

A Retrospective Assessment of Post-Operative Complication Rates Following Thyroid Surgery (Voice Change, Hypocalcemia)Pratyush Kumar¹, Swapnil², Deepshikha Mishra³, Neel Prakash⁴¹Junior Resident (Academic), Department of ENT, Patna Medical College and Hospital, Patna, Bihar, India²Junior Resident (Academic), Department of General Surgery, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India³Senior Resident, Department of ENT, Patna Medical College and Hospital, Patna, Bihar, India⁴Junior Resident (Academic), Department of ENT, Patna Medical College and Hospital, Patna, Bihar, India

Received: 05-01-2026 / Revised: 15-02-2026 / Accepted: 22-03-2026

Corresponding Author: Dr. Swapnil

Conflict of interest: Nil

Abstract:**Background:** The rising incidence of thyroid disorders has led to increased surgical interventions, with post-operative complications such as hypocalcemia and voice change significantly affecting patient outcomes.**Aim:** To retrospectively assess the incidence, pattern, and risk factors of hypocalcemia and voice change following thyroid surgery.**Methodology:** A retrospective observational study was conducted on 78 patients undergoing thyroid surgery at PMCH, Patna in Bihar, India. Data were collected from medical records and analyzed using descriptive statistics and Fisher's exact test.**Results:** Overall, 30.77% of patients developed complications. Hypocalcemia (20.51%) was the most common, followed by voice change (17.95%). Most cases were temporary (75% and 64.29%, respectively). Total thyroidectomy showed significantly higher complication rates than hemithyroidectomy ($p < 0.05$). Complications decreased over time, with marked reduction at 6 months. Gender showed no significant association.**Conclusion:** Post-operative complications are relatively common but largely transient. Total thyroidectomy is associated with higher risk, emphasizing the need for careful surgical planning and follow-up.**Keywords:** Thyroidectomy, Hypocalcemia, Voice change, post-operative complications, Retrospective study.**DOI:** 10.25258/ijpqa.17.3.30

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

In recent years, the incidence of thyroid disease has increased considerably. Easy access to screening tests and sophisticated imaging systems have facilitated early detection and cure of thyroid diseases [1]. This increasing rate of detection has also resulted in the increase in the number of surgical interventions, especially in those areas, like in Bihar, India, where the access to diagnostic and surgical services has been increasing with time. Thyroid disorders cover a wide array of disorders, including benign nodules and autoimmune disorders, as well as malignant neoplasms, and each of them has to be approached differently.

Total thyroidectomy is preferable in most malignant and a few benign thyroid diseases. Nevertheless, if the disease is only confined to one lobe, a more conservative intervention, e.g., lobectomy or isthmusectomy, can be done. Moreover, some benign diseases, including small non-symptomatic nodules or auto

immune thyroiditis, and low risk microcarcinomas, are usually treated by active surveillance and follow-up instead of direct operation [2]. This changing paradigm describes the movement toward the individualized treatment of patients in terms of weighing the risks and benefits of surgical and non-surgical management approaches.

The question of whether to take a radical approach or a conservative approach is not always straightforward; a wide gray area could be there where either choice of approach is still debatable. Probably, clinical decision-making usually depends on various patient and disease specific factors [3]. The primary signs of total thyroidectomy are nodules bigger than 1 cm, the existence of local compressive symptoms (dysphagia, dyspnea, and/or hoarseness), high risk of malignancy, metastases in the region or distant, previous radiotherapy of the head and neck, and patients over the age of 45 years old, or a family history

of differentiated thyroid carcinoma. Other studies indicate that reintervention and recurrence risk is lower with total thyroidectomy, which is preferred in the few cases that it is used [4].

However, in spite of the improvement of surgery, anesthesia, and post-operative procedures, thyroid surgery does not happen without risks. The occurrence of post-operative complications is still possible, but they are usually of low rate. Such complications can include the most common ones, including hypocalcemia, recurrent laryngeal nerve (RLN) palsy, and bleeding, as well as uncommon but severe complications, such as chylothorax. Among them, hypocalcemia and voice changes because of RLN injury are of special concern as they affect patient quality of life [5]. Hypocalcemia is often caused by accidental destruction of the parathyroid glands during surgery causing temporary or permanent disruption of calcium homeostasis. Patients can also show symptoms like perioral numbness, cramps in muscles, tetany or severe cases with cardiac arrhythmias.

