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Optimizing Calcium Monitoring Post-Total Thyroidectomy: A Proactive Approach to Prevent Hypocalcemia

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KEYWORDS

Hypocalcemia, Post total thyroidectomy, Serum calcium levels, Calcium supplements

Back ground:

Thyroid lobectomy by itself is rarely linked to postoperative hypocalcaemia, despite the fact that the development of this complication is likely to be multifactorial in nature. This complication is most frequently seen after total thyroidectomy, where there is a higher risk of parathyroid injury than with other types of thyroid surgery

Methods:

It's a prospective study,140 patients were included. They were divided into 2 groups. The postoperative calcium level in each patient (Group A) was serially measured six hours after surgery on POD 0 and then every six hours for the first twenty-four hours, then every twelve hours until POD3 and then once daily on POD4 and POD5. Group B patients underwent monitoring at random time.

Results:

Notably, the proportion of patients with hypocalcemia appears relatively higher in the <20 age group, although the absolute number is small. In group A, 17/70 and in group B, 29/70 patients developed hypocalcemia. In group A, though the sample is small, the incidence of hypocalcemia is predominantly in POD1 and POD2. However, the likely incidence in the first 6 and 12 hours is also comparative. The incidence of hypocalcemia was found to be higher in the total thyroidecomy and MNG group.

Conclusion:

Monitoring serum calcium levels helps identify hypocalcemia at the earliest before the onset of symptoms, thereby timely prevention and management with calcium supplements becomes possible. Hence, lowering the morbidity associated with total thyroidectomy. Post-operative hypocalcemia is still a common complication that can be prevented by identifying risk factors and by using appropriate, careful surgical technique.

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1. Introduction

Total thyroidectomy is a surgical procedure commonly performed to manage multinodular goiter and thyroid malignancies. Hypocalcemia is a relatively common and early complication, typically arising from inadvertent removal of the parathyroid glands or disruption of their blood supply during surgery. Post-thyroidectomy hypocalcemia can manifest with symptoms such as perioral numbness, tingling sensations (paresthesia) in the arms and legs, and carpopedal spasms [1]. Clinical signs like Chvostek's and Trousseau's signs may also be positive. Severe hypocalcemia can lead to laryngospasm, tetany, seizures, arrhythmias, and congestive heart failure, necessitating immediate intervention [2].

Hypocalcemia is a significant and frequent side effect after thyroid surgery, with reports ranging from 0.5% to 75%. Different definitions of hypocalcaemia and variations in laboratory values for normo-calcaemia contribute to this large discrepancy [3]. Postoperative hypocalcaemia has been attributed to several factors, such as hungry bone syndrome (reversal of toxic thyroid osteodystrophy), calcitonin release from thyroid gland manipulation, haemodilution or increased urinary calcium excretion due to surgical stress, and interference with parathyroid gland function through direct injury, removal, or devascularization [4].

Thyroid lobectomy by itself is rarely linked to postoperative hypocalcaemia, despite the fact that the development of this complication is likely to be multifactorial in nature. This complication is most frequently seen after total thyroidectomy, where there is a higher risk of parathyroid injury than with other types of thyroid surgery [5].

A significant contributing factor to hypocalcemia after complete thyroidectomy is the unintentional removal of the parathyroid gland or harm to its blood supply during surgery. The different risk factors listed include larger thyroid gland size, thyroid disease type, operating surgeon experience, surgical technique, extent of dissection during surgery, and biochemical blood parameters such as serum calcium and serum parathyroid hormone levels before and after surgery [6-7].

