ORIGINAL ARTICLE

Operative Benefits of Subcapsular Infiltration of Adrenaline during Open and Endoscopic Thyroid Surgery

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Abstract

Aim: Determine the operative benefits of subcapsular infiltration of adrenaline in terms of blood loss and operative time in open and endoscopic thyroid surgery.

Materials and methods: Between June 2020 and May 2021, this prospective, randomized study was carried out. All patients underwent total or hemithyroidectomy *via* an open or endoscopic approach, depending upon the characteristics of the thyroid lesion. During thyroidectomy, approximately 50–60 mL solution of adrenaline with saline was instilled in the subcapsular plane in a dose of 1:150,000 in 30 patients of group I. Only standard thyroidectomy was performed in the other 30 patients in group II. The pathological characteristics, intraoperative (intra-op) factors, clinical effects, and postoperative blood parameters were analyzed.

Results: Of the 93 patients who underwent thyroidectomy over the aforementioned time frame, 60 patients—30 from group I and 30 from group II—were included in the study. The mean time taken for total thyroidectomy was 99.14 ± 7.02 minutes ($n = 15$), group I 94.00 ± 6.52 minutes ($n = 8$) vs group II 104.29 ± 7.52 minutes ($n = 7$) (p-value = 0.001). A complete thyroidectomy caused a mean blood loss of 62.06 ± 5.03 mL ($n = 15$) and group I 56.25 ± 5.18 mL ($n = 8$) vs group II 67.86 ± 4.88 ($n = 7$) (p-value = 0.001). The mean time taken for hemi thyroidectomy was 92.84 ± 6.08 minutes ($n = 45$), group I 87.73 ± 6.40 minutes ($n = 22$) vs group B 97.96 ± 5.77 minutes ($n = 23$) (p-value = 0.001). A hemi thyroidectomy resulted in a mean blood loss of 48.64 ± 5.65 mL ($n = 45$) and group I 42.50 ± 4.82 ($n = 22$) vs group B 54.78 ± 6.48 ($n = 23$) (p-value = 0.001).

Conclusion: Results from this prospective study suggest that adrenaline infiltration significantly minimizes bleeding and reduces operative time in patients who undergo thyroidectomy.

Clinical significance: Adrenaline infiltration makes the handling of the thyroid gland easier for the surgeon. This effective surgical hemostasis ends up in lesser blood transfusions, decreased operative time, and reduced morbidity and mortality for patients. It would help us to use adrenaline regularly during thyroid surgery.

Keywords: Adrenaline, Bleeding, Operative time, Thyroidectomy.

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Introduction

Thyroidectomy is among the most common surgical procedures performed by endocrine surgeons. Intra-op bleeding remains one of the most challenging events, which makes the surgery difficult. Throughout surgical history, many technological advancements emerged in hemostasis. Suture ligatures, ties, Bovie's invention of bipolar/ monopolar diathermy, innovative hemostatic devices such as the electrothermal bipolar vessel sealer and ultrasonically activating shears, vessel ligating clips, topical hemostatic agents/sealants and tissue adhesive like oxidized cellulose (surgicel), surgical patches coated with human coagulation factors, antifibrinolytics, Ankaferd Blood Stopper, hydroxylated polyvinyl acetal tampons, collagen sealants, and fibrin were used to reduce intra and postoperative bleeding.[1] Adrenaline has a well-known vasoconstrictor action, and infiltration of solutions of adrenaline in saline is used in a variety of procedures, including breast, nasal, ophthalmic, orthopedic operations, urologic surgeries, and endoscopic procedures. In order to reduce bleeding and shorten the time required for a thyroidectomy, we therefore, chose to infiltrate adrenaline in the subcapsular plane of the thyroid and hoped that it would help us to use adrenaline regularly during thyroid surgery.

Adrenaline, which is a medication that has been used for more than a century, is safe and readily available and is quite inexpensive. The previous study has found that adrenaline spray on the surgical field significantly reduced bleeding.[1] This study investigates the therapeutic value of adrenaline infiltration in the subcapsular plane while doing open and endoscopic thyroidectomy procedures to minimize intra-op blood loss and reduce the operative time.