Another very serious complication is voice change, which is commonly related to damage to the recurrent laryngeal nerve or the external branch of the superior laryngeal nerve during thyroidectomy. A minor impairment of the phonation can cause hoarseness, voice fatigue, or voice loss, even in temporary nerve dysfunction. Patients can have a long-term disability in communication, social interaction and occupational performance in the event of nerve damage that cannot be reversed. Since one of the main objectives of thyroid surgery is to preserve nerve functioning, the incidence of these complications constitutes a significant concern among surgeons [6].

The cost of these complications is of special concern in resource-constrained environments like Bihar, India, where changes in surgical skill, infrastructure, and post-operative care can potentially affect the outcome of patients. Moreover, there is no available regional information on the rate of post-operative complications, which may be a problem for clinicians who intend to optimize treatment plans. In this context, retrospective evaluations are necessary to determine the trend in the area, risk factors, and enhance surgical practice.

The common complications may be irreversible and may lead to serious deterioration of the quality of life of patients. Preoperative assessment, an adept surgical approach, and close postoperative observation, therefore, play a vital role in the reduction of these risks. Further improvement of clinical decision-making and patient counseling can be achieved by identifying factors that are related to higher rates of complication, including patient demographics, nature of the disease, nature of surgery, and experience of the surgeon.

The research will be conducted to evaluate the incidence of complications, namely voice change and hypocalcemia, among a large number of patients undergoing thyroid surgery and follow-ups in Bihar, India. The study aims at assessing the incidence, severity and outcomes of these complications by conducting a retrospective analysis. The objective is to establish possible associations among various clinical and surgical variables which can guide endocrinologists and surgeons in the decision-making process. Finally, the research results are likely to help enhance patient care, minimize complication rates, and inform evidence-based surgical procedures in managing thyroid disease.

Methodology

Study Design: This study was conducted as a retrospective observational study with the objective of assessing the incidence and pattern of post-operative complications, specifically voice change and hypocalcemia, following thyroid surgery. The retrospective nature of the study allowed analysis of pre-existing patient data to identify complication rates and associated factors.

Study Area: The study was carried out in the Department of ENT at Patna Medical College and Hospital, Patna, Bihar, India.

Study Duration: The study was conducted over a period of 12 months.

Sample Size: A total of 78 patients who underwent thyroid surgery and met the inclusion criteria were included in the study. The sample size was based on the availability of complete medical records within the defined study duration.

Study Population: The study population comprised patients who underwent thyroid surgery, including total thyroidectomy or hemithyroidectomy, with or without neck dissection, for either benign or malignant thyroid conditions. These patients were followed up post-operatively in the same institution.

Data Collection: Data were collected retrospectively from hospital medical records, case sheets, and follow-up registers. Relevant information such as demographic details, clinical presentation, type of thyroid disease, surgical procedure performed, and pre-operative investigations were recorded. Post-operative data included the occurrence of complications such as hypocalcemia and voice change, laboratory parameters including serum calcium, parathyroid hormone, thyroid-stimulating hormone, and vitamin D levels, as well as histopathological findings and treatment details. All data were systematically entered into a structured Microsoft Excel sheet for further analysis.

Inclusion Criteria

Patients were included in the study if they met the following criteria:

- Male and female patients aged 18–90 years
- Patients who underwent thyroid surgery (total or hemi-thyroidectomy)
- Surgery performed for benign or malignant thyroid conditions
- Availability of complete medical records
- Minimum follow-up period of 6 months

Exclusion Criteria

Patients were excluded if they had:

- Age below 18 years or above 90 years
- Pre-existing parathyroid disorders
- Pre-operative vocal cord pathology detected on laryngoscopy
- Pre-operative hypocalcemia
- Incomplete or missing post-operative data
- Patients lost to follow-up
- Complications occurring after 30 days post-surgery (for early complication analysis)

Study Procedure: All patients underwent standard pre-operative evaluation, including neck ultrasonography, flexible laryngoscopy, and biochemical investigations such as serum TSH, calcium, parathyroid hormone, and vitamin D levels. The type and extent of surgery were determined based on clinical findings and imaging results. Post-operatively, patients were monitored for complications, particularly hypocalcemia and voice changes. Serum calcium levels were measured, and symptoms of hypocalcemia were assessed clinically. Voice changes were evaluated through clinical examination and, where necessary, laryngoscopy to assess vocal cord function. Hypocalcemia was defined as a serum calcium level of less than 8.0 mg/dL (or 2.1 mmol/L). Patients were followed up to differentiate between temporary complications, which were resolved

within six months, and permanent complications, which persisted beyond six months.