In clinical practice, we have observed variability in the timing of postoperative calcium monitoring. Some physicians measure serum calcium levels on postoperative day (POD) 1, while others delay it until POD 2. However, by then, patients often begin to develop symptoms of hypocalcemia. To address this, we propose a protocol of serial calcium monitoring starting 6 hours after surgery on POD 0, with subsequent measurements at 6-hour intervals for the first 24 hours, followed by 12-hour intervals thereafter until POD 3. Additional checks should be performed once on POD 4 and POD 5. In this study, we aimed to assess the efficacy of early and structured calcium monitoring protocols, and evaluate their impact on clinical outcomes. By comparing standard practices with a more rigorous monitoring strategy, we seek to provide insights into optimizing postoperative management and preventing hypocalcemic complications

2.Materials and methods:

This prospective study was conducted from 2021 to 2024 at Sri Ramachandra Medical College and Hospital to determine the incidence of hypocalcemia in patients who had total thyroidectomies following institutional ethical committee approval and patient informed written consent.

All patients who had total thyroidectomy or completion thyroidectomy without neck node dissection were included in the study. Individuals having a

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hemithyroidectomy, and abnormal preoperative blood albumin and calcium levels were excluded from the study. A total of 140 patients were included in the study. They were divided into 2 groups. Group A underwent serial calcium monitoring. Group B underwent random calcium monitoring

Data Collection:

The postoperative calcium level in each patient (Group A) was measured six hours after surgery on POD 0 and then every six hours for the first twenty-four hours, then every twelve hours until POD 3. PODs 4 and 5 should undergo further inspections once. Every attempt was made to identify and preserve at least two parathyroid glands with an intact blood supply throughout surgery. Following surgery, hypocalcemic symptoms such as paraesthesia, perioral area tingling and numbness, muscular spasms, Chvostek's and Trousseau's signs were recorded if they were present.

The existence of one or more parathyroid glands in the surgical material was investigated based on histopathology findings. On the third post-operative day following drain removal, the patients were discharged. Patients with post-operative symptomatic hypocalcemia were treated with intravenous calcium gluconate, 10 milliliters of 10% calcium gluconate in 50 milliliters of 5% dextrose or normal saline over a 15-minute period. If the symptoms were severe, a single injection of vitamin D3 600000 IU intramuscularly was administered, and if the hypocalcemic symptoms persisted, 1000 milliliters of normal saline or 5% dextrose containing 11 grams of calcium gluconate was administered at a rate of 50 milliliters per hour, in addition to serum calcium monitoring. Mildly symptomatic individuals and postoperative asymptomatic patients with biochemically reduced blood calcium levels <8 mg/dl were given oral calcium 500 mg twice daily and vitamin D supplements (1 mcg calcitriol OD). Blood calcium levels were tracked, and patients were on routine follow up.

3.Results:

The 40–50 age group has the highest number of participants overall, followed by the 30–40 and 50–60 age groups. Notably, the proportion of patients with hypocalcemia appears relatively higher in the <20 age group, although the absolute number is small. In contrast, older age groups show a more balanced distribution between the two conditions.

This visualization supports the statistical finding that there is no significant association between age group and hypocalcemia (Chi-square test, p = 0.0731), although some variation in proportions can be observed across age brackets.

The age distribution of hypocalcemia is shown in Table 1 and Fig 1.

Table 1- Age distribution of hypocalcemia

Age Group (in years)	Total No.	No of patients with hypocalcemia	p value
<20	5	4	0.07
20-30	9	3	
30-40	32	11	
40-50	42	11	
50-60	32	9	
60-70	15	4	
70-80	5	4	

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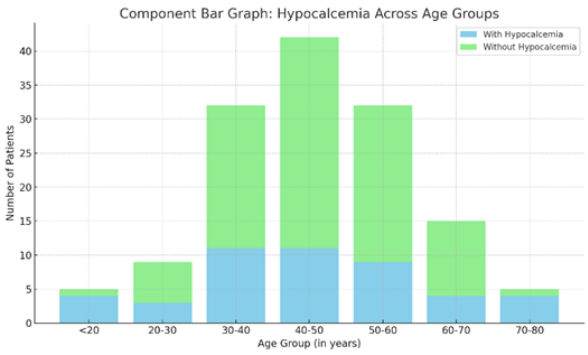

Fig1- Bar graph showing the distribution of patients with and with-out hypocalcemia cross different age groups.

