



OUTCOMES OF MICROSCOPIC THYROIDECTOMY COMPARED WITH THE CONVENTIONAL TECHNIQUE: A COMPARATIVE ANALYSIS

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ABSTRACT

Background

Microscopic thyroidectomy offers enhanced magnification and finer tissue handling, which may reduce intra and post-operative complications compared with the conventional approach. Interest in its use has grown as surgeons aim to minimise bleeding, protection against injury to recurrent & superior laryngeal nerves, and preserve parathyroid function.

Objectives

To compare postoperative outcomes of microscopic thyroidectomy with the conventional technique, and to evaluate differences between hemi- and total thyroidectomy, as well as benign and malignant thyroid diseases (papillary and follicular carcinoma).

Methods

A comparative study was conducted among 30 patients undergoing thyroidectomy (15 microscopic and 15 conventional). Operative time, blood loss, nerve integrity, postoperative hypocalcemia, and surgical complications were recorded. Subgroup comparisons were made for hemi vs total procedures and benign vs malignant lesions.

Results

Microscopic thyroidectomy showed lower intraoperative bleeding, clearer identification of recurrent and superior laryngeal nerves, and improved early postoperative calcium stability. Operative time was slightly longer but associated with improved safety margins. Total thyroidectomy was associated with a higher incidence of transient hypocalcemia compared with hemithyroidectomy, while malignant lesions required wider exposure regardless of technique.

Conclusion

Microscopic thyroidectomy provided more precise dissection and better early postoperative outcomes than the conventional method. Its advantages were most notable in nerve preservation and parathyroid safety, making it a valuable option for almost all thyroid surgeries.

Keywords: Microscopic Thyroidectomy, Recurrent Laryngeal Nerve, Hypocalcemia, Parathyroid Preservation, Thyroid Surgery.

INTRODUCTION

Thyroid surgery has steadily moved towards technique that offer clearer visualization and safer dissection, especially around structures where even small injuries carry long-term consequences. Conventional thyroidectomy remains widely practiced, yet the limited magnification can make it difficult to appreciate subtle planes around the recurrent laryngeal nerve (RLN), external branch of the superior laryngeal nerve (EBSLN), and the delicate parathyroid glands. Many avoidable complications such as voice changes, transient hypocalcemia, wound hematoma, often relate to these fine anatomic challenges rather than to the extent of resection alone.[1,2]

Microscopic thyroidectomy was introduced to improve precision by offering enhanced magnification and better illumination of narrow operative corridors. Studies have shown that magnified dissection helps surgeons identify the RLN earlier, trace its course more confidently, and preserve the EBSLN during superior pole ligation.[3] Improved visualization also allows parathyroid glands to be recognised more reliably, reducing postoperative hypocalcemia and the need for calcium supplementation.[4] Smaller dissection planes and controlled ligation may further lower bleeding and postoperative hematoma risk, two concerns that influence both safety and recovery.

Surgical outcomes are also shaped by decision-making around the extent of resection. Hemithyroidectomy is often sufficient for solitary benign nodules, whereas total thyroidectomy is chosen for bilateral disease or confirmed malignancy. The risks of hypocalcemia, nerve injury, and operative time differ between these procedures, and magnification may influence these rates differently in partial versus complete gland removal.[5,6] Similarly, outcomes vary between benign lesions and differentiated thyroid cancers such as papillary or follicular carcinoma, where oncologic principles must be balanced with functional preservation.

Given these evolving considerations, comparing microscopic and conventional thyroidectomy in a controlled cohort may help clarify where magnification offers measurable benefit. The present study evaluates postoperative complications, nerve safety, bleeding, parathyroid preservation, and overall surgical outcomes in patients undergoing microscopic versus conventional thyroidectomy, while also exploring differences between hemi- and total thyroidectomy and between benign and malignant disease.

MATERIALS AND METHODS

Study Design and Setting

This comparative study was conducted in the Department of ENT and General Surgery at Farookh Academy of Medical Education Hospital and Research Institute, Mysore between May 2025 to November 2025 where both microscopic and conventional thyroidectomy are routinely performed. All surgeries were carried out by the same surgical team members to minimise technical variation. The operating theatre setup included a standard ENT surgical microscope (ZEISS EXTARO 300) with adjustable magnification for the microscopic group, while the control group underwent thyroidectomy using the traditional open technique without magnification enhancement.

Study Population and Sample Size

Thirty patients scheduled for elective thyroid surgery were enrolled after taking written informed consent. They were divided into two equal groups:

- **Microscopic thyroidectomy (n = 15)**
- **Conventional thyroidectomy (n = 15)**

Both benign and malignant thyroid conditions were included. Patients requiring emergency airway intervention, those with prior thyroid or neck surgery, medullary and anaplastic thyroid carcinoma and those with extensive retrosternal extension were excluded.

Preoperative Assessment

All patients underwent routine blood investigations, thyroid function tests, serum calcium, ultrasound imaging of neck and indirect laryngoscopy to document baseline vocal cord movement. FNAC reports guided the preoperative classification into benign or malignant categories. CT scan neck with contrast was done in malignant cases. Each patient was counselled regarding the procedure, expected recovery, and the possibility of requiring total versus hemithyroidectomy depending on intraoperative judgement and complications of thyroidectomy.

