

Comparison between Open Mini-incision Thyroidectomy and Conventional Thyroidectomy: Clinical Experience and Literatures Review

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ABSTRACT

Background: Thyroid surgery is most common endocrine surgery in general surgical practice.

Objectives: the aim of this work is to evaluate the feasibility, benefits and outcomes of open mini-incision thyroidectomy and compared the results with that of conventional thyroidectomy. The comparison between the two groups was in term of incision length, amount of blood loss, time of operation, postoperative pain, hospital stay and the cosmetic outcomes.

Type of the study: this is a single-blinded randomized controlled study

Methods: This study compared the advantages and outcomes of 22 patients subjected to mini-incision thyroidectomy (Group A) with the equal numbers of patients subjected to conventional thyroidectomy (Group B).

Results: the operative time was statistically longer in minithyroidectomy than with conventional thyroidectomy. Postoperative pain score in the operative day and 24 hours postoperatively showed a significant difference in favor of mini-incision thyroidectomy. The cosmetic outcome and patients satisfaction was significantly and far

better in minithyroidectomy group. The results between both groups were comparable regarding the postoperative complications. The hospital stay was shorter in the mini-incision group than in conventional group but the difference was not significant.

Conclusions: mini-incision thyroidectomy is simple, safe and practical procedure that achieves the same results and the rate complications to the conventional thyroidectomy with less post operative pain and better aesthetic results. It is easily converted to conventional technique when necessary without added risks .

Keywords: Open minithyroidectomy, conventional thyroidectomy, minimally access neck surgery.

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Thyroid operations are the most common endocrine surgical procedures[1]. Conventional thyroidectomy is traditionally completed through a Kocher incision which is approximately 10 cm long, requires elevation of large flaps, to allow complete exposure of thyroid gland and it is the gold standard incision for many decades. Minimally invasive approach is new advancement in thyroid and parathyroid surgery. The main advantages of this approach include improved cosmesis resulting in greater patient satisfaction, less postoperative pain and hospitalization.[2]

Various technique of minimally invasive surgery have been mentioned and can be classified into open approach by a small incision , defined as less than 4 cm ; endoscopic surgery and video-assisted operations.[3] Minimally invasive thyroid surgery (MIT) has been demonstrated to be safe. Minithyroidectomy is an operative procedure that reduce the extent of surgery. Small incision, about 3 to 4 cm is made in the neck along the natural skin crease. [4]

The aims of minimally invasive surgery are: obtaining of the same results as those with conventional thyroidectomy, smooth and uneventful post-operative course, less traumatic surgery, short hospitalization and

better cosmetic outcomes. Patients also should have less pain after minithyroidectomy due to decrease in the magnitude of tissue dissection. The patients were considered feasible for mini-incision thyroidectomy on the basis of certain criteria, mainly the volume of the gland and the type of the disease.[5] The aim of this study is to investigate the applicability and suitability of open minithyroidectomy for selected patients with various thyroid disorders.

Modern management concept of thyroid disorders had been evolved at the beginning of the 19th century and it is still evolving till recently. Thyroid disease primarily affects young adult and middle-age female patients who usually concerned about the cosmetic results after thyroid surgery.[2,6]

Thyroidectomy has very low morbidity and mortality rate provided it performed by an expert surgeon[6] The standard Kocher incision is most common approach for many decades. The aim of surgery is to remove the gland , preserving the recurrent laryngeal and external branch of superior laryngeal nerves, parathyroid glands with good haemostasis. This approach usually ends with visible scar on the exposed anterior aspects of the neck.[3,6,7]

Traditional thyroid surgery has evolved dramatically from the end of 20th century when several different approaches were introduced gradually into the surgical practice. Minimally invasive neck surgery is one of the recent and interesting advances in this field.[7]

Patients and methods: This is a single-blinded randomized clinical study conducted in one major e hospital in Basra, Iraq comparing mini-incision thyroidectomy with conventional thyroidectomy from April 2010 to March 2014. The studied population included 44 patients, 36 female and 8 male with age range from 22 to 64 years, presented with simple unilateral and bilateral nodular goiter. All patients were subjected to detailed history and full clinical examination in addition to laboratory investigations. Ultrasound examination of the neck was done for all patients. CT scan of the neck and superior mediastinum was done for selected patients when there is a suspicion of retro-sternal extension. Preoperative indirect laryngoscopy was done for all patients for assessment of vocal cord movement. The participants were submitted to fine needle aspiration and cytology. They were considered ineligible and excluded if the results showed thyroid carcinoma. All the operations were conducted by single surgeon. The patients were blinded preoperatively to the specific approach and they were classified into two groups:

Group A: including 22 patients subjected to mini-incision thyroidectomy through a 4 cm incision.

