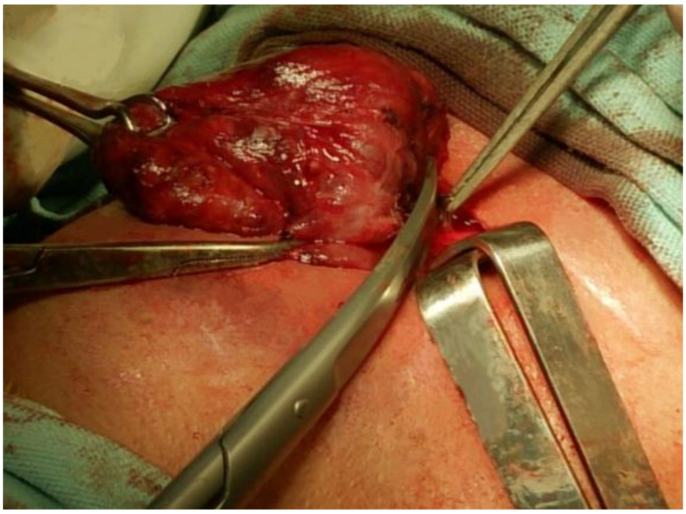
Dissection of the lateral surface of the thyroid lobe with identification, dissection of the middle thyroid vein followed, with securing it using haemostatic techniques (ligation, bipolar diathermy, LigaSure or harmonic scalpel) as available. The upper pole of the thyroid lobe was explored by retraction of the strap muscles laterally using small army navy retractors, and pushing the thyroid lobe medially and inferiorly. By the use of a suction dissector, the upper pole of the thyroid lobe was identified and dissected viewing the external branch of the superior laryngeal nerve (EB-SLN). Then, medium sized metal clips were used to secure the upper pole vessels and division was done to separate the upper pole with preservation of the nerve (Figure 3).

Figure 2: Identification and clipping of the upper pole vessels



Appropriate dissection was then performed to separate and preserve the parathyroid glands securing the branches of the inferior thyroid artery close to the thyroid gland surface, after giving the feeding supply to the parathyroid glands. Safe and appropriate dissection then followed to identify, separate and preserve RLN as it passes postero-medially to the thyroid lobe. A single tie of one or more was applied to the Berry's ligament vessels as it runs very intimate to the course of the RLN (Figure 4).

Figure 3: Identification division of Berry's ligament vessels



Dissection of the inferior pole and vessels was continued, followed by dissection of the undersurface of the thyroid gland towards the mid-line to separate it from its bed. In case of total thyroidectomy, the contralateral side was similarly dissected and removed. This was completed by dissection of the isthmus and identification dissection of the pyramidal lobe when found (Figure 5).

Hemostasis was assured after which approximation closure of the strap muscles was done, followed by closure in layers of the wound, with no drain inserted. The operative time and intra-operative blood-loss measurement were recorded in every case. Observational method for assessment of blood loss was used according to saturation of the different sizes of gauze material used during surgery (gauze visual analogue).[13] (Table 1 and Figure 6).

Figure 4: the whole thyroid gland out of the neck showing the small incision

Figure 5: Soaked patties and peanuts for estimation of intraoperative blood loss

Table 1: Mean saturated volumes in commonly used absorptive materials (ml).[13]

Material (cm)	25% saturation	50% saturation	100% saturation
30×30 Lap sponge	25ml	50ml	100ml
10x10 Raytec	3ml	6ml	12ml
Peanut sponge	*N/A	*N/A	1ml

* Partial saturations were unable to be accurately measured

Evaluation of the patient's status post-operatively was achieved according to (1) Duration of hospital stay (2) Assessment of postoperative pain, on a 10-point Visual Analogue Scale (VAS) on the first day post-operatively [14] (3) Seroma formation, defined as central neck swelling in the postoperative period, and confirmed by aspiration of serous fluid[15] (4) Recurrent Laryngeal Nerve (RLN) status, by assessment of voice changes and/or difficulty in breathing, confirmed by indirect laryngoscopy[16] (5) Parathyroid gland status by measurement of postoperative serum calcium at 12 hours postoperatively[17] (6) Cosmetic results of the wound with follow-up of the scar at the first day, 3 months and 6 months post-operatively, using patient and observer scar assessment scale (POSAS)[18,19]Histopathological examination of the excised specimen was performed to determine the nature of thyroid disease.