Surgical Images of Microscopic Thyroidectomy



Image 1: Kocher Incision

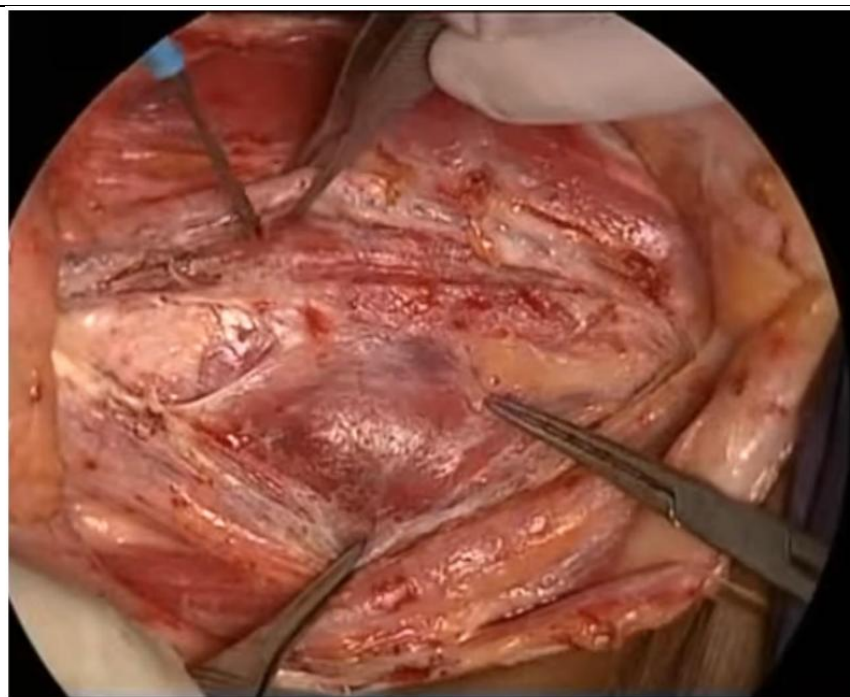


Image 2: Strap muscles

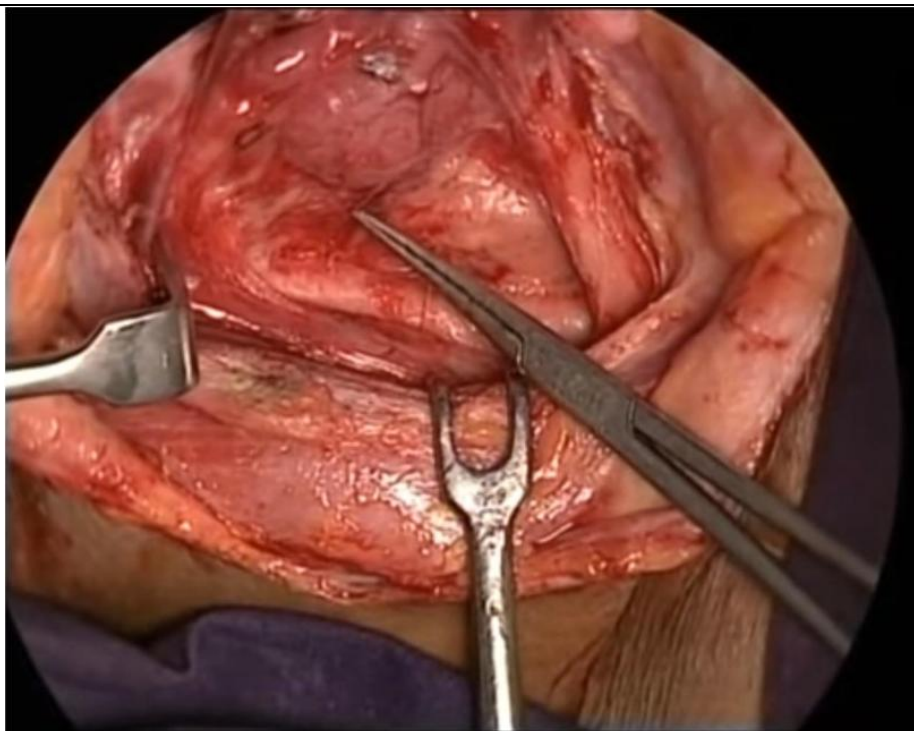


Image 3: Inferior thyroid artery



Image 4: Recurrent laryngeal nerve



Image 5: External branch of Superior laryngeal nerve

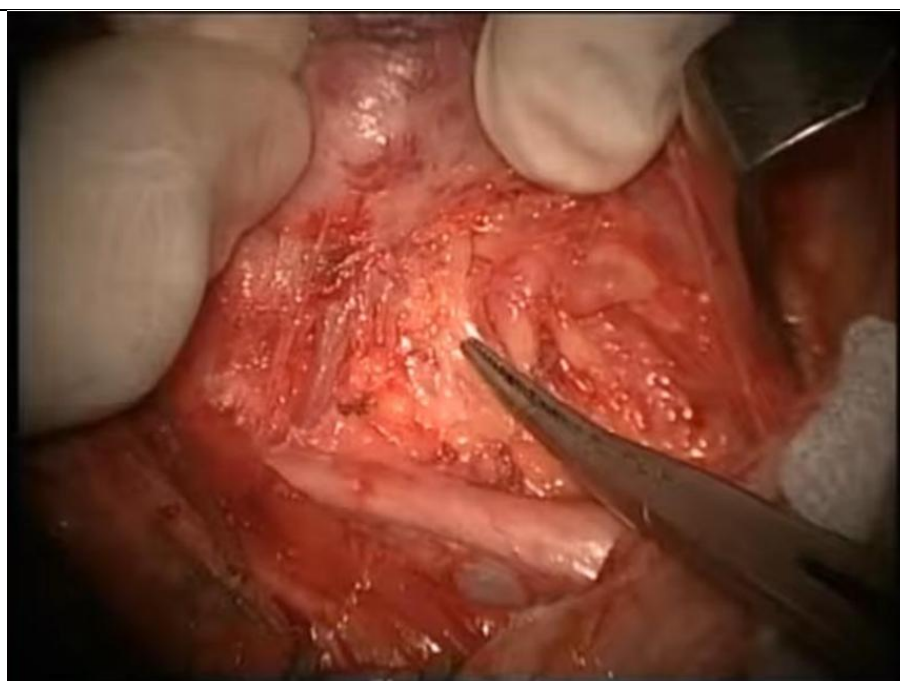


Image 6: Parathyroid gland

Microscopic Thyroidectomy Group

A standard low-collar incision was used. Dissection proceeded under the operating microscope, allowing early identification of inferior thyroid artery, recurrent laryngeal nerve and external branch of the superior laryngeal nerve. Magnification enabled clear demarcation of the parathyroid glands and their vascular pedicles, which were preserved meticulously. Hemostasis was maintained with fine bipolar coagulation, and the reduced dissection field limited traction around critical structures.

Conventional Thyroidectomy Group

Patients underwent thyroidectomy using the standard open technique with direct visualization. Nerves and parathyroid glands were identified with the naked eye, and hemostasis relied on suture ligation or conventional bipolar coagulation. Dissection planes were broader, reflecting routine practice.

Extent of Resection

Both groups included **hemithyroidectomy** and **total thyroidectomy** cases, depending on pathology and side involvement. Malignant cases (papillary or follicular carcinoma) were managed according to surgical oncology principles.

Outcome Measures

Postoperative evaluation focused on:

- Intraoperative bleeding
- Operative time
- Recurrent laryngeal nerve integrity (assessed by postoperative laryngoscopy)
- External branch of superior laryngeal nerve function
- Parathyroid gland preservation and postoperative calcium levels
- Wound hematoma or seroma
- Overall surgical outcome and postoperative recovery

Data Collection