The stacked bar graph illustrates the distribution of patients with and without hypocalcemia across different age groups. Each bar represents the total number of patients in a specific age category, divided into two segments: those diagnosed with hypocalcemia (shown in blue) and those without (shown in green).

Our study showed female predominance. The gender distribution and development of hypocalcemia is shown in Table 2.

Table 2- Gender distribution of hypocalcemia

Gender	Total No	No. of patients with hypocalcemia	p value
Male	25	6	0.42
Female	115	40	

The p-value from the chi-square test is **0.421**. There is no statistically significant association between gender and the occurrence of hypocalcemia among the patients

The incidence of hypocalcemia at different time points in group A is shown in Table 3.

Table 3- Incidence of postoperative hypocalcemia in Group A

GROUP A	Hypocalcemia within first 6hrs post op	Hypocalcemia within first12 hrs post op	Hypocalcemia within first 18hrs	Hypocalcemia in POD1	Hypocalcemia in POD2	Hypocalcemia in POD3	Hypocalcemia in POD4	Hypocalcemia in POD5
		1						
	1							
	1				2	1		
		1			1			
		1		2		1		1
				1				
			1	1	1			
Total	2	3	1	4	4	2	0	1

The table represents post operative serial calcium monitoring in patients who underwent total/completion thyroidectomy in Group A. Though the sample is small, the incidence of hypocalcemia is predominantly in POD1 and POD2. However, the likely incidence in first 6 and 12hrs is also comparative.

The timing of incidence in Group B cannot be assessed as the calcium monitoring is random and not timed. It has

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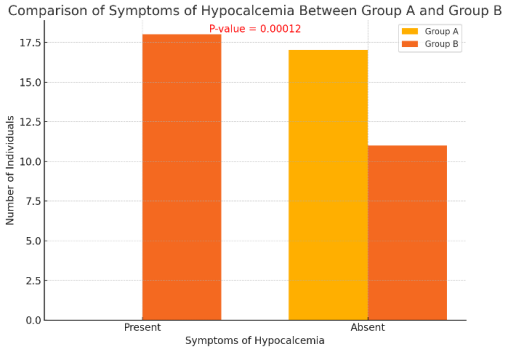
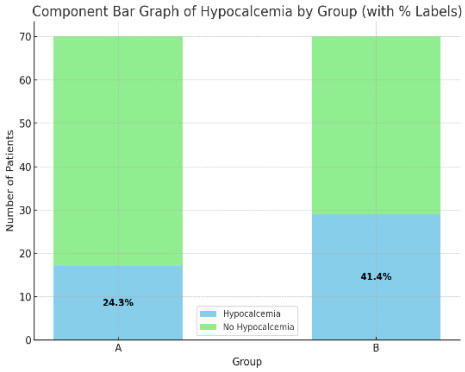
been done, mostly detected at 18 hours post-op or POD2. Hence, serial monitoring helps us identify hypocalcemia as soon as possible.

In group A 17/70 and in group B 29/70 patients developed hypocalcemia, it is shown in Table 4.

Table 4- Hypocalcemia in each group



GROUP	A	B
No of patients with hypocalcemia	17	29
Total No	70	70



The incidence of hypocalcemia in each group is shown in Table 5.

Symptoms of Hypocalcemia	No in Group A	No in Group B	p-value
Present	0	18	0.000118
Absent	17	11	

Table 5- Incidence of hypocalcemia symptoms in each group

Here is a bar chart comparing the number of individuals with and without symptoms of hypocalcemia in Group A and Group B. The p-value of 0.00012 is displayed on the graph, indicating a statistically significant difference between the groups in terms of hypocalcemia symptoms.

- **Group A**: 0 patients showed symptoms, while 17 individuals show no symptoms.
- **Group B**: 18 patients showed symptoms, while 11 showed no symptoms.