Statistical analysis

Data were analyzed using IBM SPSS software package version 20.0 **(**Armonk, NY: IBM Corp). Qualitative data were described using number and percent. Quantitative data were described using range (minimum and maximum), mean, and standard deviation. Significance of the obtained results was judged at the 5% level (p< 0.05). The used tests were Chi-square test, Fisher's Exact or Monte Carlo correction for chi-square, Student t-test and Mann Whitney test.

RESULTS

Both groups showed female predominance, and the age distribution was similar in both groups. No significant difference was found in the BMI results. Findings according to history taking and preoperative evaluation were almost identical among patients in both groups as shown in Table 2.

Table 2: Comparison between the two studied groups according to demographic data

	Group A (n=30)		Group B (n=30)		Test of significance	p
	N	%	N	%		
Gender						
Female	23	76.7	25	83.3	χ2 =0.417	0.519
Male	7	23.3	5	16.7		
Age (years)						
Min. – Max.	9.0 – 70.0		7.0 – 72.0		t=1.758	0.958
Mean ± SD.	43.97±15.75		36.40±13.07			
Median	46.50		36.50			
BMI (kg/m²)						
Min. – Max.	14.80 – 39.10		17.60 – 47.0		t=0.915	0.364
Mean ± SD.	30.15±5.02		31.42±5.68			
Median	30.75		30.40			

*test is significant at p≤0.05

Group A included 27 patients who had total thyroidectomy and 3 patients had hemithyroidectomy, while patients in Group B who had total thyroidectomy were 28 compared to 2 patients having hemithyroidectomy (Table 3)(p=1).

Table 3: Comparison between the two studied groups according to surgical procedure

Surgical procedure	Group A (n=30)		Group B (n=30)		χ2	p
	N	%	N	%		
Total Thyroidectomy	27	90.0	28	93.3	0.218	1.000
Hemithyroidectomy	3	10.0	2	6.7		

The mean incision length was 9.08±0.91 cm in Group A, but markedly shorter in Group B, as it was 2.65±0.30 cm (p<0.001). The operative time reported in Group A was 109.33±21.44 minutes, which was much less in Group B with a mean of 87.0±33.88 minutes (p=0.002). The mean volume of intraoperative bleeding in Group A was 82.5±7.51 ml, but was considerably less in Group B having a mean of 58.83±15.01 ml (Table 4) (p<0.001).

Table 4: Comparison between the two studied groups according to different intraoperative parameters

	Group A (n=30)	Group B (n=30)	Test of Significance	P
Incision length (cm)				
Min. – Max.	7.0 – 11.0	2.0 – 3.20	t= 36.767*	<0.001*
Mean ± SD.	9.08± 0.91	2.65± 0.30		
Median	9.0	2.60		
Operative time (minutes)				
Min. – Max.	60.0 – 150.0	50.0 – 180.0	t=3.051*	0.002*
Mean ± SD.	109.33± 21.44	87.0± 33.88		
Median	110.0	75.0		
Blood loss (ml)				
Min. – Max.	70.0 – 100.0	35.0 – 80.0	t= 7.7722*	<0.001*
Mean ± SD.	82.50± 7.51	58.83± 15.01		
Median	80.0	60.0		

