Section: General Surgery

Original Research Article

STUDY ON THE INCIDENCE AND CLINICAL CORRELATION OF POSTOPERATIVE HYPOCALCEMIA FOLLOWING TOTAL THYROIDECTOMY

Received : 02/01/2025
Received in revised form : 18/02/2025
Accepted : 06/03/2025

Keywords:
Total thyroidectomy; Hypocalcemia; Serum calcium; Postoperative complications; Risk factors.

Corresponding Author:
Dr. C. Gopinath,
Email: gopichandran8@gmail.com

DOI: 10.47009/jamp.2025.7.5.19

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2025; 7 (5); 89-94

D.P. Kavitha[1], K. Thenmozhi[2], C. Gopinath[3]

[1]Assistant Professor, Department of General Surgery, Coimbatore Medical College Hospital, Coimbatore, Tamil Nadu, India.
[2]Assistant Professor, Department of General Surgery, Coimbatore Medical College Hospital, Coimbatore, Tamil Nadu, India.
[3]Assistant Professor, Department of General Surgery, Coimbatore Medical College hospital, Coimbatore, Tamil Nadu, India.

ABSTRACT

Background: Postoperative hypocalcemia remains one of the most common and significant complications following total thyroidectomy. Understanding its incidence, associated clinical factors, and early predictors is essential for timely management and prevention of adverse outcomes. **Aim:** To study the incidence and clinical correlation of postoperative hypocalcemia following total thyroidectomy, and to assess the impact of demographic, surgical, and biochemical factors on its development. **Materials and Methods:** This cross-sectional observational study was conducted in the Department of General Surgery at Coimbatore Medical College Hospital, including 50 patients who underwent total or completion thyroidectomy. Preoperative assessments included serum calcium and albumin levels, imaging, thyroid function tests, and fine needle aspiration cytology. Postoperatively, patients were monitored with daily clinical evaluations and serum calcium measurements. Hypocalcemia was diagnosed based on clinical symptoms and serum calcium values. Patients were followed up for six months in cases of transient hypocalcemia and one year for permanent hypocalcemia. Statistical analysis was performed using SPSS v25.0, and significance was set at $p<0.05$. **Results:** Out of 50 patients, 40 (80%) were female and 10 (20%) were male, with the 41–50 years age group being the most common. The mean preoperative serum calcium level was 9.41 ± 0.42 mg/dL, which dropped to 8.908 ± 0.3778 mg/dL at 24 hours and 8.662 ± 0.357 mg/dL at 48 hours postoperatively. Hypocalcemia was observed in 62% (31 patients). Hypocalcemia was significantly more common in females and in patients aged above 50 years. The cause of surgery (benign vs malignant) and the duration of surgery (<2 hours vs >2 hours) were not significantly associated with hypocalcemia. Preoperative calcium levels below 9.5 mg/dL were strongly correlated with postoperative hypocalcemia. Most patients with hypocalcemia responded to oral calcium, while a minority required intravenous supplementation or long-term therapy. **Conclusion:** The duration of surgery and the underlying pathology did not significantly affect the risk of hypocalcemia. However, female gender, age above 50 years, and lower preoperative calcium levels were significant risk factors. Early identification and management of high-risk patients are crucial to reducing postoperative hypocalcemia rates. Further large-scale, multicenter studies are recommended to strengthen these findings.

INTRODUCTION

Total thyroidectomy is a commonly performed surgical procedure for a variety of thyroid disorders, including benign multinodular goiter, Graves' disease, and thyroid malignancies. Despite advancements in surgical techniques, postoperative complications continue to pose significant challenges, with hypocalcemia being among the most frequent and concerning issues.[1] Hypocalcemia following thyroid surgery can lead to a range of symptoms, from mild tingling and numbness to severe manifestations such as carpopedal spasm, tetany, and cardiac arrhythmias, making it a

ISSN (O): 2687-5365; ISSN (P): 2753-6556

complication that warrants careful evaluation and management.

The incidence of postoperative hypocalcemia varies widely across different studies, with reported rates ranging between 20% and 50% depending on the definition applied, the type of thyroid pathology treated, and the extent of surgery.[2] Hypocalcemia may be transient, resolving within a few weeks to months postoperatively, or it may become permanent, necessitating lifelong calcium and vitamin D supplementation. Understanding the incidence and clinical behavior of hypocalcemia is crucial for early diagnosis, effective management, and prevention of long-term morbidity in thyroidectomy patients.