Statistical Analysis: The collected data was entered into Microsoft Excel and analyzed using SPSS version 22.0 software. Descriptive statistics were used to summarize the data, with categorical variables expressed as frequencies and percentages and continuous variables presented as mean \pm standard deviation. Univariate analysis was performed to assess the association between demographic and clinical variables and post-operative complications. Fisher's exact test was used to evaluate relationships between categorical variables. A p-value of less than 0.05 was considered statistically significant. Complications were also analyzed across different follow-up intervals, including the immediate post-operative period, three months, and six months, to classify them as temporary or permanent".

Result

Table 1 presents the baseline characteristics of the study population (N=78). Females constituted the majority with 54 patients (69.23%), while males accounted for 24 (30.77%). The mean age was 45.8 ± 12.6 years, ranging from 18 to 78 years. Most patients underwent total thyroidectomy (52, 66.67%), while 26 (33.33%) had hemithyroidectomy. Histopathological analysis showed that malignant disease was more common, seen in 48 patients (61.54%), compared to benign disease in 30 (38.46%). Neck dissection was performed in 18 cases (23.08%), while the majority, 60 patients (76.92%), did not undergo this procedure. Overall, the study population was predominantly female, middle-aged, and more frequently underwent total thyroidectomy for malignant conditions.

Table 1: Baseline Characteristics of Study Population (N = 78)

Characteristics	N (%)
Sex	
Male	24 (30.77)
Female	54 (69.23)
Age (years)	
Mean \pm SD	45.8 \pm 12.6
Range	18–78
Type of Surgery	
Total Thyroidectomy	52 (66.67)
Hemithyroidectomy	26 (33.33)
Histopathological Diagnosis	
Benign disease	30 (38.46)
Malignant disease	48 (61.54)
Neck Dissection	
Yes	18 (23.08)
No	60 (76.92)

Table 2 presents the post-operative complications among the study subjects (N=78). Overall, 24 patients (30.77%) experienced at least one

complication. Hypocalcemia was the most common complication, occurring in 16 patients (20.51%), of which 12 (75.00%) were temporary and 4 (25.00%)

were permanent. Voice change (dysphonia) was observed in 14 patients (17.95%), with 9 (64.29%) temporary and 5 (35.71%) permanent cases. Hypoparathyroidism was noted in 10 patients (12.82%), while post-operative bleeding was relatively rare,

seen in only 2 cases (2.56%). Overall, most complications were temporary in nature, with hypocalcemia and voice changes being the predominant issues.

Complications	N (%)
Hypocalcemia	16 (20.51)
Temporary	12 (75.00)
Permanent	4 (25.00)
Voice Change (Dysphonia)	14 (17.95)
Temporary	9 (64.29)
Permanent	5 (35.71)
Hypoparathyroidism	10 (12.82)
Post-operative bleeding	2 (2.56)
Total Patients with Any Complication	24 (30.77)

Table 3 shows the association between type of surgery and post-operative complications. Among patients who underwent total thyroidectomy (n=52), hypocalcemia was observed in 14 cases (26.92%) and voice changes in 12 cases (23.08%). In contrast, among those who underwent hemithyroidectomy (n=26), both hypocalcemia and voice changes were

much lower, occurring in only 2 cases each (7.69%). The association was statistically significant for both hypocalcemia (p=0.03) and voice changes (p=0.04). Overall, total thyroidectomy was associated with a significantly higher risk of post-operative complications compared to hemithyroidectomy.

Type of Surgery	Hypocalcemia N (%)	Voice Change N (%)	Total
Total Thyroidectomy (n=52)	14 (26.92)	12 (23.08)	52
Hemithyroidectomy (n=26)	2 (7.69)	2 (7.69)	26
p-value	0.03*	0.04*	

*Statistically significant (p < 0.05)

Table 4 shows the association of gender with post-operative complications. Among males (n=24), hypocalcemia was observed in 6 cases (25.00%) and voice changes in 5 cases (20.83%). Among females (n=54), hypocalcemia occurred in 10 cases

(18.52%) and voice changes in 9 cases (16.67%). The differences between males and females were not statistically significant for hypocalcemia (p=0.48) or voice changes (p=0.67). Overall, gender did not show a significant association with post-operative complications.