The operating surgeon recorded intraoperative details (blood loss, nerve identification, complication events). Laboratory calcium levels were measured on postoperative days 1 and 2. Voice changes, hypocalcemic symptoms, and wound status were assessed daily until discharge, and again during follow-up at two weeks.

Statistical Analysis

Continuous variables were summarised as means and compared using independent t-tests. Categorical variables were analysed with chi-square or Fisher's exact tests. Statistical significance was defined as $p < 0.05$. The sample size was modest but adequate for a preliminary comparative analysis.

RESULTS

The study included 30 patients, with 15 undergoing microscopic thyroidectomy and 15 undergoing the conventional approach. The cohort comprised 8 male and 22 female patients, with 4 males and 11 females in each group. Patient age ranged from 24 to 62 years. Baseline characteristics, including age distribution, sex ratio, thyroid functional status, and preoperative vocal cord mobility, were comparable between the two groups, ensuring adequate baseline homogeneity for outcome comparison.

1. Operative Time and Intraoperative Bleeding

Microscopic thyroidectomy resulted in slightly longer operative time, although improved visibility helped reduce intraoperative bleeding significantly. Most bleeding episodes in the conventional group were related to traction during superior pole dissection.

Parameter	Microscopic (n=15)	Conventional (n=15)	p-value
Mean operative time (minutes)	92.4 ± 12.6	84.1 ± 10.8	0.041
Intraoperative blood loss (mL)	41.3 ± 15.2	72.8 ± 21.7	< 0.001
Significant bleeding requiring additional hemostasis	1 (6.7%)	5 (33.3%)	0.077
Table 1: Operative time and intraoperative bleeding in both groups			

$p < 0.05$ was considered statistically significant. Mean intraoperative blood loss differed significantly between groups ($p < 0.001$). The proportion of patients requiring additional hemostatic measures did not differ statistically significantly ($p = 0.077$).