Group B: including 22 patients who undergone conventional thyroidectomy.

The exclusion criteria were toxic non controlled diffuse goiter, thyroid cancer, retrosternal goiter, recurrent goiter, thyroiditis, thyroid volume more than 65 ml by ultrasound, thyroid nodule size more than 6 cm and a history of prior neck operations .

In Group A: the operative technique was carried out by making a 4 centimeters skin incision along the skin creases about 3 centimeters above the sternal notch. The strap muscles were divided in the midline and separated from thyroid gland. The thyroid gland was exposed and the isthmus was freed completely from the trachea and divided, followed by identification and ligation of superior thyroid artery, then ligation of inferior thyroid vessels, with the medial rotation of the gland, the middle thyroid vein then exposed, which is now ligated and divided. The recurrent laryngeal nerve and parathyroids were identified during surgery and preserved. The thyroid lobe delivered through the incision and resected. The other lobe was removed in a similar way when indicated. The insertion of closed Redi-vac suction drain was optional. The operation is completed by approximation of the strap muscles; skin is sutured and closed by a subcuticular interrupted 3/0 catgut suture.

In Group B: patients were submitted to the conventional thyroidectomy through the standard 8-10 cm Kocher incision. The parathyroid glands and recurrent laryngeal nerve and were identified, isolated and thus preserved, and the wound closed similarly as for mini- incision thyroidectomy.

During this study, the measurement of procedure time, incidence of temporary and/or permanent complications mainly injury of recurrent laryngeal nerve ,postoperative bleeding and haematoma formation, and hypocalcaemia were recorded and evaluated. Besides, assessment of post operative pain, length of incision, patient satisfaction with cosmetic results, and period of hospital stay are also studied. The operative time was calculated from beginning of incision to last stitches in the skin closure. The integrity of recurrent laryngeal nerve was examined immediately after surgery by assessment of vocal cord mobility by anesthetist during extubation. Postoperative haematoma was deemed significant only if it necessitate a return of the patient to operative theater for haemostasis. Symptoms and signs of hypocalcaemia were looked for and investigated mainly after the first and second day postoperatively.

Pain postoperatively was assessed using a 10-point visual analog scale (VAS) when the "no pain" on the 0 left side of the scale and the worst intolerable pain on the other 10 score side. The patients were asked to record their pain 6, 12, 24 and 48 hours after surgery. VAS score 1-3 is considered mild pain, 3-6 moderate pain and more than 6 is considered sever pain. Satisfaction with cosmetic results was measured using a 10 point VAS also during the 3 months follow up period.

Results: There were 19 female and 3 males patients undergoing mini-incision in group A. Group B included 17 females and 5 males patients undergoing conventional thyroidectomy. The clinical characteristics of the patients in both groups were identical. Female patients were predominant in both groups. The volume of thyroid lobes and the size of their nodules were comparable in both groups as well. The characteristics of patients are shown in table (1).

Table 1: Clinical characteristic of patients in both groups

Patients characteristic	Mini-thyroidectomy	Conventional thyroidectomy
Age (years)	22-60 (mean 42.3)	24-64 (mean38.6)
Sex (male/female)	3/19	5/17
Size of nodules(cm)	2.5-4.5 (3.2)	1.8-5.5(3.9)

Type of pathology	14	6
- Nodular(one lobe)	6	12
- Nodular (both lobes)	2	4
- Diffuse		

Hemithyroidectomy was done for 14 patients, subtotal thyroidectomy in 6 patients and near total thyroidectomy for 2 patients in group A mini-incision thyroidectomy patients, while hemithyroidectomy was done in 6 patients, subtotal thyroidectomy in 12 patients and near total thyroidectomy in 4 patients through a conventional incision. Conversion to conventional surgery was not required in any patients in mini-incision thyroidectomy group. The length of incision was determined by tape measure at the beginning of procedure. Skin incision in a mini-incision thyroidectomy patients (Group A) started with 3 to 4 cm with a mean length of incision 3.8 cm , while the length of skin incision in all patients of conventional thyroidectomy group was from 8 cm to 10 cm.

The operative time of lobectomy (hemithyroidectomy) ranged from 45 to 65 minutes with a mean value of 55.6 minutes, in subtotal and near total thyroidectomy it ranged from 65 to 90 minutes with a mean value of 82.2 in Group A. While the operative time in lobectomy was 35 to 50 minutes with a mean value of 42.3 minutes, ,in subtotal and near total thyroidectomy, it ranged from 45 to 80 minutes with a mean value of 62.8 minutes in Group B patients.