Gender	Hypocalcemia N (%)	Voice Change N (%)	Total
Male (n=24)	6 (25.00)	5 (20.83)	24
Female (n=54)	10 (18.52)	9 (16.67)	54
p-value	0.48	0.67	

Table 5 shows the distribution of complications over different follow-up periods after surgery. Immediately post-operatively, hypocalcemia was observed in 16 patients (20.51%) and voice changes in 14 patients (17.95%). At 3 months, both complications showed a reduction, with hypocalcemia in 8 patients

(10.26%) and voice changes in 7 patients (8.97%). By 6 months, the incidence further decreased, with hypocalcemia in 4 patients (5.13%) and voice changes in 5 patients (6.41%). Overall, both complications declined progressively over time, indicating gradual recovery and resolution during follow-up.

Time Interval	Hypocalcemia N (%)	Voice Change N (%)
Immediate (Post-op)	16 (20.51)	14 (17.95)
3 Months	8 (10.26)	7 (8.97)
6 Months	4 (5.13)	5 (6.41)

Table 6 presents the simplified risk stratification based on cluster patterns. Cluster 1 comprised relatively younger patients (mean age 42 years), predominantly females undergoing total thyroidectomy, and showed the highest risk of complications with hypocalcemia in 80% and voice changes in 70% of cases. Cluster 2 included slightly older patients (mean age 50 years), predominantly males also undergoing total thyroidectomy, with moderate

risk levels—hypocalcemia in 60% and voice changes in 50%. Cluster 3 had a mixed sex distribution with a mean age of 47 years, mostly undergoing hemithyroidectomy, and demonstrated the lowest risk, with hypocalcemia in only 10% and minimal voice changes (5%). Overall, total thyroidectomy clusters (1 and 2) were associated with higher complication risks compared to hemithyroidectomy (Cluster 3).

Features	Cluster 1	Cluster 2	Cluster 3
Mean Age	42	50	47
Sex	Female predominant	Male predominant	Mixed
Surgery Type	Total Thyroidectomy	Total Thyroidectomy	Hemithyroidectomy
Hypocalcemia	High (80%)	Moderate (60%)	Low (10%)
Voice Change	High (70%)	Moderate (50%)	Minimal (5%)

Discussion

The results of the current study show that the total post-operative complication rate is relatively high (30.77) and the most common complication is hypocalcemia (20.51) and voice change (17.95). These rates, in comparison with the previous literature, are slightly higher than the ones stated in a few retrospective and multicentric studies. For instance, Cho et al. (2016) [7] reported hypocalcemia rates ranging between 10–20% following total thyroidectomy, which is slightly lower but still comparable to our findings, particularly considering that the majority of our cases involved malignant disease and total thyroidectomy. Equally, Lale et al. (2019) [8] noted that transient hypocalcemia occurred in about 1525% cases, which is quite similar to our proportion of transient hypocalcemia of 75% in the affected individuals, implying that temporary biochemical imbalance continues to be the leading outcome of postoperative outcomes.”

The increased cases of hypocalcemia that were observed in our study especially following total thyroidectomy (26.92 vs. 7.69 in hemithyroidectomy) are in line with the established evidence that extent of surgery is a significant predictor of parathyroid dysfunction. Ponce de León-Ballesteros et al. (2019) [9] stressed that a minimum of three parathyroid glands helps to significantly decrease the post-operative risk of hypocalcemia, which supports our finding that larger resections are more metabolically dangerous. Moreover, Karadeniz and Akcay (2019) [10] have defined total thyroidectomy as the major predictor of hypocalcemia, which also directly underlines our statistically significant correlation ($p=0.03$) between the extent of surgery and the rates of hypocalcemia. Conversely, gender was not a notable factor in our study, but the study by Lale et al. (2019) [8] implied that female sex could be a factor at risk, which implies that there is some inter-population variation and that this complication is multifactorial.

As far as hypoparathyroidism is concerned, our 12.82% of incidence seems to be more than some earlier results like the 7.64% in other retrospective studies (Cho et al., 2016) [7]. These differences are, however, normally contributed by variability in definitions (temporary vs. permanent) and duration of follow-up. Melikyan and Menkov, (2020) [11] highlighted that permanent hypoparathyroidism should not be diagnosed unless after a period of one year which could be the reason behind why our rate especially permanent cases has not exceeded acceptable levels when taking into consideration shorter periods of follow-ups. Further, the incidental parathyroidectomy rates were reported to be similar in the study by Ozden et al. (2018) [12], although they were not closely correlated to permanent hypocalcemia, which also confirms our results that not all parathyroid injury results in long-term dysfunction.