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Conflict of interest: None

Materials and Methods

We designed a prospective study for one year between June 2020 to May 2021 in our center. The regional ethics committee gave its approval to the study protocol. All the patients between the age group of 18–65 years who underwent total thyroidectomy or hemithyroidectomy *via* endoscopic or open procedure were eligible for study participation.

Based on the following criteria, patients were excluded:

- Patient refusal.
- Unfit for general anesthesia.
- Patients on anticoagulant drugs or abnormal international normalized ratio.
- Patients with a history of hypertension and angina.
- Patients with a malignant tumor.
- Patients with previous neck surgery.
- Incompatibility of adrenaline with anesthetic drugs.

Methodology

- The same surgical procedures and principles were applied in each case by a single surgeon who performed the operations.
- Patients were randomized into two groups, I and II, by the principal investigator. Simple randomization was done.
- Group I received subcapsular infiltration of adrenaline during thyroidectomy.
- Group II underwent standard thyroidectomy without adrenaline.
- Approximately 50–60 mL solution of adrenaline with saline was used in a dose of 1:150,000 (Figs 1 to 3).
- Adrenaline was infiltrated in the subcapsular plane in a technique similar to subcapsular saline injection.

Fig. 1: Intraoperative (intra-op) image showing infiltration of adrenaline

- Blood loss was measured using the gravimetric method and intra-op suction volume.[2]
- There were no additional procedures performed, such as lymph node dissection.
- Selection of type of procedure (open vs endoscopic) was done on a random basis.
- After the operation, the specimens were weighed and sent for histopathological examination.

Outcomes and Data Measures

Operative time (measured in minutes), which is the total amount of time from the skin incision to the wound closure, and bleeding during surgery (measured in mL), which is the total amount of blood lost during surgery, were the main outcomes assessed.

Data analyses were performed using Statistical Package for the Social Sciences software. Operative time and blood loss were described using standard deviation and means, and the unpaired "*t*-test" was used. A *p*-value of 0.05 or below was used to determine the statistical significance of all tests.

Results

During this time, 93 people had thyroidectomies overall. A total of 33 of them were not eligible for the study because they did not meet the inclusion requirements. For the data analysis, a total of 60 patients were included, with 30 patients in group I and 30 patients in group II. Total or hemithyroidectomy was performed on all individuals. There was no dissection of lymph nodes. The mean age of patients was 36.63 ± 10.18 years (range: 22–65 years). Female to male was 9:1. The mean TSH (thyroid stimulating hormone) of all patients was 1.51 ± 1.36 µIU/mL (range: 0.01–5.87). Table 1 shows the distribution of patients as per the surgery undergone.

The average weight of the total thyroidectomy specimen was 102 gm. and the hemithyroidectomy was 45 gm. The average size of the total thyroidectomy specimen was 4.2 cm, and the hemithyroidectomy was 2 cm (Table 2). Between the two groups, there were no significant differences in the preoperative, intra-op, or postoperative blood parameters. Table 3 shows the postoperative histopathological characteristics of the specimen resected.

The mean time taken for total thyroidectomy was 99.14 ± 7.02 minutes (n = 15), group I 94.00 ± 6.52 minutes (n = 8) vs group II 104.29 ± 7.52 minutes (n = 7) (p-value = 0.001). Mean blood loss

Fig. 2: Vestibular approach for endoscopic thyroidectomy

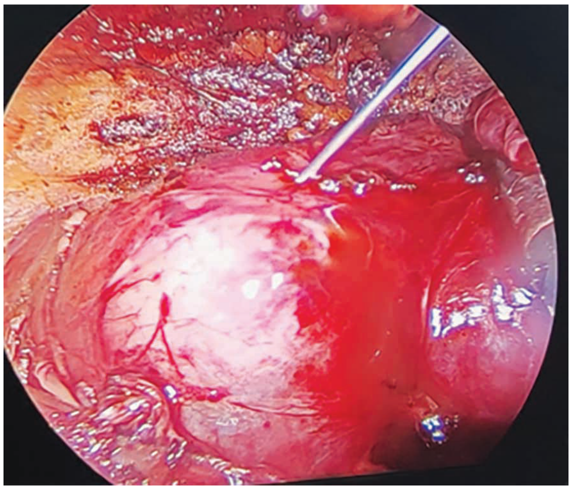

Fig. 3: Intraoperative (intra-op) image of endoscopic thyroidectomy

Table 1: Distribution of type of surgery in relation to infiltration of adrenaline