Several mechanisms contribute to the development of hypocalcemia after total thyroidectomy. The most commonly implicated factors include inadvertent removal of the parathyroid glands during surgery, devascularization of the parathyroid tissue, or pre-existing compromised parathyroid function.[3] Studies have shown that meticulous surgical technique, aimed at identifying and preserving parathyroid glands and their vascular supply, can significantly reduce the incidence of postoperative hypocalcemia.[4] Nonetheless, even with the most careful dissection, some degree of transient parathyroid dysfunction may be inevitable due to manipulation or temporary ischemia.

Preoperative assessment of patients, including evaluation of serum calcium and vitamin D levels, has been proposed as a strategy to predict and mitigate the risk of postoperative hypocalcemia. Hypovitaminosis D has been shown to predispose patients to a greater risk of symptomatic hypocalcemia after thyroidectomy.[5] Prophylactic administration of calcium and vitamin D supplements preoperatively and postoperatively has also been investigated and appears beneficial in reducing both the incidence and severity of hypocalcemic symptoms in selected patient populations.

The debate between total versus near-total thyroidectomy in terms of risk of postoperative complications also persists. Some evidence suggests that near-total thyroidectomy may carry a slightly lower risk of hypocalcemia because a portion of thyroid tissue — and possibly some parathyroid tissue — is left intact, potentially preserving parathyroid function.[4,6] However, total thyroidectomy remains the procedure of choice in conditions such as thyroid malignancy and Graves' disease where complete gland removal is necessary.[7]

The clinical features of hypocalcemia typically present within the first 24 to 72 hours following surgery. Early identification based on clinical signs, such as perioral numbness, tingling sensations, Chvostek's sign, and Trousseau's sign, is important. Laboratory measurement of serum ionized calcium provides a more accurate assessment of biologically active calcium levels compared to total serum calcium, and thus plays a critical role in diagnosing and monitoring postoperative hypocalcemia.

Routine measurement of serum calcium levels postoperatively can aid in stratifying patients into different risk categories. Patients with low postoperative calcium levels or significant drops from baseline values should be monitored more closely and considered for early supplementation. Some studies have recommended protocols involving early oral or intravenous calcium supplementation to prevent the development of symptomatic hypocalcemia and reduce hospital stay duration.[8]

Moreover, the pattern of hypocalcemia following surgery can vary depending on several intraoperative and patient-related factors. Inadvertent parathyroidectomy, whether identified histologically or clinically, is one of the major predictors of postoperative hypocalcemia.[3] Additionally, extensive surgery involving neck dissection for malignancy increases the risk of parathyroid injury and subsequent hypocalcemia.[7] Patients with large multinodular goiters, recurrent thyroid disease, or distorted anatomy are also at an increased risk due to the greater technical difficulty of surgery.

Management of postoperative hypocalcemia primarily revolves around calcium and vitamin D supplementation. The regimen varies depending on the severity of hypocalcemia, ranging from oral calcium supplements for mild cases to intravenous calcium gluconate administration for severe or symptomatic hypocalcemia. Long-term follow-up is necessary to distinguish transient hypocalcemia from permanent hypoparathyroidism, which is typically diagnosed if hypocalcemia persists beyond six months postoperatively despite adequate supplementation.

Despite advances in surgical techniques and perioperative care, postoperative hypocalcemia remains a major concern. Establishing standardized protocols for the early identification and management of hypocalcemia is necessary to improve patient outcomes. Furthermore, patient education regarding the signs and symptoms of hypocalcemia before discharge is critical for early recognition and prompt treatment.

MATERIALS AND METHODS

This was a cross-sectional observational study conducted in the Department of General Surgery at Coimbatore Medical College Hospital (CMCH), Coimbatore. The study included 50 patients who underwent total or completion thyroidectomy across various surgical units within the department. A total of 50 patients were enrolled in the study.

Inclusion Criteria

- Patients of all age groups ranging from 14 to 75 years.
- Both male and female patients.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

- Patients with benign, malignant, toxic, or non-toxic goitre who underwent total or completion thyroidectomy.

Exclusion Criteria

- Patients aged below 14 years.
- Patients who underwent hemithyroidectomy.
- Patients with primary parathyroid pathology.
- Patients already receiving calcium supplementation.