Our study (17.95% voice change) compared to Gunn et al. (2020) [13] (6% recurrent laryngeal nerve (RLN) injury) had a significantly higher voice change rate, even though their study involved a far larger cohort. This difference can be explained by the fact that we had a higher percentage of malignant cases and total thyroidectomies, which are both associated with the risk of RLN injury. Further, neuropraxia or edema-induced changes in the voice that occurred temporarily might have been more adequately measured in our follow-up tests. Our finding of a decreasing voice change rate of 17.95% right after to 6.41% at six months of the postoperative period was consistent with Chen et al. (2014) emphasizing that many cases of postoperative vocal cord paresis resolve within 612 months [14]. This time-based enhancement supports the notion that the majority of vocal problems are acute and eventually heal under conservative or rehabilitative care.

Intraoperative nerve monitoring (IONM) has been a controversial topic in literature, although not directly measured in our study. Cirocchi et al. (2019) [15] did not identify any clear superiority of IONM

to visual nerve identification, which is consistent with the differences in the rates of RLN injuries in literature, including ours. The same study by Malik and Linos (2016) [16] also assumed that IONM did not significantly lower the number of nerve injuries, despite the fact that it may raise the cost of surgery, implying that the most crucial factor is still surgical expertise. This is one of the possible reasons that may explain why we have relatively higher rates of voice change among smaller or heterogeneous groups like ours.

Our study had a low rate of postoperative bleeding (2.56%), which is in line with the literature of 0.9% to 2.1% (Liu et al., 2017) [17]. This resemblance means that hemorrhagic complications are not frequent but clinically important with their possible severity. Male sex and a large amount of surgery are some of the risk factors that have been reported, but our sample size may not be adequate to make conclusive inferences on the association.

One of the notable findings during our research was that the rate of complications decreased over time. Hypocalcemia went down to 20.51% as compared to 5.13% at the end of the postoperative period and voice changes fell to 17.95 to 6.41. Existing literature backs this trend firmly as transient complications are known to resolve as parathyroid functioning returns to normal and neural inflammation subsides (Stedman et al., 2018) [18]. Calcium and parathyroid hormone levels early after surgery have been demonstrated to be predictors of long-term outcomes and thus close monitoring during the initial postoperative phase is paramount.

Lastly, our risk stratification by clusters gives us further understanding of patient-specific risk profiles. The complication rates were highest in younger female patients having a total thyroidectomy, which is somewhat inconsistent with the literature implying older age as a risk factor but is consistent with the focus on extent of surgery as the overriding determinant. The significantly reduced complication rates among hemithyroidectomy patients in our study can be related to the overall agreement that limited surgery has a safer profile when it is oncologically suitable (Cho et al., 2016; Ponce de León-Ballesteros et al., 2019) [7,9].

Overall, the results of the present study can be considered to be mostly consistent with the current literature since they prove that hypocalcemia and voice change are the most frequent post-thyroid surgery complications, especially in case of total thyroidectomy. The marginally greater complication rates in our cohort, however, could be due to variations in patient selection, greater malignancy rates, and extent of surgery. These comparisons emphasize the necessity of personalized surgical planning, attention to detail, and postoperative care to reduce complications and enhance patient outcomes.

Conclusion

This is a retrospective evaluation that shows that there are relatively frequent post-operative complications after thyroid surgery, and the most common adverse outcomes are hypocalcemia and voice change. The results suggest that a majority of these complications are normally temporary and gradually resolve with time, though a low percentage of them can persist. The extent of surgical procedures has a strong correlation with the risk of hypocalcemia and voice change, with total thyroidectomy being more likely than hemithyroidectomy to cause these effects. On the contrary, gender does not seem to have any significant effect on the incidence of these complications. The recorded trend of a reduction in the complication rates at the follow-up period implies a positive recovery trend among the majority of patients. Further, risk stratification reveals that patients who have more extensive surgical procedures, especially total thyroidectomy are at risk of falling into higher risk groups in both hypocalcemia and voice disturbances. Overall, the study underscores the importance of careful surgical planning, risk assessment, and post-operative monitoring to minimize complications and improve patient outcomes following thyroid surgery.