*test is significant at p≤0.05

Post-operative hospital stay in Group A patients had a mean value of 1.5±0.68 days, while patients in Group B were all discharged on the first post-operative day (p<0.001). Post-operative pain assessed using VAS was significantly less in Group B having a mean of 5.79±1.07 than in Group A with a mean of 6.91±0.83 (p<0.001). The post-operative complications developed were similar in both groups. Seroma developed in 5 and 2 patients in Group A and B respectively. Wound infection was encountered in 3 patients in Group A and in 2 patients in Group B. Transient hypocalcemia, explained by decreased serum calcium level below 8 mg/dl, developed in 3 patients in Group A and in 2 patients in Group B. All patients with transient hypocalcemia were ordered oral calcium supplementation and rechecked for their serum calcium level after a one-week therapy. Temporary hoarseness of voice was experienced by only one patient in Group A, and improved spontaneously through several weeks, as recorded in Table 5.

Table 5: Comparison between the two studied groups according to post-operative parameters

	Group A (n=30)		Group B (n=30)		Test of Significance	P
	N	%	N	%		
Hospital stay (day)						
Min. – Max.	1.0 – 3.0		1.0 – 1.0		t= 4.0138*	<0.001*
Mean ± SD.	1.50 ± 0.68		1.0 ± 0.0			
Median	1.0		1.0			
Pain (VAS)						
Min. – Max.	5.5 – 8.2		3.5 – 7.6		t= 4.490*	<0.001*
Mean ± SD.	6.91 ± 0.836		5.797 ±1.07			
Median	6.75		5.8			
Complications						
Total	12	40	6	20	$\chi2$=2.857	0.091
Seroma	5	16.7	2	6.7	$\chi2$=1.456	0.424
Wound infection	3	10.0	2	6.7	$\chi2$=0.218	1.000
Hypocalcaemia	3	10.0	2	6.7	$\chi2$=0.218	1.000
Hoarseness	1	3.3	0	0.0	$\chi2$= 1.017	1.000
Follow-up serum Calcium level (mg/dl)						
Min. – Max.	7.0 – 9.60		6.80 – 9.80		t=0.271	0.787
Mean ± SD.	8.70±0.57		8.74±0.47			
Median	8.70		8.80			

*test is significant at p≤0.05 VAS: visual analogue scale.

Histopathological examination after excision showed a non-significant difference between the both groups (p=0.121). Multinodular goiter (MNG) was the diagnosis obtained in most patients in both groups (26 patients (86.6%) in Group A and 20 patients (66.7%) in Group B). Only one case in Group B (3.3%) was found to have uncontrolled toxic goiter (UCTG) who was non-responding to anti-thyroid mediations (Table 6).

Table 6: Comparison between the two studied groups according to post-operative histopathology

Post-operative Histopathology	Group A (n=30)		Group B (n=30)		χ^2	p
	N	%	N	%		
MNG	26	86.7	20	66.7	3.706	0.121
CTG	4	13.3	9	30.0		
UCTG	0	0.0	1	3.3		

MNG: multinodular goiter, CTG: controlled toxic goiter, UCTG: uncontrolled toxic goiter

The cosmetic results were significantly better in patients in Group B than those in Group A. The difference between the two groups was highly significant (p<0.001) when measured at day 1, 3 months and 6 months post-operatively. As shown in Table 7, the mean POSAS score in Group B was 9.93±3.75, 6.73±3.16 and 3.73±2.98, while in Group A it was 21.43±4.23, 15.87±, and 10.43±4.72 respectively. Figure 7 demonstrates the relation between the two studied groups according to the resultant scar POSAS score. Figure 8 shows the looking of the scar 6 months post-operatively in a 35 year old male patient from Group B.

