

An Early Single Institutional Experience in Sutureless Total Thyroidectomy

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INTRODUCTION

Thyroid surgery is one of the most commonly performed surgeries nowadays. Total thyroidectomy was only popular for indications other than cancer at the last quarter of twentieth century for fear of its complications¹. In this era however this operation has been the treatment of choice even for benign thyroid pathology such as multinodular goiter, toxic goiter and refractory Graves' disease. The indications was brought wider with the evolution of technique as the surgery was proven to be a safe surgery with low morbidity^{2,3,4}.

The early operations in 1890s were accompanied by frightful mortalities of 41% mainly due to haemorrhage, injury to the recurrent laryngeal and vagus nerves, damage to the trachea and oesophagus and air emboli. Death was due to haemorrhage either primary or secondary with inevitable sepsis. Currently the overall morbidities are slightly above one percent⁵.

Thyroidectomy involves devascularization and excision of the thyroid gland with preservation of the nerves and parathyroid glands. The rich blood supply surrounding the gland makes haemostasis of utmost importance. Traditionally, it involves knot-tying to control the two ends of a vessel. Modification had been made using vessel clips, mono-and bipolar cauteries. Suture ligations are time consuming and sometimes tedious especially in a limited operative field. Vessel clips can be applied rapidly however it can easily get dislodge during manipulation of the gland. In cautery usage, the lateral thermal injury especially when used near important structures had limited its use. Furthermore, after cauterization time is further consumed for ligation of the vessel⁶. With the introduction of ultrasonic shears in laparoscopic surgery, this provide an alternative to surgeons in safely controlling haemostasis in a lesser time in thyroid surgery.

Ultracision is an instrument which produces high-frequency (55000Hz) ultrasonic energy (Fig 1). Its active blade vibrates against inactive blade over an excursion of 50 to 100microminutes. With this it disrupts the protein hydrogen bonds. The speed of cutting and the amount of coagulation can be adjusted by the power setting of the generator and pressure applied on the shears. The temperature produced with this mechanics is nearly 80 degree Celcius. The lateral thermal injury is around 1 to 3mm wide^{7,8,9}. Tarek A *et al* had

studied the safety of ultrasonic dissector and concluded that heat production was directly proportional to the power setting and activation time and it has been assessed that this instrument produces no collateral damage at power level three and activation time not exceeding five seconds¹⁰.

Usefulness of ultrasonic shears in thyroid surgery has been consistent with regards to the reduction in operative time and intra- operative bleeding which eventually give rise to a cost benefit with its usage. A number of investigators had reported the superiority of ultrasonic shears as compared to the conventional knot tying method in thyroid surgery through randomized controlled trials^{11,12}. Siperstein *et al* found a shorter operative time of 89 minutes compared to 115 minutes in thyroid lobectomy with conventional method¹³. Voiteliianan and Hogland likewise found a 36minutes shorter time using ultrasonic shears¹⁴. In addition to these, Sheman reports a smaller incision (4.5 versus 5.5cm) in thyroid surgery using ultrasonic dissector¹⁵. Finally, Vach *et al* documented that pathologists can more easily evaluate thyroid specimens which are excised using ultrasonic shears¹⁶.

Based on these evidences, we sought to determine the safety and efficacy of total thyroidectomy using ultracision in our center.

MATERIALS AND METHODS

This was a prospective observational study including all patients who underwent total thyroidectomy in University Kebangsaan Malaysia Medical Center (UKMMC) between January 2007 till May 2008. Informed and written consents were taken from these patients. Patients with radiographic evidence of extrathyroidal infiltration into surrounding structures, previous neck surgery, history of radiation treatment to the thyroid gland and radioiodine ablation will be excluded from the study. All the exclusions criteria were predicted to pose more difficult surgery thus longer operating time.

