ORIGINAL ARTICLE

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Transoral endoscopic thyroidectomy vestibular approach (TOETVA): initial experience in Australia

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scarless thyroidectomy, TOETVA, transoral endoscopic vestibular thyroidectomy.

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Abstract

Background: Thyroidectomy is traditionally an open procedure. The potential for and unpredictability of patients developing an unsightly anterior neck scar has led many investigators to develop various 'scarless' thyroidectomy techniques. Here we report on our initial experience, and to our knowledge, the first and largest series of this technique in Australia and New Zealand.

Methods: Across two centres in Western Australia, three Endocrine surgeons utilized the Transoral Endoscopic Thyroidectomy vestibular approach (TOETVA). Key endpoints such as operating time, blood loss, pain scores, recurrent laryngeal nerve injury and hypoparathyroidism was collected. Data was analysed using R statistical program.

Results: One hundred and two TOETVAs were performed between March 2018 and May 2021. There were 66 hemithyroidectomies, 34 total thyroidectomies (four converted to open), and two isthmusectomies. We noted a trend in median operating time decreasing over the study period. There were no cases of permanent recurrent laryngeal nerve palsy, wound infection, seroma or haematoma. We had four instances of open conversion; one temporary RLN palsy, and 12 cases of temporary hypoparathyroidism.

Conclusion: This is the first series of TOETVA reported in Australia and New Zealand. Our results demonstrate that with appropriate surgeon experience, training, collaboration, and in well selected patients, this is a feasible and safe thyroidectomy technique. We hope that our work will build confidence in Endocrine Surgical units seeking to develop this technique in Australia.

Introduction

Open conventional thyroidectomy has developed to become a safe and effective technique with extremely low morbidity and near zero mortality.[1] However, scars from anterior neck incisions may impact a patient's quality of life and attract unwanted social attention.[2,3] Various novel surgical approaches have been developed to overcome this problem.[4] Gagner[5] described the first endoscopic approach to the parathyroid glands. Approaches to the thyroid gland using natural orifice via the oral cavity—sublingual and vestibular have been described.[6–9] The former is associated with more complications attributed to destruction of tissue in the floor of the mouth, hence being less popular.[10,11] Transoral endoscopic thyroidectomy vestibular approach (TOETVA), popularized by Anuwong *et al.*[12] was developed to overcome some of these drawbacks.

TOETVA remains a novel technique. To our knowledge, we introduced the TOETVA technique to Australia, developing a unit of endocrine surgeons who perform this procedure. TOETVA was offered to selected patients in Western Australia (WA) since March 2018.

The aim of this study was to analyse the outcomes of the first 102 cases of TOETVA performed in Western Australia, and to our knowledge, the first reported series in Australia and New Zealand.

Surgical technique

All cases were performed by three surgeons. We adopted the surgical technique for TOETVA, as described by Anuwong *et al.*[12] All three surgeons are fellowship-trained endocrine and laparoscopic surgeons, who each undertook a cadaver dissection course, as well

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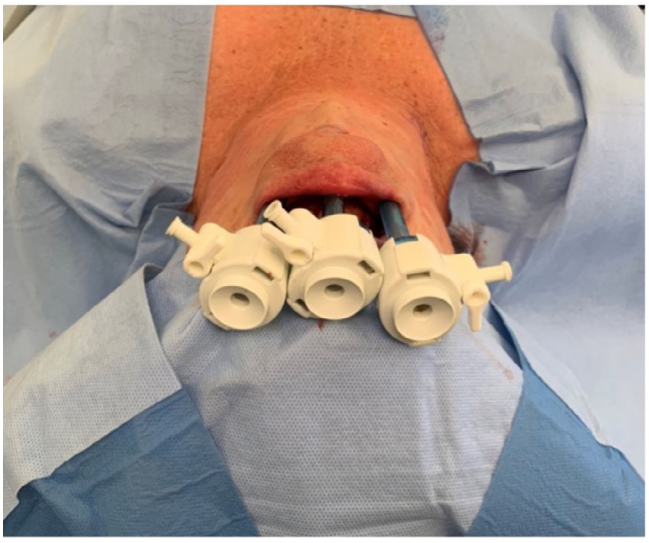

Fig. 1. 5 mm port placed via lip markings.

as visiting Dr. Anuwong for training. Provisional credentialing was obtained at each hospital. After reporting of the results of the first 20 cases to the respective credentialing committees, unrestricted credentialing was approved.