The intraoperative blood loss among patients undergoing lobectomy, measured from the container of suction device, was slightly lower in patients from minithyroidectomy group (45.3ml in minithyroidectomy patients versus 55.7ml in conventional group). Only 2 patients in Group A needed active drainage by Redi-Vac drain compared to 4 patients needed active drainage in conventional group. There were no significant difference in the blood loss between both groups undergoing subtotal thyroidectomy (60.5 ml versus 69.6 ml) (Table2).

Table 2:Comperasion of surgical parameters between both groups.

Surgical parameters	Mini-thyroidectomy	Conventiona l thyroidectomy
Length of incision	3-4 cm	8-10 cm
Duration of surgery		
- lobectomy	45-65 min(55.6)	35-50 min(42.3)
- Subtotal and near total thyroidectomy	65-90 min(82.2)	45-80 min(62.8)

Average Blood loss		
- lobectomy	45.3 ml	55.7 ml
- Subtotal and near total thyroidectomy	60.5 ml	69.6 l
Extend of surgery		
- lobectomy	14	6
- Subtotal and near total thyroidectomy	6	12
	2	4
Significant hematoma formation	0	0
Recurrent nerve injury		
- Temporary	2	1
- Permanent	0	0
Seroma formation	1	3

Regarding the postoperative complications, two cases of recurrent laryngeal nerve injuries were recorded in the mini-incision thyroidectomy group compared to one injury in conventional thyroidectomy group. All cases of nerve palsy in both groups were following subtotal thyroidectomy and fortunately were transient and improved to normal function 3 months after surgery by expectant conservative treatment.

Postoperative bleeding was encountered in 3 patients undergoing minithyroidectomy versus two patients in conventional thyroidectomy. All cases of bleeding occurred during surgery and were dealt with by good haemostasis. Seroma developed in one patient and wound infection in other two patients in mini-incision group. Wound infection was observed in only one patient while seroma was observed in 3 patients in conventional group.

There were 2 cases of symptomatic hypocalcaemia in each group in this study. All these cases were transient and showed good improvement with calcium substitution therapy. External laryngeal nerve injury was not recorded in both groups.

Postoperative pain was assessed on the 10-point visual analog scale "VAS". The mean pain score in the same day of surgery (day 0) was 3.4 for the mini-incision thyroidectomy group and 5.7 for conventional thyroidectomy group. In the first operative day, the mean VAS score in the mini-incision group was 2.6 and 3.9 in the conventional thyroidectomy group. It was significantly less in the Group A when compared with conventional thyroidectomy Group B patients. There was no statistically significant difference in the pain score after the second postoperative day between the two groups. It was 2.2 for mini-incision thyroidectomy group versus 3.1 for conventional thyroidectomy group (P >0.05). Moreover, postoperative pain control by analgesia was significantly less in the mini-incision thyroidectomy group.

The mean hospitals stay for patients undergoing minithyroidectomy group was 1.2± 0.5 days compared 2.3±

1.5 days for conventional thyroidectomy group. The difference however, was not significant.

Three months after surgery ,patients in the Group A reported a significantly higher satisfaction rate with better cosmetic results compared to that obtained by conventional thyroidectomy The mean satisfaction rate for the mini-incision group was 8.8 versus 5.2 for conventional group on a scale of 1 to 10 score. (Table 3)

Table 3: Postoperative outcomes among patients in both groups

	Mini-thyroidectomy	Conventional thyroidectomy
Pain score by VAS ^c		
- Day 0	3.4	5.7
- 1 st post op day	2.6	3.9
- 2 nd post op day	2.2	3.1
Hospital stay (mean)	1.2	2.3
Aesthetic results Three months after surgery by VAS ^c	8.8	5.2



Figure-1-



Figure-2-



Figure-3-

Figure A to C shows minithyroidectomy procedure and post operative scar

Discussion The aesthetic aspect is particularly important for young women patients, as they constitute the majority of patients affected by thyroid diseases [2,5,8]. Pioneer in this field was the work of Gagner et al who mentioned cervical endoscopic parathyroidectomy.[9] Later on, Miccoli et al described for the first time the endoscopic technique to the thyroid surgery, which was the basis for their future work of minimally invasive video-assisted thyroidectomy, achieved through the small incision on the anterior aspect of the neck (< 3cm), using endoscope and special instruments.[10] The main disadvantages of endoscopic neck surgery are long operative time, need of advanced technical instruments and long learning curve. All of this made the surgeon to search for other less technically demanding methods.