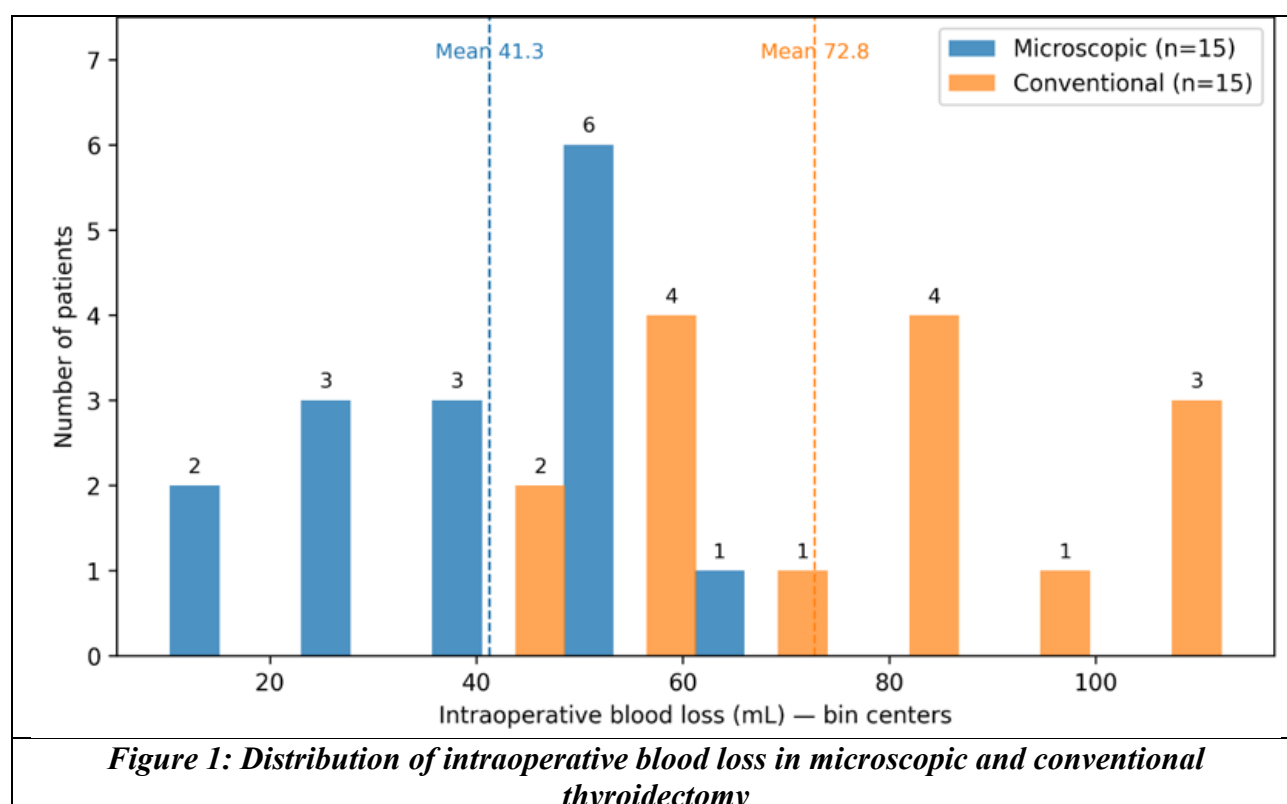


Figure 1: Distribution of intraoperative blood loss in microscopic and conventional thyroidectomy

Histogram bars represent patient counts across blood-loss intervals; dashed vertical lines indicate mean blood loss for each surgical technique.

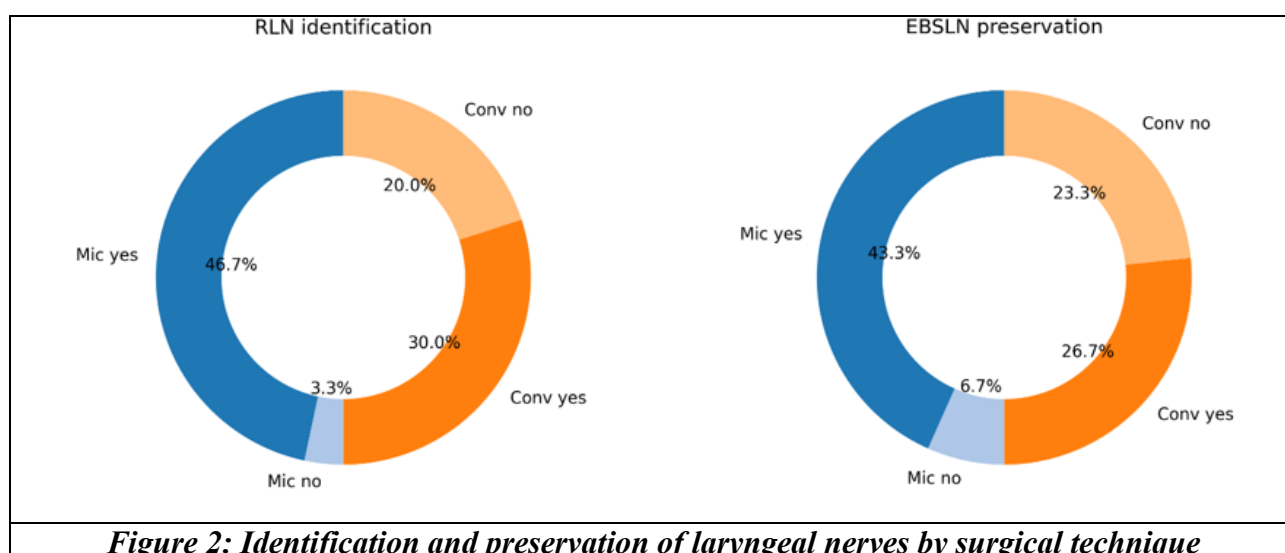
2. Identification and Integrity of Laryngeal Nerves

The microscopic group demonstrated earlier and clearer identification of both RLN and EBSLN. Postoperative laryngoscopy confirmed fewer transient nerve-related complaints.

Outcome	Microscopic (n=15)	Conventional (n=15)	p-value
RLN identification (early & clear)	14 (93.3%)	9 (60.0%)	0.036
EBSLN preservation (subjectively assessed)	13 (86.7%)	8 (53.3%)	0.048
Transient RLN paresis	1 (6.7%)	3 (20.0%)	0.290
Persistent RLN palsy	0	1 (6.7%)	0.311

Table 2: Laryngeal nerve identification and postoperative integrity

$p < 0.05$ was considered statistically significant. Differences in transient and persistent RLN dysfunction between groups were not statistically significant.



Donut charts show the proportion of cases with successful identification of the recurrent laryngeal nerve and preservation of the external branch of the superior laryngeal nerve.

3. Parathyroid Preservation and Postoperative Calcium Levels

All parathyroid glands were successfully identified and preserved in 13 of 15 patients (86.7%) in the microscopic group, compared with 7 of 15 patients (46.7%) in the conventional group, demonstrating a statistically significant difference ($p = 0.047$).