Figure 7: Comparison between the two studied groups according to follow-up assessment. POSAS: patient observer scar assessment scale

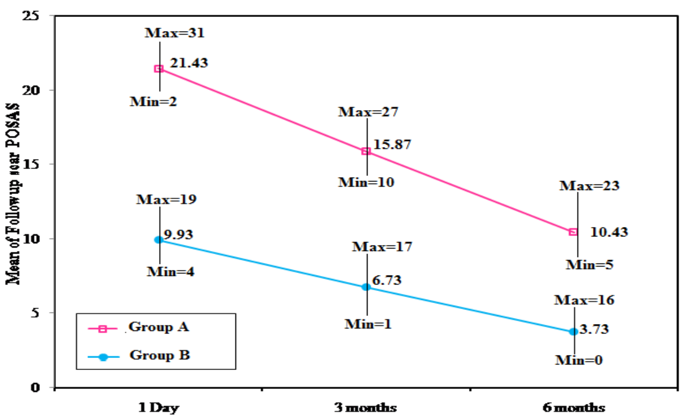


Table 7: Comparison between the two studied groups according to follow up scar POSAS[18,19]

Follow up scar POSAS	Group A (n=30)	Group B (n=30)	Test of significance	p
1 Day				
Min. – Max.	2.0 – 31.0	4.0 – 19.0	t=11.139*	<0.001*
Mean ± SD.	21.43±4.23	9.93±3.75		
Median	22.0	9.0		
3 months				
Min. – Max.	10.0 – 27.0	1.0 – 17.0	t=9.389*	<0.001*
Mean ± SD.	15.87±4.29	6.73±3.16		

Median	15.50	7.0		
6 months				
Min. – Max.	5.0 – 23.0	0.0 – 16.0	t=6.576*	<0.001*
Mean ± SD.	10.43±4.72	3.73±2.98		
Median	9.0	3.0		

*test is significant at p≤0.05

Figure 6: Appearance of scar at months post-operatively in a 35 year old male patient from Group B (POSAS=1)

DISCUSSION

Minimally invasive thyroid surgery (MITS) has expanded in the last decade and is being considered as an alternative to the conventional thyroidectomy, simply because it reduces tissue trauma and postoperative pain, and provides excellent cosmetic results.[20] Many different techniques have been developed for MITS over a short period; these can be broadly classified into pure/or completely closed endoscopic techniques, video-assisted techniques and minimally invasive open surgery.[21-7] Major advantages of MITS techniques include reduced tissue trauma, shorter hospital stay, better cosmetic results, minimal postoperative pain, lower cost of healthcare and, above all, patient comfort.[28]

The extent of surgical resection was similarly distributed in both groups as 27 patients (90%) had total thyroidectomy in Group A compared to 28 (93.3%) in Group B, while hemithyroidectomy was performed in 3 patients (10%) in Group A and in 2 in Group B(6.7%), according to the disease extension through the thyroid lobes. Similar results were obtained in other studies in the literature, as Park and colleagues[29] reported that 49% of the patients were subjected to total or near total thyroidectomy using the conventional method compared to 45.5% of the patients in the minimally invasive group, while 51% of the patients had hemithyroidectomy by the conventional technique in comparison to 45.5% in the minimally invasive group. Also, El Sesy and Behairy[30] documented the same results where 72.5% of the patients were operated for subtotal or total thyroidectomy conventionally and 72% using the limited open procedure, while 27.5% of the patients had hemithyroidectomy using the conventional way compared to 28% in the limited open approach group.[30]

The incision length measured in the present study ranged from 7-11 cm in Group A (mean 9.08±0.91), while in Group B it was 2-3.2 cm (mean 2.56±0.3) showing the marked reduction among patients in Group B (p<0.001). This significant reduction in incision length was also reported in other studies in the literature, as Park and colleagues[29] mentioned a mean value of incision length was 9.6±3.3 cm among patients in the conventional group compared to 3.7±0.7 cm in the minimally invasive group. El Sesy and Behairy[30] performed the procedure of thyroidectomy through an incision with a mean length of 9.6±1.7 cm in the classic approach group compared to 2.8±0.5 cm in the limited open approach group. Ahmed and colleagues[31] did their operation using an incision with a mean length of 4.0±0.37 cm in the mini-thyroidectomy group in comparison to standard length of 10 cm in the conventional group. Also Perigli et al[32] measured the incision length in the conventional group that had a mean of 53.3±2.5 mm, which was significantly shorter in patients in the minimal incision group with a mean of 31.3±0.8 mm. Noori[33] did his thyroidectomies through an incision of 8-10 cm in the conventional group, but in the mini-incision group, the incision was considerably shorter with a range 3-4 cm.