The comparison of calcium supplementation in both groups is shown in Table 6 and table 7.

Table 6 - Treatment in the two groups

TREATMENT FOR HYPOCALCEMIA	GROUP A	GROUP B
IV Calcium	2	18
Therapeutic oral calcium	15	11
Prophylactic oral calcium	46	41
NO TREATMENT	7	0

Table 7- IV calcium treatment in hypocalcemia

Surgery	Total	Hypocalcemic patients	% patients with hypocalcemia	p value

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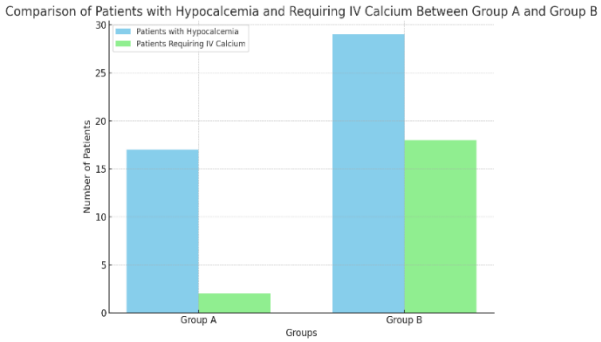
Total thyroidectomy	123	41	33	0.962
Completion thyroidectomy	17	5	29	0.962



The table and bar graph compare Group A and Group B based on the number of patients with hypocalcemia and those requiring IV calcium. Group A has 17 patients with hypocalcemia and 2 requiring IV calcium, while Group B has 29 patients with hypocalcemia and 18 requiring IV calcium. The graph shows that Group B has more patients with hypocalcemia and a higher need for IV calcium compared to Group A, highlighting the greater severity of hypocalcemia in Group B.

Group	Patients with Hypocalcemia	Patients Requiring IV Calcium	p-value
Group A	17	2	0.053975
Group B	29	18	

Table 8 - Hypocalcemia in total vs completion thyroidectomy

The occurrence of hypocalcemia in total vs completion thyroidectomy is statistically not significant. However, a better conclusion can be made if equal number of surgeries were included in both the groups. Hence it is not very conclusive.

Table 9 – Type of HPE findings in Hypocalcemic patients

HPE	Total	No of hypocalcemic patients
MNG	59	24
Papillary carcinoma	42	13
Follicular carcinoma	7	1
Medullary carcinoma	1	0
Anaplastic carcinoma	1	0
Lymphocytic thyroiditis	14	2
Hashimoto	1	0
Graves	1	0
Colloid Goitre	2	2
Follicular adenoma	12	4
Total	140	46

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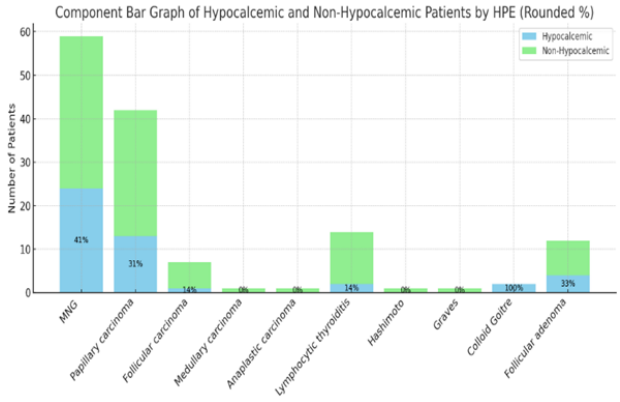
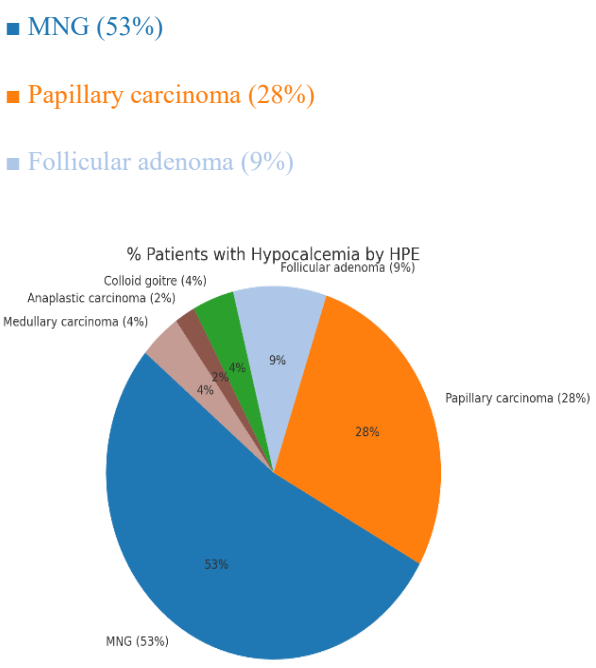