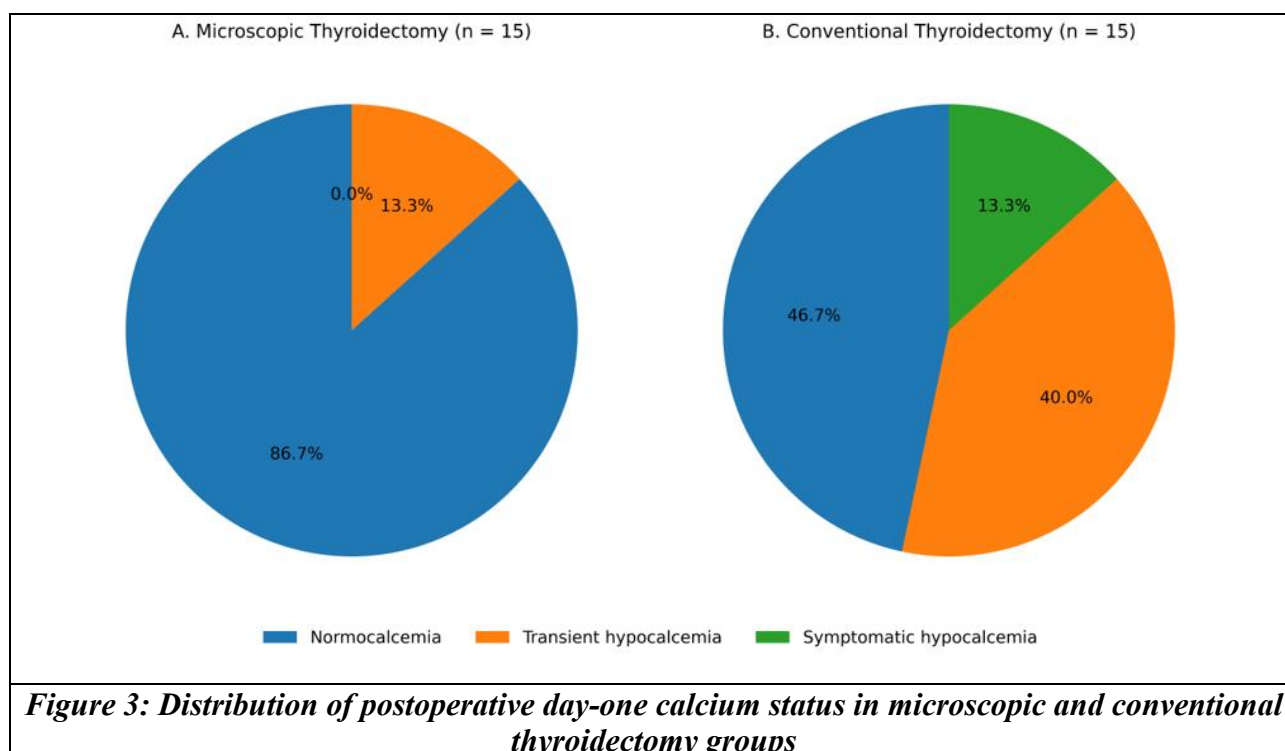
Mean serum calcium levels on postoperative day one were significantly higher in patients operated under microscopic assistance (8.42 ± 0.38 mg/dL) compared with the conventional technique (7.86 ± 0.41 mg/dL), reflecting improved early calcium homeostasis ($p = 0.002$).

Transient hypocalcemia was observed in 2 patients (13.3%) in the microscopic group and 6 patients (40.0%) in the conventional group; however, this difference did not reach statistical significance ($p = 0.097$). Importantly, no patient in the microscopic group developed symptomatic hypocalcemia requiring intravenous calcium supplementation, whereas 2 patients (13.3%) in the conventional group required intravenous calcium therapy, although this difference was not statistically significant ($p = 0.144$).

Parameter	Microscopic (n=15)	Conventional (n=15)	p-value
All parathyroids identified & preserved	13 (86.7%)	7 (46.7%)	0.047
Mean serum calcium POD1 (mg/dL)	8.42 ± 0.38	7.86 ± 0.41	0.002
Transient hypocalcemia	2 (13.3%)	6 (40.0%)	0.097
Symptomatic hypocalcemia requiring IV calcium	0	2 (13.3%)	0.144

Table 3: Comparison of parathyroid identification, preservation, and postoperative calcium outcomes between microscopic and conventional thyroidectomy groups

$p < 0.05$ was considered statistically significant. Differences in transient and symptomatic hypocalcemia did not reach statistical significance.



Values represent percentage distribution of normocalcemia, transient hypocalcemia, and symptomatic hypocalcemia on postoperative day one.

4. Postoperative Complications and Recovery

Patients in the microscopic group demonstrated smoother postoperative recovery with fewer hematomas and less prolonged drain output.

Complication	Microscopic (n=15)	Conventional (n=15)	p-value
Wound hematoma	0	2 (13.3%)	0.144
Seroma	1 (6.7%)	2 (13.3%)	0.545
Prolonged drain output (>48 hrs)	2 (13.3%)	5 (33.3%)	0.190

Table 4: Postoperative complications

$p < 0.05$ was considered statistically significant. No statistically significant differences were observed between groups for postoperative complications.