According to the operative time, in the present study it had a mean of 109.33±21.44 minutes in Group A, which appeared to be much longer than that in Group B, with a mean of 87.0±33.88 minutes (p=0.002). The diminished operative time reported in other studies in the literature was not that significant, but it was found that there was less in the minimally invasive techniques than conventionally. In the study done by Park and colleagues[29], the operative time in the conventional thyroidectomy had a mean value of 85.2±32.3 minutes, compared to 57.6±11.7 minutes in the minimally invasive open procedure. El Sesy and Behairy[30] recorded a mean of 75.0±6.3 minutes for conventional thyroidectomy, but the mean duration of the limited open approach was 62.0±8.9 minutes. Perigli et al[32] performed thyroidectomies conventionally in a time with a mean of 65.8±4.8 minutes, while the minimal incision procedure took a mean of 61.6±6.9 minutes to be finished. However, Ahmed and colleagues[31] performed their thyroidectomies classically through a time of a mean of 74.3±16.4 minutes, which was shorter than the time needed for them in the mini-thyroidectomy technique, as it had a mean of 128±26.4 minutes. Also Noori[33] found that thyroidectomy procedures with the conventional method (mean 62±5.5 minutes) were shorter in duration than mini-incision method (mean 82±13.7 minutes). This variation in the time factor between several studies in the literature could be explained by the less experience of these newly developed approaches which take, sometimes, a prolonged learning curve. But with experience and the new emerging facilities and vascular-sealing devices, the minimally invasive procedures can be performed within a similar duration as, or even shorter than, the classic approaches.

Operative blood loss is predicted to be less in the minimally invasive techniques than in the classical conventional thyroidectomy. The blood loss estimated in this study had a mean of 109.33±21.44 ml in Group A, significantly more in volume compared to 87.0±33.88 ml estimated in Group B (p<0.001). Comparable results obtained from the other different studies with similar or less significance. Park and colleagues(29) reported an intraoperative blood loss with a mean of 43.1±21.8 ml in the conventional group, compared to 18.4±15.3 ml. El Sesy and Behairy(30) measurement of blood loss intraoperatively had a mean of 75±6.2 ml in the conventional method, but the loss measured in the limited open approach group had a mean of 60±8.3 ml. The mean volume of blood loss in the conventional method estimated by Perigli et al(32) was 32.8±6.7 ml, but it was less in the minimal incision thyroidectomy procedure (22.9±6.9 ml), with a nonsignificant difference. Noori(33) did not find a considerable difference in operative bleeding measurement between the two groups. The average amount estimated was 70 ml in the conventional group, compared to 60.5 ml in the mini-incision group.

All patients in Group B were discharged in the first day post-operatively, while the post-operative hospital stay in Group A was found to be considerably longer, with a mean of 1.5±0.68 days (p<0.001). Park and colleagues(29) reported also a significant difference in the post-operative hospital stay, as patients in the conventional group were still admitted in the hospital for 4.3±1.6 days post-operatively, in comparison to a mean period of 1.6±0.5 days in the minimally invasive thyroidectomy group. Authors of the other studies in the literature reported a nonsignificant difference in the post-operative stay between both groups of comparison. El Sesy and Behairy(30) recorded a mean duration of 2.6±1.2 days in the conventional group, compared to 1.6±0.5 days in the limited open approach group. Perigli et al(32) documented an almost equal duration with a mean of 28.2±2.5 hours and of 28.2±2 hours in the conventional and minimal incision groups respectively. Noori(33) also reported a post-operative stay period with a mean of 2.3±1.5 days in the conventional thyroidectomy group, compared to 1.2±0.5 days in the mini-incision group.