The patient was placed in the supine position. General anaesthesia was administered with oral endotracheal intubation with neural integrity monitor (NIM) endotracheal tube (Medtronic). Intravenous cephazolin and metronidazole were given at induction of anaesthesia, followed by oral cavity preparation with chlorhexidine. A 10 mm incision was made at midline of the lower lip at approximately 1 cm above the gingivobuccal sulcus (Fig. S1). Electrocautery and blunt dissection were carried out to reach the periosteum of mental protuberance. The subplatysmal space is infiltrated with 1:500000 adrenaline and normal saline solution. A blunt tip tissue dilator is then used to develop the subplatysmal plane. Lateral stab incisions were made at the lateral aspect of the lower lip opposite the canine teeth. Standard (5 mm covidien) endoscopic ports were placed and insufflated to 8 mmHg (Fig. 1). An 5 mm endoscope (Olympus ENDOEYE 5 mm, 30° angle) was introduced via the middle port.

Dissection and haemostasis was achieved with Ligasure and hook diathermy. The subplatysmal space was developed to the level of the supra-sternal notch inferiorly and laterally to the medial edge of sternocleidomastoid muscles (Fig. 2). The median raphe of the strap muscles was divided to expose the isthmus. The strap muscles were dissected off the thyroid lobe and retracted with transcutaneously placed 2–0 prolene suture.

The thyroid lobe was then mobilized by division of isthmus to expose the trachea. Superior pole was then mobilized, exposing the avascular cricothyroid space of Reeve to allow individual ligation of superior thyroid vessels close to thyroid gland. This also ensures preservation of external branch of the superior laryngeal nerve (EBSL) and superior parathyroid gland. After superior pole dissection, we identified the recurrent laryngeal

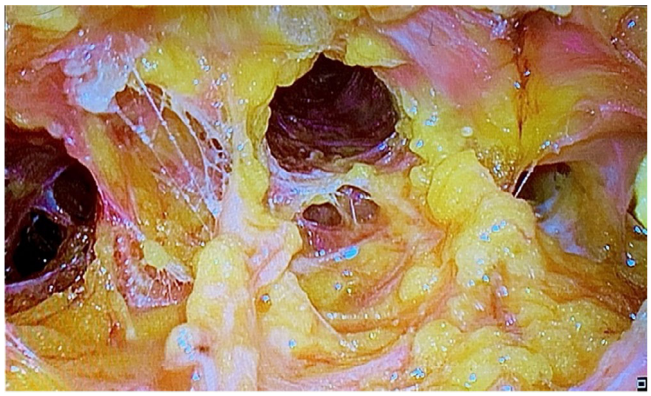

Fig. 2. Sub-plastysmal plane, flap dilator view.

nerve (RLN) at the laryngeal insertion point. We then performed capsular dissection and mobilization of thyroid lobe in a craniocaudal direction, preserving the RLN and inferior parathyroid gland (Figs. S2 and S3). We used intraoperative nerve monitoring (IONM) to test the function of RLN during the procedure. The thyroid gland was completely excised by dividing the ligament of Berry. Ipsilateral central neck lymphadenectomy was performed for a single pre-operatively biopsy proven thyroid cancer case.

The specimen was then placed in an endocatch bag after replacing the middle 5 mm port with a 10 mm port, and extracted through the central vestibular incision. We ensured haemostasis and placed Surgicel in the thyroid bed. The strap muscles were re-approximated with 3–0 V-lock sutures. Oral mucosa was closed with 4–0 vicryl rapide.