	Adrenaline		*No adrenaline*		
	Open	*Endoscopic*	*Open*	*Endoscopic*	*Total*
Total thyroidectomy	5	3	4	3	15
Hemithyroidectomy	13	9	14	9	45
Total	30		30		

Table 2: Postoperative weight and size of the specimen

	Total thyroidectomy	*Hemithyroidectomy*
Average diameter of the nodule	4.2 cm	2 cm
Average gland weight	102 gm	45 gm

Table 3: Postoperative histopathological characteristics of the specimen

	Total thyroidectomy	*Hemithyroidectomy*
Cyst	6	17
Goiter	3	10
Adenoma	6	18
Total	15	45

during total thyroidectomy was 62.06 ± 5.03 mL (*n* = 15), group I 56.25 ± 5.18 mL (*n* = 8) vs group B 67.86 ± 4.88 (*n* = 7) (*p*-value = 0.001). The mean time taken for hemi thyroidectomy was 92.84 ± 6.08 minutes (*n* = 45), group I 87.73 ± 6.40 minutes (*n* = 22) vs group II 97.96 ± 5.77 minutes (*n* = 23) (*p*-value = 0.001). Mean blood loss during hemi thyroidectomy was 48.64 ± 5.65 mL (*n* = 45), group I 42.50 ± 4.82 (*n* = 22) vs group II 54.78 ± 6.48 (*n* = 23) (*p*-value = 0.001).

The mean time taken for open thyroidectomy was 91.16 ± 4 minutes (*n* = 36), group I 86.18 ± 4.56 minutes (*n* = 18) vs group II 96.14 ± 3.44 minutes (*n* = 18) (*p*-value = 0.001). Mean blood loss during open thyroidectomy was 53.07 ± 8.01 mL (*n* = 36), group I 47.50 ± 7.83 mL (*n* = 18) vs group II 58.64 ± 8.19 (*n* = 18) (*p*-value = 0.001). The Mean time taken for endoscopic thyroidectomy was 103.38 ± 4.12 minutes (*n* = 24), group I 98.25 ± 3.73 minutes (*n* = 12) vs group II 108.50 ± 4.50 minutes (*n* = 12) (*p*-value = 0.001). Mean blood loss during endoscopic thyroidectomy was 49.06 ± 7.85 mL (*n* = 24), group I 42.50 ± 7.07 mL (*n*=12) vs group II 55.63 ± 8.63 mL (*n* = 12) (*p*-value = 0.005).

The mean time taken for surgery in group I was 89.40 ± 6.92 minutes, and in group II was 99.43 ± 6.66 minutes (Fig. 4). The mean time taken for surgery was significantly higher in patients of group II. The mean blood loss in group I was 46.17 ± 7.84 mL, and in group II was 57.83 ± 8.27 mL (Fig. 5). The mean blood loss was significantly lower in patients of group I. None of the patients suffered from postoperative hypertension, hypocalcemia, vocal cord palsy, or any other significant adverse effect,