Methodology

All participants underwent thorough preoperative assessment, including routine hematological and biochemical investigations such as serum calcium and serum albumin levels. Radiological imaging included chest X-ray in posteroanterior view and neck X-ray in anteroposterior and lateral views. Additional preoperative evaluations comprised electrocardiogram (ECG), thyroid function tests (TFTs), ultrasonography of the neck, fine needle aspiration cytology (FNAC) of the thyroid gland, and vocal cord examination to rule out preexisting vocal cord palsy. Patients diagnosed with toxic goitre were rendered euthyroid preoperatively using appropriate antithyroid medications and beta-blockers.

All 50 patients underwent either total or completion thyroidectomy in different surgical units. Serum calcium levels were recorded both preoperatively and postoperatively for each patient. Postoperatively, patients were closely monitored with daily clinical evaluation and serum calcium measurements. Patients who remained asymptomatic without complications were discharged by the fourth or fifth postoperative day.

Postoperative hypocalcemia was defined based on serum calcium levels and clinical symptoms. Patients identified with transient hypocalcemia were followed up for a period of six months, while those diagnosed with permanent hypocalcemia were followed for one year. Follow-up evaluations were scheduled biweekly for the first two months and then monthly thereafter. At each follow-up visit, clinical assessment, serum calcium estimation, and thyroid function testing were performed for patients exhibiting postoperative hypocalcemia.

For statistical analysis, quantitative data including serum calcium levels were expressed as mean ± standard deviation (SD). Categorical variables such as the presence or absence of hypocalcemia, type of thyroid disorder, and gender were summarized as frequencies and percentages. Comparisons between preoperative and postoperative serum calcium levels were made using the paired t-test, and statistical significance was established at $p < 0.05$. Data were analyzed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA).

RESULTS

Table 1 show that out of 50 patients, 40 were females, 10 were males, male: female ratio- 1:4, shows female predominance. In this study out of 50, 9 patients were <30years, 12 patients were 31-40years, 16were between 41-50years, 8 were between 51-60years, 5 were > 60years. 41-50 years was the most common age group underwent total thyroidectomy in this study. Out of 50 who underwent total thyroidectomy, 42 were underwent surgery for benign causes, 8 were underwent surgery for malignant causes. In this study out of 50 who underwent total thyroidectomy, 38 cases were finished <2hours, 12 were taken >2hours.

Table 2 show that average pre op calcium value was 9.41±0.116 with standard deviation of 0.420. In this study average ca2+ valueafter 24hours was 8.908 ±0.105 with standard deviation of 0.3778. ca2+ valueafter 48hours was 8.662 ±0.099 with standard deviation of 0.357. In this study out of 50 who underwent total thyroidectomy, 31(62%) developed hypocalcemia,

Table 3 show that out of 31 who developed hypocalcemia, 28were female, only 3 were males, with statistically significant p-value.

Indicates post op hypocalcemia was more common in female.

In this study out of 31 who developed hypocalcemia, 12 were above 50years, 19 were < 50years, with statistically significant p-value.

Indicating >50years was the risk factor for developing post of hypocalcemia in total thyroidectomy.

In this study out of 31 who developed hypocalcemia, 25 were underwent surgery for benign causes, were underwent surgery for malignant causes, with statistically not significant p-value. In this study out of 31 who developed hypocalcemia, 25 were underwent surgery ,<2hours, were underwent surgery >2hours, with statistically not significant p-value.

Table 1: Demographic and Clinical Profile of Patients Undergoing Total or Completion Thyroidectomy (n = 50)

Parameter	Category	No. of Patients	Percentage (%)
Gender Distribution	Male	10	20.00
	Female	40	80.00
Age Distribution	<30 years	9	18.00
	31–40 years	12	24.00
	41–50 years	16	32.00
	51–60 years	8	16.00
	>60 years	5	10.00
Cause of Surgery	Benign	42	84.00
	Malignant	8	16.00
Duration of Surgery	<2 hours	38	76.00
	>2 hours	12	24.00

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Table 2: Preoperative and Postoperative Serum Calcium Levels

Time Point	Average Calcium (mg/dL)	± Percentage	Standard Deviation (SD)
Preoperative	9.41	±0.116 (±1.24%)	0.420
24 hours Postoperative	8.908	±0.105 (±1.18%)	0.3778
48 hours Postoperative	8.662	±0.099 (±1.14%)	0.357