Total thyroidectomy was done by one of the three consultant endocrine surgeon using Ultracision (US) ACE 14cm (Ethicon Endosurgery). All patients had routine preoperative workup including indirect laryngoscopic examination for vocal cord assessment and the same anaesthetic and hospital care postoperatively.

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Patients received morphine or fentanyl during the procedure. All procedures were done under general endotracheal intubation, positioned and draped the usual manner. A 4- to 6 cm collar incision made depending on the thyroid size. Thyroidectomy performed using the midline approach. The inferior, middle and superior thyroid vessels were divided using US. This instrument was also used for dissection. Only vessels with diameter of 5mm or smaller were divided using US. US was not used if important structures lie at close proximity i.e 3mm or nearer to the site. The thyroid lobe was then rotated medially and the vessels in the ligament of Berry divided. During all these procedures care was taken to look for and preserve the recurrent laryngeal nerve and the external laryngeal nerve. Similar steps repeated for removal of the contralateral lobe. Finally wound was irrigated with normal saline. Upon closure a radivac drain was placed at the thyroid bed in all patients. Subcutaneous tissue approximated with polyglactin 3/0 suture and skin closed interruptedly with 4/0 polypropylene. All patients received local wound infiltration with 10ml of 0.25% bupivacaine with 1:200,000 of adrenaline. All patients received Arcoxia® 120mg once daily for pain relief.

Pain was rated using the 11-point numeric rating scale (NRS-11) until day three postoperatively. Drains removed if the drainage was less than 30ml after 24 hours post operatively. Patients with suspicion of RLN injury had a repeat indirect laryngoscopic examination during clinic follow up. Serum Calcium level was measured at 16, 24 and 48 hours post surgery and discontinued if normal. If necessary an oral calcium supplement was prescribed. Patients followed up until 2 months post operatively and assessed for symptoms of hypocalcaemia and serum calcium was taken if necessary.

The main outcome measure studied was the operating time and other additional data assessed were the estimated blood loss, postoperative pain, haematoma, seroma, transient hypocalcaemia, postoperative RLN palsy and length of hospital stay. Estimated blood loss was determined by the weight difference of the used gauze. Fully soaked gauze would be equivalent to 9ml of blood loss. Operating time was taken from the time skin incision was made. Any time consumed for frozen section will be excluded. Transient hypocalcaemia is defined as presence of hypocalcaemic symptoms with requirements of oral vitamin D or calcium with serum calcium level of less than 2 within the first six months after surgery. In the absence of symptoms level of 1.8 is considered low. The symptoms should disappear and calcium level normalise after 6 months.

The nonparametric results were analysed using Chi-square and the parametric data analysed using the Student t-test, SPSS version 12.0.

RESULTS

A total of 35 patients had undergone total thyroidectomy between January 2007 and May 2008. These comprised of 27 female and 8 male patients. Majority of these patients were Malays (21 patients), followed by Chinese (12 patients) and Indians (2 patients). The mean age of these patients was 47.6 ranging from 27 to 71 years old. More than half (54.3%) of these patients aged 50 years and above.

The mean weight of the thyroid gland operated on was 174.1 ± 25.5 grams and 82.9% weigh less than 300 grams. In most cases the indication for surgery was for multinodular goitre. This was consistent with the histopathological examination post-operatively except in two cases. In one patient who was preoperatively diagnosed as multinodular goitre based on fine needle aspiration cytology had papillary carcinoma on histopathological examination. Other discrepancy noted was preoperative diagnosis of multinodular goitre in another patient which turned out to be a medullary carcinoma.

The length of surgery ranged from 45 to 240 minutes (mean = 121.29 ± 47.9 minutes). Forty three percent of the cases were completed within 90 minutes. Intra-operative blood loss ranged from 40 to 480ml (mean = 82.63 ± 74.9ml). Sixty nine percent of patient had intra-operative blood loss of less than 100ml.