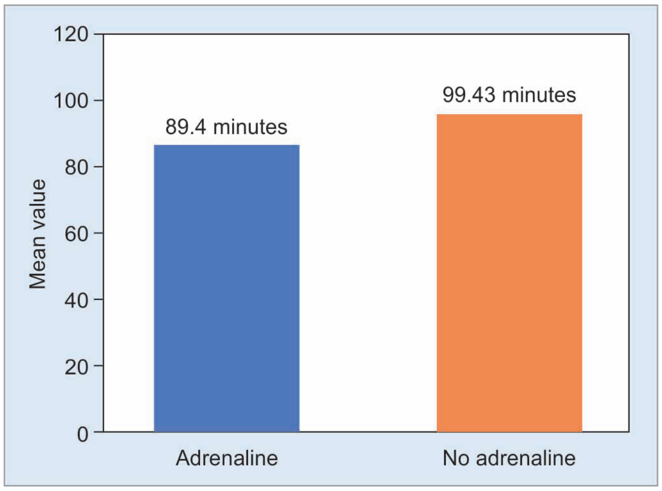

Fig. 4: Comparison of mean surgery time in relation to adrenaline

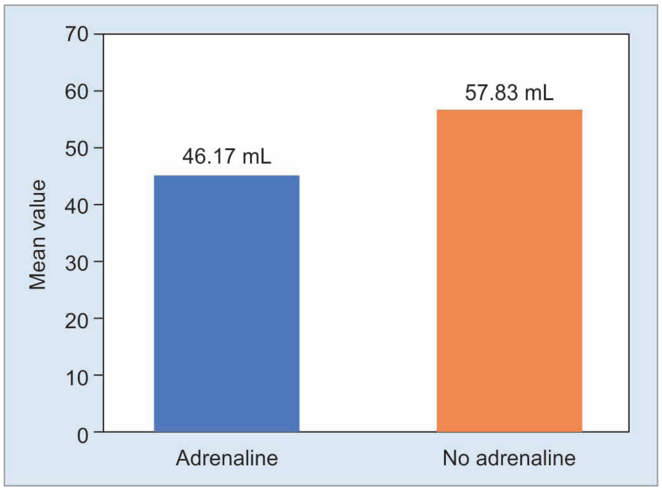

Fig. 5: Comparison of mean blood loss in relation to adrenaline

Discussion

Adrenaline infiltration makes the handling of the thyroid gland easier for the surgeon. This effective hemostasis also ends up in lesser blood transfusions, decreased operative time, and reduced mortality and morbidity for patients. It would help us to use adrenaline regularly during thyroid surgery. The method utilized for hemostasis, drainage, and hemorrhagic risk factors that each patient has, such as hyperthyroidism that results in thyroid congestion, tumescence, and rich thyroid blood supply, all contribute to the development of hemorrhagic problems.[3,4] The head and neck areas are very susceptible to bleeding because of the rich vascular supply.[5,6] Each vessel must be safely occluded and divided in order to carry out the operation quickly and safely.[5]

The results of our study were partially similar to a study done in Turkey,[1] where the investigator sprayed adrenaline over the thyroidectomy area to reduce bleeding. We injected adrenaline into the subcapsular plane to avoid any potential complications of adrenaline. Although there was no systemic absorption of adrenaline, patients on anticoagulants, hypertensive patients, or patients having cardiovascular diseases were excluded from the study as a precautionary measure.

Adrenaline, when added to saline or the local anesthetic solution, will minimize venous and capillary bleeding. The efficacious usage of adrenaline solution as a hemostatic agent dates back to the last of the 19th century with reports of the application of adrenal gland extract for the treatment of epistaxis,[7] and by the 20th century, a purified epinephrine chloride (1:1000 solution) was employed in nasal and ophthalmic surgery.[8]

When the infiltration solution is combined with the local anesthetic agent, postoperative pain is decreased, which is another important benefit of adrenaline infiltration. This might make it possible to execute the operation as an outpatient or daycare treatment. On the other hand, reports of delayed wound healing, visceral damage, skin necrosis, and systemic physiologic consequences such as hypertension and rebound bleeding have brought attention to the morbidity associated with epinephrine infiltration.[9–11] But we didn't experience any significant complications related to any of those effects. There were no cardiovascular complications during anesthesia. In addition, none of the patients in the study had high blood pressure problems, possibly due to the low dose used. Malignant cases and patients having a previous history of neck surgery were excluded from the study because of the difficulty in dissection during surgery and unpredictable intra-op findings. A few limitations of the study include the exclusion of patients with cardiac risk factors, patients with malignancy, and the small sample size. The same surgical technique was adopted in all the cases by a single surgeon. Different surgical techniques by others may yield different results. The effectiveness and safety of administering adrenaline during thyroid surgery still need to be confirmed in prospective randomized trials with a sufficient number of participants.

Conclusion

According to the results of our study, we can say with certainty that the initial experience with adrenaline use in thyroid surgery has been positive and that it is helpful as an adjunct to reduce blood loss and the duration of the operation.

Clinical Significance

The effective surgical hemostasis achieved by subcapsular infiltration of adrenaline results in decreased operating time, fewer blood transfusions, and reduced mortality and morbidity for patients. It would help us to use adrenaline regularly during thyroid surgery.

Consent

Consent to publish the article was not obtained. This report does not contain any personal information that could lead to the identification of the patient.

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