This graph explains the percentage of occurrence of hypocalcemia in each condition based on their HPE. For eg. 41% of individuals who underwent total/completion thyroidectomy for MNG developed hypocalcemia or in other words the incidence of hypocalcemia in MNG in 41%. Similarly none were hypocalcemic in medullary, anaplastic carcinomas, hashimoto, graves. However, the overall number of patients exhibiting the condition/HPE is significantly low for generalising the results.

10. Distribution of hypocalcemia according to HPE



Based on the data and visualizations, the analysis of hypocalcemia incidence across different Histopathological Examinations (HPE) shows that Multinodular Goitre (MNG) has the highest percentage of patients with hypocalcemia, accounting for 52% of all hypocalcemia cases observed. This is followed by Papillary carcinoma, which contributes 28%, and Follicular adenoma with 9%. Several HPE types—including Medullary carcinoma, Anaplastic carcinoma, Hashimoto's thyroiditis, and Graves' disease shows no correlation with hypocalcemia which can be attributed to the low numbers in this study. Minor contributions also come from Lymphocytic thyroiditis and Colloid Goitre (each at 4%) and Follicular carcinoma (2%).

This distribution suggests a stronger association between MNG and post-operative hypocalcemia, possibly due to the extent of surgery or greater gland involvement and accidental removal of parathyroid.

4.Discussion:

Given that the rates of complications after thyroidectomy are not negligible (7.4%–13.8%), it is imperative to establish a framework for safe outpatient thyroidectomy. [8,9]. The most frequent side effect following thyroidectomy is hypocalcemia; the frequency of both

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temporary and permanent hypocalcemia has been reported to range from 3% to 52% and 0.4% to 13%, respectively [10–11]. Postoperative hypocalcemia has been diagnosed and treated using a variety of techniques. Since the trough of hypocalcemia usually happens within 48 hours after surgery, many institutions across the world continue to adopt the conventional strategy of a 2-day hospital stay and serum calcium level monitoring following surgery [12]. We concur that it's critical to monitor patients during the first few hours following surgery for bleeding and airway blockage that can need an immediate trip back to the operating room;

To reduce the risk of hypocalcemia and decrease hospital stays, several surgeons have recommended frequent postoperative oral calcium and/or vitamin D administration. In the outpatient or short-stay context, when there is little time to treat hypocalcemia once it is identified, such regular usage is very prevalent. Others have suggested that if hypocalcemia symptoms appear, patients should be sent home with prescriptions for elemental calcium supplements [13] The short half-life of parathyroid hormone has sparked interest in postoperative intact parathyroid hormone (IPTH) as an early indicator of hypocalcemia in recent years, with the goal of identifying an earlier predictor for the condition [13]. Nonetheless, systematic IPTH assessment to evaluate the risk of postoperative hypocalcemia has not yet gained acceptance as a common procedure. Comparing research is challenging due to differences in assays, measurement time, and cutoff values.