One patient developed post-operative bleeding detected by rapidly increasing neck haematoma while the patient was still in the recovery bay. This was a case of toxic multinodular goitre. He had a re-exploration immediately to evacuate the haematoma and arrest the bleeding which was from the superior thyroid artery. Patient recovered well and was discharged 5 days later.

One of the patients had the right recurrent laryngeal nerve injury and was detected intraoperatively. This was a case of multinodular goitre. The nerve was promptly repaired intraoperatively using prolene 7/0 suture. The patient was monitored closely in the intensive care unit postoperatively for the next 24 hours. Fortunately, there was no voice change detected and she was discharged 5 days later. Presence of right vocal cord palsy was confirmed via an indirect laryngoscopic examination done during her subsequent follow up.

Three patients who had total thyroidectomy for multinodular and 1 patient with papillary carcinoma had transient hypocalcaemia requiring oral calcium supplement post operatively. This was slowly tapered down during the clinic follow up when the blood calcium level was within normal range. Three patients were still on calcium supplement 6 months after surgery. The mean calcium level at 8, 16 and 24 hours postoperatively were 2.21, 2.14 and 2.13 mmol/dL respectively.

Fifty four percent of patients gave minimal pain score of 3 or less on post operative day one and all patients had minimal pain score from day 2 onwards. Twenty two patients (62.8%) were discharged on post operative day 2 and one patient was discharged only at day 12 post operatively in order to stabilise her calcium level.

There was a statistically significant correlation between the weight of the thyroid removed and the duration of surgery with P value of 0.029. We also noted that in benign cases the time taken for surgery was longer than needed in cases involving malignancy. This was because of the smaller thyroid gland removed in malignant cases. Intra-operative blood loss was more in benign cases with the mean of 90ml as compared to malignant cases of 45.6ml. This might also be attributed to the bigger size of thyroid removed in benign cases.

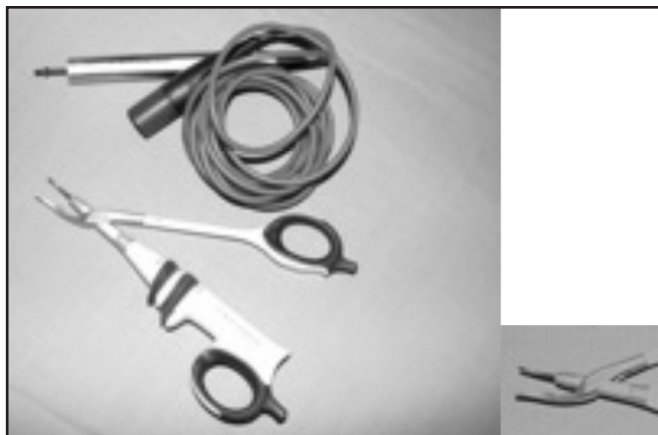


Fig. 1: The ultrasonic dissector used in this study, Ultracision (US) ACE 14cm (Ethicon Endosurgery). Smaller picture showing a closer view of the instrument's blades

DISCUSSION

From the introduction of thyroid surgery until recently several principles of thyroid surgery had remained constant with regards to the importance of haemostatic control and preservation of parathyroids and nerves. One of the evolving surgical techniques involved the introduction of a few methods to improve on the efficacy of the haemostatic control and the pursuit of the minimally invasive technique^{16,17,18,19}. This hand in hand had resulted in the development of dissecting system based on ultrasonic energy that has multifunctional purpose (eg: shears that can be used for mechanical dissection as well as energized cutting and coagulation). The perception has been that this instrument would improve the efficiency of surgery and at the same time reduce the morbidity from collateral/ proximity iatrogenic injuries.

Tarek A et al had evaluated the safety of ultrasonic shears and found that it is safe and carries low risk of collateral damage¹⁰. Several randomized controlled trials had been conducted to compare the safety and effectiveness of the ultrasonic shears with either the time consuming conventional knot tying or other haemostatic instrument eg: clips, bipolar cautery^{14,15,17}. In all these studies ultrasonic shears gave the advantage of shorter duration of surgery and thus lead to an overall reduction in cost. It would be ideal to conduct a randomized control trial for this study, but we were unable to do so because of the small number of operation performed and the short study period.