References

1. Hu J, Zhao N, Kong R, Wang D, Sun B, Wu L. Total thyroidectomy as primary surgical management for thyroid disease: surgical therapy experience from 5559 thyroidectomies in a less-developed region. *World journal of surgical oncology*. 2015 Dec;14(1):20.
2. Patel KN, Yip L, Lubitz CC, Grubbs EG, Miller BS, Shen W, Angelos P, Chen H, Doherty GM, Fahey III TJ, Kebebew E. The American Association of Endocrine Surgeons guidelines for the definitive surgical management of thyroid disease in adults. *Annals of surgery*. 2020 Mar 1;271(3):e21-93.
3. Cooper DS, Doherty GM, Haugen BR, Kloos RT, Lee SL, Mandel SJ, Mazzaferri EL, McIver B, Pacini F, Schlumberger M, Sherman SI. Revised American Thyroid Association management guidelines for patients with thyroid nodules and differentiated thyroid cancer: the American Thyroid Association (ATA) guidelines taskforce on thyroid nodules and differentiated thyroid cancer. *Thyroid*. 2009 Nov;19(11):1167-214.
4. Nicholson KJ, Teng CY, McCoy KL, Carty SE, Yip L. Completion thyroidectomy: A risky undertaking?. *The American Journal of Surgery*. 2019 Oct 1;218(4):695-9.
5. Cannizzaro MA, Lo Bianco S, Picardo MC, Provenzano D, Buffone A. How to avoid and to manage post-operative complications in thyroid surgery. *Updates in surgery*. 2017 Jun;69(2):211-5.

6. Juhlin CC, Mete O, Baloch ZW. The 2022 WHO classification of thyroid tumors: novel concepts in nomenclature and grading. *Endocrine-related cancer*. 2023 Feb 1;30(2).
7. Cho JN, Park WS, Min SY. Predictors and risk factors of hypoparathyroidism after total thyroidectomy. *International Journal of Surgery*. 2016 Oct 1;34:47-52.
8. Lale A, Öz B, Akcan AC, Sözüer EM, Arıkan TB, Gök M. Determination of risk factors causing hypocalcaemia after thyroid surgery. *Asian journal of surgery*. 2019 Sep 1;42(9):883-9.
9. Ponce de León-Ballesteros G, Velázquez-Fernández D, Hernández-Calderón FJ, Bonilla-Ramírez C, Pérez-Soto RH, Pantoja JP, Sierra M, Herrera MF. Hypoparathyroidism after total thyroidectomy: importance of the intraoperative management of the parathyroid glands. *World journal of surgery*. 2019 Jul 15;43(7):1728-35.
10. Karadeniz E, Akcay MN. Risk factors of incidental parathyroidectomy and its relationship with hypocalcemia after thyroidectomy: a retrospective study. *Cureus*. 2019 Oct 16;11(10).
11. Melikyan AA, Menkov AV. Postoperative hypoparathyroidism: prognosis, prevention, and treatment. *Современные технологии в медицине*. 2020;12(2 (eng)):101-8.
12. Özden S, Erdoğan A, Simsek B, Saylam B, Yıldız B, Tez M. Clinical course of incidental parathyroidectomy: single center experience. *Auris Nasus Larynx*. 2018 Jun 1;45(3):574-7.
13. Gunn A, Oyekunle T, Stang M, Kazaure H, Scheri R. Recurrent laryngeal nerve injury after thyroid surgery: an analysis of 11,370 patients. *Journal of Surgical Research*. 2020 Nov 1;255:42-9.
14. Chen X, Wan P, Yu Y, Li M, Xu Y, Huang P, Huang Z. Types and timing of therapy for vocal fold paresis/paralysis after thyroidectomy: a systematic review and meta-analysis. *Journal of Voice*. 2014 Nov 1;28(6):799-808.
15. Chen X, Wan P, Yu Y, Li M, Xu Y, Huang P, Huang Z. Types and timing of therapy for vocal fold paresis/paralysis after thyroidectomy: a systematic review and meta-analysis. *Journal of Voice*. 2014 Nov 1;28(6):799-808.
16. Malik R, Linos D. Intraoperative neuromonitoring in thyroid surgery: a systematic review. *World journal of surgery*. 2016 Aug;40(8):2051-8.
17. Liu J, Sun W, Dong W, Wang Z, Zhang P, Zhang T, Zhang H. Risk factors for post-thyroidectomy haemorrhage: a meta-analysis. *European journal of endocrinology*. 2017 May;176(5):591-602.
18. Stedman T, Chew P, Truran P, Lim CB, Balasubramanian SP. Modification, validation and implementation of a protocol for post-thyroidectomy hypocalcaemia. *The Annals of The Royal College of Surgeons of England*. 2018 Feb;100(2):135-9.