It is useful to abide strict indication criteria in order to achieve these aims. These criteria were stated by Miccoli et al, as thyroid nodules less than 3 cm in their biggest diameter, thyroid glands volume smaller than 25 ml, absence of thyroid fixation as in cases of thyroiditis, negative history of irradiation or prior neck surgery.[1,2,10] Follicular tumor and low risk papillary carcinoma were within the exclusion criteria as well .Principally, the surgeon's limitations are still the gland volume and the degree of its fixation to the surrounding structures.[11]

Our study, prospectively comparing open non-endoscopic, mini-incision thyroidectomy with conventional thyroidectomy showed that both approaches proved to be equally effective, with some advantages in favor of mini incision thyroidectomy. The studied groups were comparable for patients characteristics, nature of pathology treated including the nodules size and volume of the gland resected.

The length of incision in our study was ranged from 3 cm to 4cm as a maximum with a mean of 3.8 cm in group A patients while in group B patients, the standard Kocher incision with length ranged from 8 to 10 cm. Extension in the length of incision in the mini-incision thyroidectomy was not

needed and so the conversion to conventional thyroidectomy was not recorded in this study. This is mainly due to restriction to inclusion criteria for mini-incision thyroidectomy and proper selection of patients.

There was a significant difference in the length of incision between both groups of the study. The length of incision, however, could not be the only criteria of minimally invasive approach. Henery et al considered that minimally invasive thyroidectomy as surgical procedure, using lesser degree of dissection space as compared to conventional thyroidectomy procedure.[12]

Ferzli and colleagues reported in their study of minithyroidectomy the length of incision ranging from 2.5 to 6 cm with a mean of 4.2 ± 0.2 cm [13] while the length of incision in study by Ikeda et al was a 3 cm central incision through which 21 thyroidectomies had been done [6]. Ferzli recommended that the site of the incision should be 3 to 4 cm above the suprasternal notch higher than the classically Kocher incision. Incisions near the sternum are liable to keloid formation. On the other hand, a wound made too high in the neck is frequently visible, and when it is made in a smooth anterior neck, it is unsightly and obvious[14].

Nenkov reported 145 minithyroidectomy performed through a skin incision between 2.5 and 3.5 cm without complications, concluding that minithyroidectomy is a safe, and applicable procedure in properly selected patients [15]. Sturniolo in his study analyzed 125 patients undergone thyroidectomy by mini-cervical incision suggesting that mini-incision thyroidectomy in selected cases, involve some advantages included less postoperative pain, best cosmetic results and high patients satisfaction [16]. Timon and Rafferty recommend that a surgeon starting to use minimally invasive thyroid surgery should begin with a larger incision (3.5 to 4.5) and decrease gradually with improvement in the linear curve [17].

It is important to make the incision in a deep natural skin crease for better concealment. Besides the length and position of incision, there are other important factors affecting the cosmetic outcomes, namely meticulous and fine suturing, avoidance of excessive cauterization and retraction which results in bruising of wound edges, and individual idiosyncrasy for keloid formation [5,13,17].

The results of this study showed that mean operative time of lobectomy was 58.6 ± 11.4 in the minithyroidectomy group while the mean operative time for same operation in the conventional group was 40 ± 7.7 . The mean operative time for subtotal thyroidectomy was 82 ± 13.7 in group A patients versus mean operative time of 62 ± 5.5 for the same operation in the group B patients.

In similar study conducted by Ahmed S et al., the mean operative time of hemithyroidectomy was 94 ± 20.7 in minithyroidectomy group versus 45 minutes in the only one hemithyroidectomy that had been done by conventional thyroidectomy [18]. The mean operative time for

hemithyroidectomy in the study conducted by Bellantone et al, was 81 ± 3 minutes in video assisted thyroidectomy and 62 ± 4 minutes in conventional thyroidectomy [19]. Ikeda et al [20] in their study of minimally invasive thyroidectomy, the operative time of total lobectomy was 94 ± 22 minutes while it was 146 ± 35 for subtotal thyroidectomy in conventional group [20]. Kitagawa et al reported a mean operative time for lobectomy of 167 ± 37.8 [21] while Miccoli et al reported a mean operative time for lobectomy as 69.4 ± 30.6 and 87.4 ± 43.5 minutes for total thyroidectomy done by minimally invasive thyroidectomy. [22]

The time of operation recorded in mini-incision thyroidectomy appears to be greater than that of traditional thyroidectomy, a finding which is common to several of studies of minimally invasive approaches to thyroid [3,6,10,18,23]. This could be explained by less experience of this newly developed approach which always implies a learning period. With more experience, it is likely that the time for minithyroidectomy will decrease and probably approaches that of conventional approach, particularly with frequent usage of electrothermal vessel sealing tools such as harmonic scalpel, which have recently become the preferred way for vessel control and dissection in both open and minimally invasive thyroidectomy. The operation time recorded by several studies for minimally invasive thyroid surgery is becoming comparable with that of traditional thyroidectomy.[8,11,13,15,24]

There is a prediction that the approach of minimally invasive thyroidectomy should reduce postoperative blood loss because of less tissue dissection [5,18,25]. Our results in this study comparing the mini-incision and conventional techniques regarding the operative and post operative blood loss did not show any significant difference between the two groups.