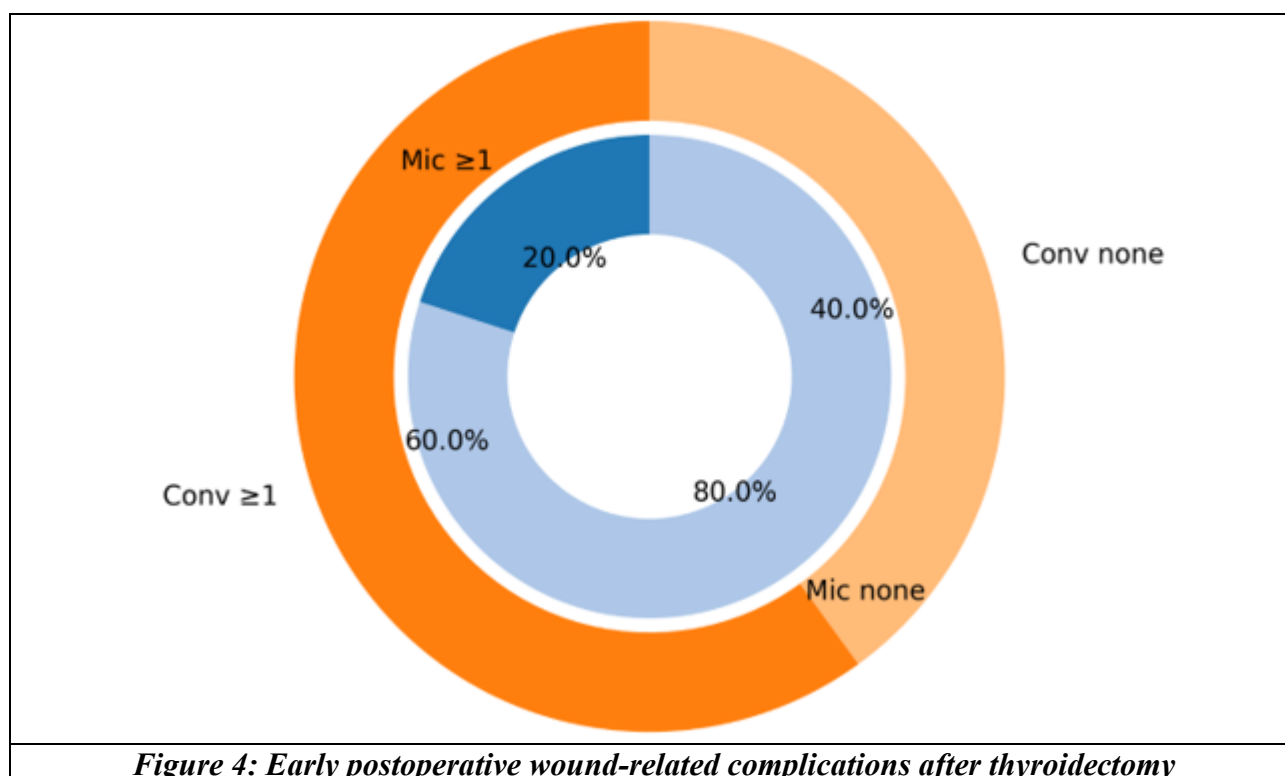


Figure 4: Early postoperative wound-related complications after thyroidectomy

Nested donut chart depicts the proportion of patients with no complications versus at least one early postoperative wound complication in each group.

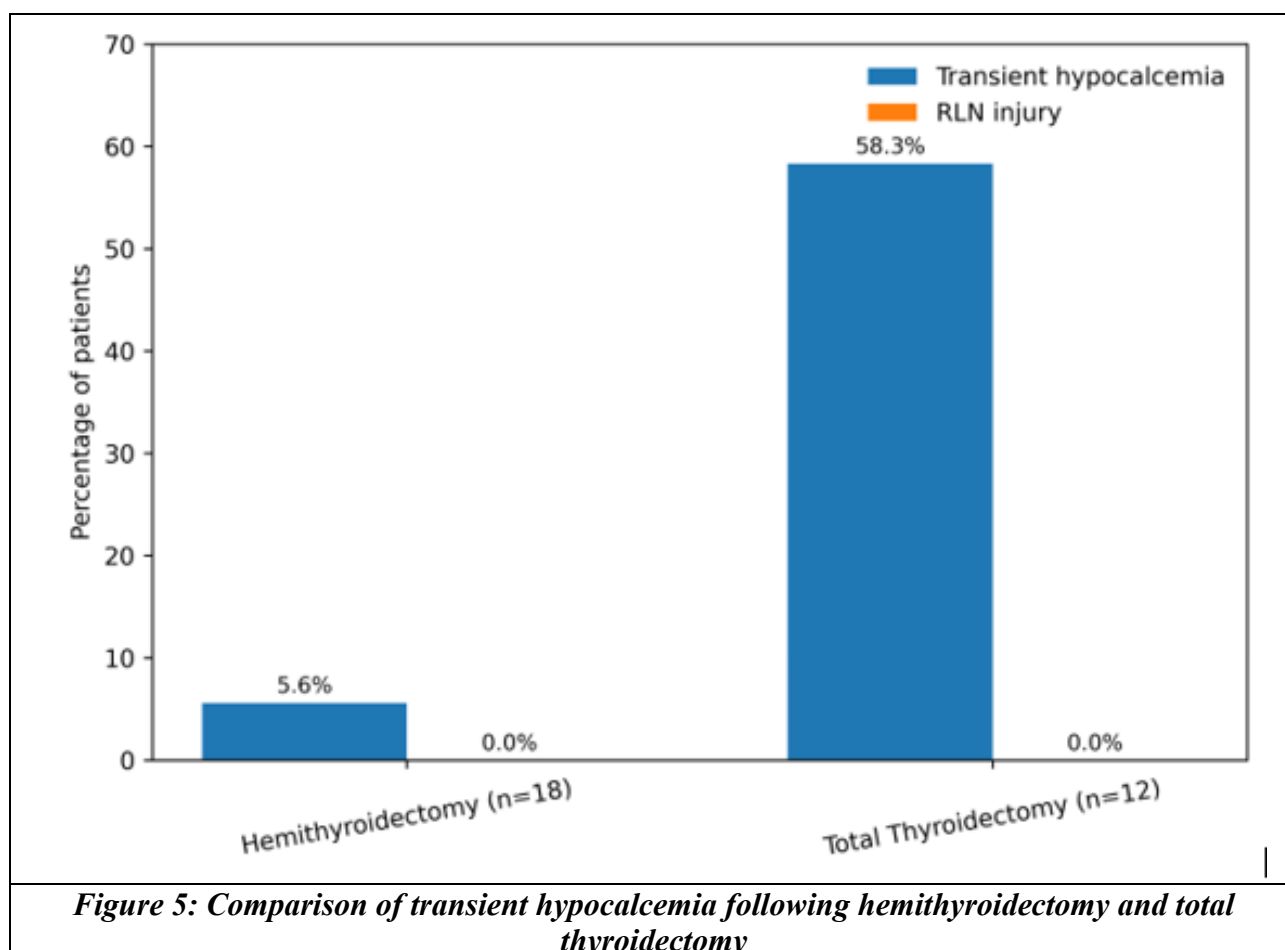
5. Subgroup Comparison: Hemithyroidectomy vs Total Thyroidectomy