Table 3: Distribution and Risk Factors Associated with Postoperative Hypocalcemia (n = 50)

Comparison Parameter	Category	Hypocalcemia Present (n)	Hypocalcemia Absent (n)	Total (n)	Chi-square (χ^2)	p-value	Statistical Significance
Overall Distribution	-	31	19	50	-	-	-
Gender	Male	3	7	10	5.433	0.01	Significant
	Female	28	12	40			
Age Group	<50 years	19	18	37	6.849	0.008	Significant
	>50 years	12	1	13			

Table 4: Comparison of Cause of Total Thyroidectomy with Post-Operative Hypocalcemia

Hypocalcemia	Benign (n=42)	Malignant (n=8)	Total (n=50)	Chi-square	p-value
Present	25	6	31		
Absent	17	2	19		
Total	**42**	**8**	**50**	**0.683**	**0.4**

Table 4 show that out of 31 who developed hypocalcemia, 25 were underwent surgery for benign causes, were underwent surgery for malignant causes, with statistically not significant p-value

Table 5: Comparison of Duration of Surgery with Post-Operative Hypocalcemia

Hypocalcemia	< 2 hours (n=38)	> 2 hours (n=12)	Total (n=50)	Chi-square	p-value
Present	25	6	31		
Absent	13	6	19		
Total	**38**	**12**	**50**	**0.965**	**0.32**

Table 5 show that out of 31 who developed hypocalcemia, 25 were underwent surgery ,<2hours, were underwent surgery >2hours, with statistically not significant p-value.

The mean preoperative calcium levels were 9.41 ±0.116 mg/dL whereas serum calcium after 24 and 48 hours of the surgery was 8.908 ±0.105 mg/dL and 8.662 ±0.099 mg/dL, respectively. The difference in serum calcium at three intervals were significantly different. Out of 31 patients with post op hypocalcemia, 21 need oral calcium supplement alone all 21 had transient hypocalcemia, 10 patients needed IV calcium supplement, out of 10, 6 had transient hypocalcemia, 4 needed long term calcium supplements.

Table 6: Comparison of Pre-Operative Calcium with Post-Operative Hypocalcemia

Hypocalcemia	Pre-op Calcium < 9.5 (n=34)	Pre-op Calcium > 9.5 (n=16)	Total (n=50)	Chi-square	p-value
Post-op hypocalcemia present	30	1	31		
Post-op hypocalcemia absent	4	15	19		
Total	**34**	**16**	**50**	**31.04**	**0.00001**

Table 6 show that 31 patients who developed post op hypocalcemia, 30 of them had pre op calcium level of <9.5, out of 19 who not developed post op hypocalcemia only 4 patients had pre op calcium value of <9.5 with statistically significant p-value. Indicate patients with pre op calcium value of <9.5 has high chance of developing post op hypocalcemia.

DISCUSSION

In the present study, demographic analysis revealed that out of 50 patients undergoing total thyroidectomy, 40 (80%) were females and 10 (20%) were males, indicating a strong female predominance with a male-to-female ratio of 1:4. The most common age group was between 41–50 years, accounting for 32% of cases. Similar demographic trends were reported by Arumugam et al (2017),[9] who observed a higher incidence of thyroid surgeries among middle-aged females, reinforcing the gender and age predisposition to thyroid disorders.

The majority of surgeries were performed for benign conditions (84%), while malignancies accounted for 16% of cases. Furthermore, 76% of surgeries were completed within two hours, reflecting good operative efficiency. These findings are comparable to observations made by Tolone et al (2013),[10] where benign thyroid disease was the major indication, and shorter operative times were associated with experienced surgical teams.

In terms of biochemical outcomes, the mean preoperative serum calcium level was 9.41 ± 0.42 mg/dL. Following surgery, mean calcium levels dropped significantly to 8.908 ± 0.3778 mg/dL at 24 hours and 8.662 ± 0.357 mg/dL at 48 hours. The fall in calcium levels over time was statistically

ISSN (O): 2687-5365; ISSN (P): 2753-6556

significant. A postoperative hypocalcemia incidence of 62% was observed (31 out of 50 patients). These findings are consistent with the reported hypocalcemia rates ranging from 20% to 60% in prior studies such as Baldassarre et al (2012),[11] and Alqahtani et al (2021).[12]

When assessing gender differences (Table 3), postoperative hypocalcemia was notably higher among females (28 out of 40 females, 70%) compared to males (3 out of 10 males, 30%), with a statistically significant p-value. Lee et al (2010),[13] similarly found that females are more susceptible to hypocalcemia after thyroidectomy, possibly due to physiological variations such as hormonal influences on calcium metabolism.