Post-operative pain was assessed using a 10-point VAS, and measured in the first day post-operative, showed a highly significant less pain in patients in Group B than in Group A. The mean score recorded by the patients in Group A was 6.91±0.84 compared to 5.79±1.07 in Group B (p<0.001). Similar results were obtained in the study done by Noori(33), which showed a significant reduction in pain felt in patients in the mini-incision group than in the conventional group (mean VAS score 2.6 and 3.9 respectively). Perigli et al(32) also reported a considerably less pain in the minimal incision group (mean 1.2±0.4) than in the conventional group (mean 3.2±0.4) using VAS, but in a reversed manner with the 0-point means no pain and 10-point is the maximal pain (p<0.05). Other authors measured the pain subjected post-operatively by the number of patients who required oral analgesics. Park and colleagues(29) mentioned in their study that 89% of the patients belonged to the conventional group required pain killers post-operatively compared to only 26% in the minimally invasive group. El Sesy and Behairy(30) also reported a need for post-operative analgesics in 56% of patients who belonged to the conventional thyroidectomy group, while 28% of those in the limited open approach group required analgesics.

Post-operative complications developed were comparable between both groups, with the nonsignificant difference found in the most studies in the literature. Seroma development after surgery, in this study, was documented in 5 patients (16.7%) in Group A, and in 2 patients (6.7%) in Group B (p> 0.05). Park and colleagues(29) similarly found that patients who developed seroma were equal in both groups. Also Noori(33) documented that out of 22 patients in each group, seroma developed in 3 patients in the conventional group and only one in the mini-incision group. Transient hoarseness in voice, denoting injury to RLN, wound infection and transient hypocalcemia (parathyroid gland dysfunction) were seldom met, and the distribution was similar in both groups of the study. The other studies in the literature also reported the same insignificant findings.

Cosmetic results, as the most appreciated demand in patients subjected to such surgeries, were assessed using different methods in different studies in the literature. In our study, scar assessment and follow-up of the cosmetic results of both techniques was recorded using POSAS, at day 1, 3months and months post-operatively. Considerable difference and better satisfaction and cosmetic results were met in patients belonged to Group B than in Group A, through the whole follow-up period. In the first day after surgery, the mean score was 21.43±4.23 in Group A, compared to 9.93±3.75 in Group B (p<0.001). At 3 months, the mean score in Group A was 15.87±4.29, and was better in Group B with a mean of 6.73±3.15 (p<0.001). At 6 months, the score was much more better, as the mean score was 3.73±2.98 among patients in Group B, compared to 10.43±4.72 in Group A. Ahmed and colleagues(31) mentioned that the cosmetic results were excellent according to patient satisfaction, when assessed 6 weeks post-operatively, in the mini-thyroidectomy group than in the conventional group. Perigli et al(32) used a numerical score system in assessment of the scar. They reported a mean score of 8.4±0.3 in the minimal incision group, which was much better than that of the conventional group with a mean of 3.8±0.9 (P<0.05). While Noori(33) assessed the scar cosmetic results using the mean satisfaction rate subjected by the patients. It had an average of 8.8 in mini-incision group, which more significantly better than the conventional group with an average of 5.2 (p<0.001). With conventional surgery, a scar of 8 cm or more was typically very apparent on the exposed aspect of the neck, while with MIFT procedures, any scar left is nearly invisible after 3 to 6 months. Moreover, patients who receive is approach have faster wound healing than in the conventional group.

In conclusion, MIFT appeared to be a safe and feasible alternative to classical thyroidectomy in management of selected cases of benign thyroid disease, with shorter incision length, lower bleeding, reduced operative time, diminished post-operative hospital stay, less pain, similar complication rates and better cosmetic results.

Conflicts of Interest

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

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