Total thyroidectomy cases showed more pronounced calcium fluctuations. Greater postoperative calcium fluctuation was observed following total thyroidectomy compared with hemithyroidectomy.

Parameter	Hemithyroidectomy (n=18)	Total Thyroidectomy (n=12)	p-value
Mean POD1 calcium (mg/dL)	8.62 ± 0.32	7.71 ± 0.44	< 0.001
Transient hypocalcemia	1 (5.6%)	7 (58.3%)	< 0.001

Table 5: Calcium disturbances and RLN injury in hemithyroidectomy vs total thyroidectomy

p < 0.05 was considered statistically significant. POD1 serum calcium levels and rates of transient hypocalcemia differed significantly between hemithyroidectomy and total thyroidectomy.



Bars represent percentage of patients developing transient hypocalcemia by extent of resection.

Pathology	Microscopic (n=15)	Conventional (n=15)
Benign lesions	11 (73.3%)	11 (73.3%)
Malignant lesions (papillary/follicular)	4 (26.7%)	4 (26.7%)

Table 5a: Distribution of benign and malignant lesions by surgical technique

Descriptive distribution of pathological diagnosis according to surgical technique.

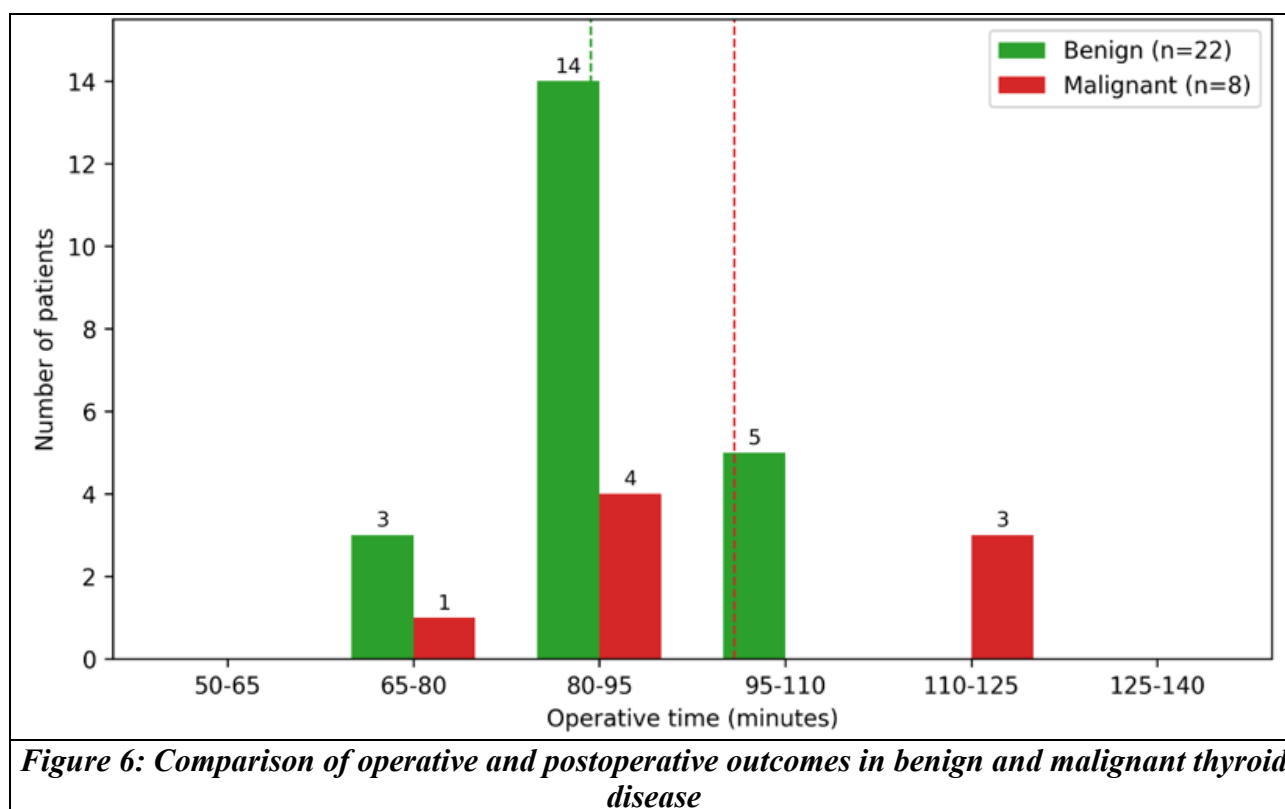
6. Subgroup Comparison: Benign vs Malignant Lesions

Malignant cases required wider exposure and longer dissection planes, influencing complication rates.