In our study, the average time consumed for total thyroidectomy was 121.29 minutes. Siperstein observed an operative duration of 132 minutes for total thyroidectomy and had a time advantage of 30minutes as compared to when using the knot tying method¹³. Joaquin on the other hand found shorter duration of operative time being 86 minutes for total thyroidectomy as compared to 101 minutes in the clamp and tie technique¹⁷. The duration of surgery in our study as compared to these historical studies is incomparable as there are biases in terms of the surgeons' experience and

the types of cases that were operated on. For example a case of toxic multinodular goitre would take longer operative time as compared to a case of newly diagnosed papillary carcinoma.

An analysis of the post operative histopathological results as compared to the preoperative fine needle aspiration results had revealed discrepancies in 2 cases which turned out to be a tumour. This might be due to the non-representative nodule aspirated upon before surgery.

The complications of total thyroidectomy are postoperative bleeding, recurrent laryngeal nerve injury and inadvertent injury to the parathyroid glands resulting in permanent hypocalcaemia^{2,3,4,5}. Care was taken not to use the ultrasonic shears in vessels which are larger than 5mm in diameter and in incidences which important structures lie in close proximity (2 to 3mm). Instead we used absorbable ligatures when these circumstances arose. In experienced hand intraoperative blood loss is minimal in thyroid surgery as in our study which we found that the average blood loss was only at 82ml. In one case which developed haematoma postoperatively, we manage to secure the bleeding vessel from a branch of the superior thyroid artery as soon as possible when the patient was noted to have a rapidly expanding neck haematoma while still in the recovery bay. It has been found that the most common error in using ultrasonic shears is allowing insufficient time of contact for coagulation and applying too much pressure on the vessel. It is important to wait patiently until the tissues fall apart for complete haemostasis. This might be the cause of early haematoma formation observed in our study. The other reason which might have attributed to this morbidity was the need for neck extension intraoperatively which causes the vessels supplying the gland to be stretched and deceptively smaller in size. This can cause bleeding post operatively once the neck is positioned back to its normal anatomy.

The other morbidity encountered during this study period was the injury to the right recurrent laryngeal nerve which was detected intra operatively. This was repaired with non absorbable suture and post operative recovery of this patient was uneventful. This adverse event might be attributed to the ergonomics of the instrument used in our study in which at the initial part of the study we had to use the bulky-handled ultrasonic shears and the tip for dissection was also slightly bulky. The other reason might be due to surgeon's factor in which the surgeon might not be very familiar with the instrument at the initial part of the study.

The generation of local water vapour had raised the question for the release of cancer cells, however, Nduka had demonstrated in animal study that viable air borne cancer cells are not released with the use of the ultrasonic shears¹⁹.

We also noted a reduced analgesic use in these studied group in which only three patients gave a pain score of more than 1 on post operative day 2. The analgesic used was the non steroidal anti-inflammatory group and we did not step up to the codeine group in any of our patient. A hypothesis that there is decreased production of phlogogenic substances as coagulation is induced by mechanical vibration at lower

temperatures was put forward for the reduction of pain perceived¹⁰. The other reason could be attributed to the length of surgery as neck hyperextension is a well known source of post operative pain in thyroidectomized patients¹¹. Another advantage of using ultracision is that the need for assistants during surgery is reduced. This is because the surgeon does not need to use both hand for tying knots.

CONCLUSION

In experienced hands, ultrasonic shears had been found to be a useful tool in total thyroidectomy surgery as long as the safety precautions are adhered to closely. It has the advantage of minimising operating time and will eventually reduce the cost of surgery. A randomised controlled trial is thus suggested to further evaluate its efficacy.

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