All patients received local anaethetic blocks in the distribution of the transverse cervical nerve with 0.2% Ropivacaine. Routine analgesia (paracetamol, tramadol, celecoxib and buprenorphine) was prescribed. Visual analogue score (range 0–10) for pain was recorded on postoperative day 1. Apart from recommending a soft diet for the first 2 days, postoperative care was otherwise the same as for conventional open thyroidectomy.

Methods

Ethics approval from the hospital's ethics committee was obtained. Data was prospectively collected for 102 consecutive TOETVA cases performed in WA between March 2018 and May 2021. Informed consent was obtained from the patients.

The inclusion criteria in this study were: diagnostic Hemithyroidectomy—FNAC Indeterminate or atypical/follicular neoplasm where nodule ≤3 cm; Graves' disease; multinodular goitre; and intrathyroidal papillary thyroid carcinoma <2 cm.[12–14]

Exclusion criteria included a thyroid nodule >3 cm; a clinically or radiologically large multinodular goitre and patients with a history of surgery or radiation to the neck and dental braces. High BMI and male gender was not a contradiction for TOETVA.

Data collected included patient demographics, diagnosis, tumour characteristics, biochemistry results, operative time, estimated

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blood loss (measured by suction), visual analogue score for pain for day 1 post-op, length of stay and complications. Operation time was defined as time from incision to closure of incisions. Hospital stay was calculated as number of nights in the hospital. Complications examined included bleeding, infection, recurrent laryngeal nerve palsy, and hypoparathyroidism.

Statistical analysis

Data was analysed using R statistical program, with models generated using the package TableOne. Descriptive data was tested for differences using the Pearson's Chi Square if categorical and one-way ANOVA if continuous. Variables with a P-value <0.05 were deemed to be significant. Data is presented expressed as mean (standard deviation).

Results

Out of 102 consecutive patients who underwent TOETVA, 66 underwent hemithyroidectomy, 34 underwent total thyroidectomy and two underwent isthmusectomy. Four patients undergoing total thyroidectomy were converted to open due to cancer adhesions, large goitre or graves' thyroiditis.

The mean age was 41 (12). 92% of the patients were female. The indications for TOETVA in our pilot study are listed in Table 1. Mean tumour size was 2 (1) cm.

There was a trend towards shorter operative time over the study period with mean operating times reduced when comparing the first 30 and last 30 hemithyroidectomies (126 (38) versus 105 (15) min). Operative times were similar between the first 14 and last 14 total thyroidectomies (152 (39) versus 154 (22) min). Mean intraoperative blood loss in our series was 10 mL (Table 2).

The postoperative pain was assessed using a Visual analogue score (VAS), with the worse score within the first 24 h being 3. None of the patients required regular analgesia. The mean inpatient stay was 1 day (STDEV = 0.5, range 1–3).

Regarding complications, one patient developed temporary left vocal cord paresis which resolved within 2 months. Twelve cases of temporary hypoparathyroidism resolved within 3 months of surgery, with no incidence of permanent hypoparathyroidism. We had two cases of prolonged hypoparathyroidism, one of which had resolved at 7 months, the other having a persistently low but detectable PTH. There were no cases of permanent recurrent laryngeal nerve palsy, mental nerve injury, infection, or haematoma. A single patient had surgical emphysema, which had resolved at the time of the follow up with the surgeon.

Table 1 Indications for surgery

Papillary thyroid cancer (PTC)	4
Follicular neoplasm (FN)	19
Indeterminate	28
Nondiagnostic, suspicious USS	4
Compressive symptoms	27
Grave's disease	20

Table 2 Summary of intraoperative & post-operative data

Duration of surgery—all total thyroidectomies (mean (SD)) mins ($n = 30$)	152 (30)
Duration of surgery—all hemithyroidectomies (mean (SD)) mins ($n = 66$)	116 (30)
Operative time (mean (SD)) mins	126 (37)
Blood loss (mean (SD)) ml	10 (9)

Discussion

This study analysed the outcome of the first 102 (66 hemithyroidectomies, 34 total, 2 isthmus nodulectomy) cases of TOETVA performed by three surgeons in Western Australia. Our early data support previously described advantages of TOETVA, namely, a scarless technique, relatively painless recovery with a short length of stay and suitability for a variety of thyroid pathology.