Postoperative pain and recovery in this study were shorter in minithyroidectomy than those with conventional thyroidectomy. The difference was statistically significant between both groups. Decreased analgesic consumption was observed clearly in minithyroidectomy group. This is mainly due to lesser tissue dissection and the platysma muscle does not completely divided in addition to very short wound. The shorter skin wound and limited area of dissection results in less disruption of cutaneous nerve supply which further results in decrease postoperative pain. The assessment of postoperative pain was done the visual analog scale (VAS). The mean VAS in minithyroidectomy group at the day of operation was 4.4, in the first operative day was 2.7 and after 48 hours was 2.2. The VAS in the conventional group was 6.7 in operative day, 5.6 after 24 hours and 3.8 after 48 hours.

The same findings were observed by Ahmed et al who noted that the pain in the minithyroidectomy group was much less than that of conventional thyroidectomy group and the difference between both groups was significant [18]. However, Perigli et al did not record any difference regarding the postoperative pain and the cosmetic results

[26]. Peter et al reported in their series that the pain was significantly less in minimally invasive thyroidectomy compared to conventional procedure [27].

Complications of mini-thyroidectomy and conventional thyroidectomy were comparable this study. There was no significant difference between small and conventional large incision surgeries regarding the incidence of recurrent laryngeal nerve injury and hypocalcaemia secondary to hypoparathyroidism. Furthermore, all these cases improved by conservative treatment. External laryngeal nerve involvement was not detected in both groups. Bleeding was observed in 3 patients (13.6%) in mini-incision technique and in 2 patients (9%) in conventional surgical approach. All these bleedings were discovered intraoperatively and managed accordingly by secure haemostasis. There was no significant difference in the wound infection and seroma formation between both groups in this study. Bellantone et al [] and Lombardi et al did not noted any cases of recurrent laryngeal nerve damage in their similar study of minimally invasive thyroidectomy [19,28]. With regard to postoperative hypocalcaemia, no cases had been reported in both studies of Bellantone et al [] or Chao et al [19,29].

Conversion to conventional thyroidectomy was not recorded in this study. The same findings were noted in Lombardi et al[28], Chao et al and Miccoli et al [28,29,30]. Bellantone et al. reported 13% (4 patients) conversion rate to conventional thyroidectomy due to failure to isolate the recurrent laryngeal nerve [19]. Miccoli et al. [4,10,30] demonstrated that the incision of minithyroidectomy can be easily extended allowing conversion to be safely done [4,10,30].

The hospital stay was shorter in minithyroidectomy group compared with that after conventional thyroidectomy in this study, but this difference was statistically not significant. Samy et al in their study of minimally invasive open thyroidectomy showed that most of the patients were discharged within 24 hours with no complications and suggested that the minithyroidectomy could be performed increasingly as day case surgery [31].

There is statistically significant difference between the two groups regarding patients satisfaction and cosmetic outcome . The scar was significantly better in minithyroidectomy (P >0.001). Our finding was in concordance with the findings of previous similar studies by Therezia et al , Essam et al , Daniel et al , and Terris et al [32,33,34,35]. With conventional surgery, a scar of 10 cm or more was typically very apparent on the exposed aspect of the neck, while with mini-thyroidectomy, any scar left is nearly visible after 3 to 6 months. Moreover, patients who receive this approach have faster wound healing than patients who receive conventional surgery.

The role of mini-thyroidectomy for carcinoma is still unclear. Most surgeons are still not recommended the use of minimally invasive thyroidectomy for thyroid malignancy. Miccoli et al emphasized that the only thyroid cancer which

is feasible for minimally invasive thyroidectomy is small size well differentiated follicular or papillary carcinoma without lymph node metastasis [11,22,30].

Conclusion: The results of open, mini-incision thyroidectomy were comparable to that of conventional thyroidectomy. It is safe and feasible procedures for selected patients. Although the procedure takes a longer operative time, it is superior on conventional thyroidectomy in term of post operative pain, postoperative recovery and cosmetic results. The mini-incision thyroidectomy technique is easily converted to traditional thyroidectomy without any additional risk.

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