Age also emerged as a significant risk factor. In our study, hypocalcemia was more common in patients above 50 years (12 out of 13, 92.3%) compared to those below 50 years (19 out of 37, 51.4%). This correlates with findings by Erbil et al (2009),[14] who demonstrated that older age is associated with a diminished parathyroid reserve and delayed recovery from surgical stress.

Interestingly, when comparing hypocalcemia rates between patients operated for benign versus malignant causes (Table 4), there was no statistically significant difference. Of those who developed hypocalcemia, 25 had benign disease and 6 had malignant disease. This observation echoes the results of Ozogul et al (2014),[15] and Tredici et al (2011),[16] who concluded that surgical handling and preservation of parathyroid glands matter more than the underlying thyroid pathology.

Regarding the duration of surgery (Table 5), most hypocalcemic events occurred in patients whose surgeries lasted less than two hours (25 out of 31). However, the difference compared to longer surgeries (>2 hours) was not statistically significant. This finding is consistent with the study by Qasaimeh et al (2011),[17] suggesting that parathyroid injury or ischemia is related more to surgical skill and careful dissection than to operation time.

The analysis of preoperative calcium levels revealed that patients with lower preoperative calcium (<9.5 mg/dL) were significantly more likely to develop postoperative hypocalcemia (30 out of 34 patients, 88%). Conversely, those with preoperative calcium >9.5 mg/dL had a much lower risk (only 1 out of 16 developed hypocalcemia). This finding was highly statistically significant ($p < 0.00001$). A similar strong association was reported by Eismontas et al (2018),[18] highlighting preoperative calcium status as a key predictor for postoperative outcomes.

In terms of management outcomes, 21 patients with transient hypocalcemia were successfully treated with oral calcium alone, while 10 patients required intravenous calcium supplementation. Of the 10 patients who needed IV calcium, 4 progressed to persistent hypocalcemia requiring long-term supplements. This distribution of management strategies aligns with observations made by Sippel et al (2007),[19] who suggested that severe cases necessitating intravenous supplementation are more likely to develop permanent parathyroid dysfunction. Moreover, the comparison with other studies shows that our postoperative hypocalcemia incidence (62%) was somewhat higher than reported by Arumugam et al (2017),[9] (46%) and Alqahtani et al (2021),[12] (48%), but comparable to high-volume thyroidectomy series like that of Baldassarre et al (2012).[11] The slight variation could be attributed to differences in surgical experience, the complexity of cases (including malignancies requiring extensive dissection), and variations in calcium supplementation protocols.

The role of incidental parathyroidectomy was not directly assessed in this study but has been widely recognized in literature as a major risk factor, as highlighted by Sippel et al (2007),[19] and Qasaimeh et al (2011).[17] Preservation of the parathyroid glands, meticulous dissection, and minimal devascularization remain critical to reduce the incidence of postoperative hypocalcemia

CONCLUSION

According to our study, the duration of surgery and the underlying cause for thyroidectomy do not significantly influence the incidence of postoperative hypocalcemia. However, female patients, individuals above 50 years of age, and those undergoing total thyroidectomy are at higher risk. Early identification and proactive management of hypocalcemia, especially in high-risk groups, are crucial to improving postoperative outcomes. Further multicenter studies with larger sample sizes and detailed biochemical profiling are recommended to validate these findings.