The median operative time in our series is longer than reported in the first series by Anuwong,[12] but there is a trend towards shorter operative time over the study period. This trend reflects the impact of increasing experience with the technique. We feel that the safety and feasibility of the transoral approach are strictly related to the surgeon's experience in laparoscopic and thyroid surgery.[15] Some authors have recently described a learning curve of 11 cases for TOETVA, which seems considerably shorter than the learning curves for other remote access thyroidectomy procedures.[16]

Our reported blood loss is less than the 30 ml reported in the first series by Anuwong *et al.*[12] Additionally, we did not use drains in our cases, whilst Anuwong routinely used drains in total thyroidectomies. Postoperative analgesia requirement was minimal, with the majority of patients managing with paracetamol on discharge. The mean day one VAS for pain of 3 was comparable to the previously published study by A Anuwong.[4] Our mean hospital stay of 1 day is less than the 3.6 days reported in the first 60 cases by Anuwong,[12] although this may be attributed to the Australian practice of minimizing hospitalization.

The perioperative and postoperative complication rates are comparable to the first published series.[12] Four TOETVA were converted to open procedure in our series but there are no reported cases of conversion to open in the published series.[12,13] The occurrence of transient recurrent laryngeal nerve palsy was 1 (0.7%), similar to the first reported series[12] but less than 5.9% in series of 422 case[13] by same author. Twelve out of 34 (35%) patients who underwent total thyroidectomy developed transient hypoparathyroidism, compared to 35/200 (17%) in comparable studies.[17] The literature notes the incidence of transient and permanent hypoparathyroidism in open thyroidectomy to be 0%–11% and 5%–7%, respectively.[18–21]

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Specific concerns for TOETVA noted by recent metanalysis comparing TOETVA & open thyroidectomy were wound infection (clean contaminated procedure) and mental nerve injury.[17] Our experience showed no cases of permanent recurrent laryngeal nerve palsy, mental nerve injury, infection, or haematoma. A single patient had surgical emphysema, which had resolved at the time of the follow up with the surgeon.

We note there are limitations to our study. We acknowledge that our study and the literature has not formally assessed patient satisfaction and other patient reported outcome measures (PROMs) or compared these with the open approach. Additionally, long term results for this technique has not been established, highlighting potential areas for future study.

TOETVA is a challenging new technique with a significant learning curve. It requires the surgeon undertaking this technique be proficient and experienced in advanced laparoscopic skills and open thyroidectomy techniques. We advocate for performing cranio-caudal approach in open conventional cases before applying it in TOETVA cases.[22] We found that collaborating as a group of endocrine surgeons performing this technique greatly reduced the risk of morbidity during the adoption of this technique. For endocrine units considering learning TOETVA, we suggest visiting centres that perform this technique.

Conclusion

This is the first series of TOETVA reported in Australia and New Zealand. Within an appropriately experienced and trained endocrine surgery unit, and in well selected patients, we can demonstrate that this is a feasible and safe thyroidectomy technique. We believe this novel, natural orifice, endoscopic and scarless approach stands to become a significant tool in the armamentarium of the modern endocrine surgeon.

Author contributions

Sharin Pradhan: Data curation; formal analysis; writing – original draft; writing – review and editing. **Dhanushke T. Fernando:** Data curation; formal analysis; writing – original draft; writing – review and editing. **Sze Ling Wong:**Conceptualization; investigation; writing – review and editing. **Alan Tien:** Conceptualization; investigation; writing – review and editing. **Ming K. Yew:** Conceptualization; investigation; methodology; supervision; writing – review and editing.

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Conflict of interest

None declared.

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Figure S1. Lip markings for port placement.
Figure S2. Left recurrent laryngeal nerve and inferior parathyroid gland.
Figure S3. Right recurrent laryngeal nerve with branches.

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