Parameter	Benign (n=22)	Malignant (n=8)	p-value
Transient RLN paresis	2 (9.1%)	2 (25.0%)	0.257
Hypocalcemia	3 (13.6%)	5 (62.5%)	0.008
Mean operative time (minutes)	86.8 ± 11.3	98.4 ± 13.1	0.023

Table 6: Outcomes in benign vs malignant thyroid disease

$p < 0.05$ was considered statistically significant.



Bar chart compares operative time and postoperative complication patterns between benign and malignant thyroid lesions.

DISCUSSION

Preservation of parathyroid function remains a central determinant of postoperative recovery following thyroid surgery, particularly given the morbidity associated with postoperative hypocalcemia. In the present study, microscopic thyroidectomy demonstrated a clear advantage in parathyroid identification and early postoperative calcium stability when compared with the conventional approach. The significantly higher rate of successful parathyroid identification and preservation observed under magnified dissection supports the principle that refined surgical technique influences postoperative hypoparathyroid-related outcomes in total thyroidectomy surgery.[7]

Alongside parathyroid safety, improved visualization has relevance for neural preservation, especially at the superior pole where dissection is technically demanding. Evidence comparing direct visualization strategies with adjuncts such as neuromonitoring for the external branch of the superior laryngeal nerve highlights the broader theme that enhanced identification methods can improve functional preservation during thyroidectomy.[8] From an operative standpoint, superior pole work is also closely linked to vascular anatomy, and anatomical variability of the superior thyroid artery can influence bleeding risk and the complexity of hemostasis, making the argument for improved visualization and careful technique clinically plausible.[9]

In our cohort, the microscopic approach was associated with clearer identification of key nerves and fewer postoperative voice-related complaints. Contemporary surgical literature has repeatedly emphasized that recurrent laryngeal nerve injury remains a major determinant of postoperative morbidity, and careful dissection with heightened attention to nerve course is central to risk reduction.[10] Similarly, work focused on superior laryngeal nerve identification and preservation reinforces how targeted visualization of vulnerable neural structures can protect postoperative phonatory outcomes, which is particularly relevant when comparing techniques that differ primarily in operative visibility.[11]

Interpretation of postoperative voice-related outcomes also depends on robust baseline documentation. The importance of preoperative laryngeal examination in thyroid and parathyroid surgery has been clearly articulated, since it prevents misattribution of pre-existing vocal fold dysfunction to postoperative nerve injury and strengthens the validity of postoperative comparisons.[12] Finally, although our subgroup analysis included malignant disease, oncologic cases can require wider exposure and more extensive compartmental work; outcomes in differentiated thyroid carcinoma cohorts undergoing more extensive surgical management underscore how disease biology and operative extent may independently influence perioperative risk profiles, irrespective of visualization strategy.[13]

Several limitations of the present study should be acknowledged. The modest sample size restricts statistical power, particularly for low-frequency outcomes such as symptomatic hypocalcemia requiring intravenous correction. Long-term biochemical follow-up (serial calcium and parathyroid hormone) was not performed, limiting conclusions regarding permanent hypoparathyroidism. Nevertheless, the internal consistency between improved parathyroid preservation, higher early postoperative calcium levels, and the absence of severe symptomatic hypocalcemia in the microscopic group supports the clinical plausibility of benefit in early postoperative physiology.

Taken together, these findings suggest that microscopic thyroidectomy may offer tangible advantages in functional preservation by enabling more precise dissection around parathyroid glands and vulnerable neural structures. Larger multicentric studies with longer biochemical follow-up are warranted to confirm whether these early improvements translate into sustained reductions in clinically significant hypocalcemia and other functional complications.

Limitations

The sample size of this study was modest, which may limit the strength of subgroup comparisons, particularly for malignant lesions. All surgeries were performed within a single centre and by one surgical team; while this reduced technical variability, it may also restrict generalisability to institutions with different case volumes or operative expertise. Short-term outcomes were assessed, but long-term voice parameters, calcium trends, and oncologic surveillance were not included. Additionally, more granular tools, such as intraoperative neuromonitoring or standardized voice analysis, were not utilised, which could have provided finer functional detail. These factors should be considered when interpreting the findings, and larger multicentric studies may help strengthen the evidence base.

CONCLUSION

Microscopic thyroidectomy provided consistently safer and more controlled operative conditions than the conventional technique. Magnification improved the clarity of dissection, reduced bleeding, and enabled earlier recognition of the RLN, EBSLN, and parathyroid glands. These technical advantages were associated with fewer postoperative nerve-related problems, improved early calcium stability, and overall smoother recovery. Although operative time increased mildly, the added duration was offset by improved patient safety and functional preservation. The technique also demonstrated benefit across both hemi and total thyroidectomy procedures and retained its value even in the more demanding context of malignant disease.

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