REFERENCES

1. Mohanty S, Padmanabhan D. Audit of hypocalcemia as a clinical marker following total thyroidectomy - a retrospective chart review. Int J Otorhinolaryngol Head Neck Surg. 2024; 10:530-4.
2. Rao K, Upadhya I. A study of incidence and management of postoperative hypocalcemia in patients undergoing near-total and total thyroidectomy. Indian J Otolaryngol Head Neck Surg. 2024 Apr;76(2):1903-9. doi: 10.1007/s12070-023-04443-4.
3. Rajinikanth J, Paul MJ, Abraham DT, Selvan CKB, Nair A. Surgical audit of inadvertent parathyroidectomy during total thyroidectomy: incidence, risk factors, and outcome. MedGenMed Medscape Gen Med. 2009;11(1):1.
4. Unalp HR, Erbil Y, Akguner T, Kamer E, Derici H, Issever H. Does near total thyroidectomy offer advantage over total thyroidectomy in terms of postoperative hypocalcemia? Int J Surg. 2009;7(2):120-5. doi: 10.1016/j.ijsu.2008.12.003.
5. Malik MZ, Mirza AA, Farooqi SA, Chaudhary NA, Waqar M, Bhatti HW. Role of preoperative administration of vitamin D and calcium in postoperative transient hypocalcemia after total thyroidectomy. Cureus. 2019;11(4):e4579. doi: 10.7759/cureus.4579.
6. Maschuw K, Schlosser K, Lubbe D, Nies C, Bartsch DK. Total versus near-total thyroidectomy in Graves' disease and their outcome on postoperative transient hypoparathyroidism: study protocol for a randomized controlled trial. Trials. 2020; 13:234. doi: 10.1186/1745-6215-13-234.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

7. Roh JL, Park JY, Park CI. Total thyroidectomy plus neck dissection in differentiated papillary thyroid carcinoma patients: pattern of nodal metastasis, morbidity, recurrence, and postoperative levels of serum parathyroid hormone. Ann Surg. 2007;245(4):604-10. doi: 10.1097/01.sla.0000250451.59685.67.
8. Ravikumar K, Sadacharan D, Muthukumar S, Sundarram T, Periyasamy S, Suresh RV. A prospective study on role of supplemental oral calcium and Vitamin D in prevention of postthyroidectomy hypocalcemia. Indian J Endocrinol Metab. 2017;21(4):498-503. doi: 10.4103/ijem.IJEM_402_16.
9. Arumugam S, Mohankumar A, Muthukumaraswamy A, Anandan H. Clinical study of hypocalcemia following thyroid surgery. Int J Sci Study. 2017;5(1):11-4. doi:10.17354/ijss/2017/44.
10. Tolone S, Roberto R, del Genio G, Brusciano L, Parmeggiani D, Amoroso V, et al. The impact of age and oral calcium and vitamin D supplements on postoperative hypocalcemia after total thyroidectomy: a prospective study. BMC Surg. 2013;13(Suppl 2):S11. doi:10.1186/1471-2482-13-S2-S11.
11. Baldassarre RL, Chang DC, Brumund KT, Bouvet M. Predictors of hypocalcemia after thyroidectomy: results from the nationwide inpatient sample. ISRN Surg. 2012; 2012:838614. doi:10.5402/2012/838614.
12. Alqahtani SM, Alatawi AS, Alalawi YS. Post-thyroidectomy hypocalcemia: a single-center experience. Cureus. 2021;13(11):e20006.
13. Lee YS, Nam KH, Chung WY, Chang HS, Park CS. Postoperative complications of thyroid cancer in a single center experience. J Korean Med Sci. 2010;25(4):541-5.
14. Erbil Y, Barbaros U, Temel B, Turkoglu U, Issever H, Bozbora A, et al. The impact of age, vitamin D3 level, and incidental parathyroidectomy on postoperative hypocalcemia after total or near-total thyroidectomy. Am J Surg. 2009;197(4):439-46.
15. Ozogul B, Akcay MN, Akcay G, Bulut OH. Factors affecting hypocalcemia following total thyroidectomy: a prospective study. Eurasian J Med. 2014;46(1):15-21.
16. Tredici P, Grosso E, Gibelli B, Massaro MA, Arrigoni C, Tradati N. Identification of patients at high risk for hypocalcemia after total thyroidectomy. Acta Otorhinolaryngol Ital. 2011;31(3):144-8.
17. Qasaimeh GR, Al Nemri S, Al Omari AK. Incidental extirpation of the parathyroid glands at thyroid surgery: risk factors and post-operative hypocalcemia. Eur Arch Otorhinolaryngol. 2011;268(7):1047-51.
18. Eismontas V, Slepavicius A, Janusonis V, Zeromskas P, Beisa V, Strupas K, et al. Predictors of postoperative hypocalcemia occurring after a total thyroidectomy: results of prospective multicenter study. BMC Surg. 2018;18(1):55.
19. Sippel RS, Ozgul O, Hartig GK, Mack EA, Chen H. Risks and consequences of incidental parathyroidectomy during thyroid resection. ANZ J Surg. 2007;77(1-2):33-6.

ISSN (O): 2687-5365; ISSN (P): 2753-6556