To assist surgeons in differentiating patients who are at low risk of developing hypocalcemia from those who require calcium supplements treatment and inpatient care, it is imperative to determine the most trustworthy early predictors of hypocalcemia. When compared to conventional postoperative hospital stays, the capacity to differentiate between these groups may enable a cost savings of up to 50%. Finding independent risk factors for the emergence of postoperative hypocalcemia, assessing the effectiveness of early and organized calcium monitoring methods, and assessing their influence on clinical outcomes were the goals of the current investigation. By contrasting routine procedures with a more stringent monitoring plan, we want to provide light on how to best manage postoperative care and avoid hypocalcemic issues.

Regarding whether age is a risk factor for hypocalcemia following thyroidectomy, there is disagreement in the literature. Hypocalcemia has been linked to more advanced age in a few studies, but it has been linked to younger age in others. A recent meta-analysis by Edafe et al[14] investigated age as a predictor of hypocalcemia in 2576 individuals and showed no significant difference in mean age between patients with hypocalcemia and those without. In our research, we found that postoperative hypocalcemia was more common in patients under the age of twenty, whereas the distribution of both was more evenly distributed in older age groups.Age group and hypocalcemia did not significantly correlate (Chi-square test, $p = 0.0731$), however there was modest fluctuation in proportions between age groups.

Conflicting reports on associations with sex may also be found in the literature. Sex has not been found to have an impact on calcium homeostasis after surgery in certain studies. On the other hand, a substantial amount of research indicates that women are far more likely than men to experience hypocalcemia[14-15]. In our study, on comparison 36 % of females developed hypocalemia, but only 24 % of males had hypocalcemia.

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On comparison of both groups on the incidence of hypocalcemia, 17/70 developed hypocalcemia in group A and 29/70 developed hypocalcemia in group B. In Group A, though the sample is small, the incidence of hypocalcemia is predominantly in POD1 and POD2. However, the likely incidence in first 6 and 12 hours is also comparative. These patients were treated before the development of hypocalcemia symptoms. So, the incidence of symptoms of hypocalcemia is less in Group A (0 out of 17 patients) on comparison to group B (18 out of 29 patients). The need for IV calcium in the management of hypocalcemia is more in group B.

Multinodular Goitre (MNG) has the largest percentage of patients with hypocalcemia, accounting for 41% of all hypocalcemia cases reported, according to the data and visualizations used to analyze the frequency of hypocalcemia across various Histopathological Examinations (HPE). Next in line are follicular adenoma (which provides 9%), and papillary carcinoma (28%).

After thyroid surgery, parathyroid function may be compromised by trauma, devascularization, or unintentional excision of the parathyroid glands. Despite the fact that the cause of postoperative hypocalcemia appears to be complex, studies have shown that iatrogenic surgical damage to the parathyroid glands—which is made worse by the depth of surgical dissection—is the most significant contributing factor.10, 42 In addition to increasing the chance of unintentional parathyroid gland excision, more extensive thyroid and central neck surgery puts the parathyroid glands' venous and arterial vasculature at risk. The results of our study comparing the development of hypocacemia with total versus completion thyroidectomy were not statistically significant. However, we discovered that the group that had a total thyroidectomy had a higher incidence of hypocalcemia (33% vs. 29%)

This study's primary drawbacks include single-center research and a smaller sample size. Permanent hypocalcemia could not be assessed as long term follow up was not done

5.Conclusion:

To conclude, the incidence of hypocalcemia post thyroidectomy is predominant on POD1 and POD2. We can even say the first 12 hours. Although not significant, we found younger age group, female sex and total thyroidectomy status patients predominantly developed hypocalcemia. We found an association of MNG patients with the highest occurrence of hypocalcemia.

Our findings demonstrated that those who received calcium monitoring per our protocol, beginning on POD 0, six hours after surgery and continuing at 6-hour intervals for the first twenty-four hours, then 12-hour intervals until POD 3, demonstrated early detection of hypocalcemia before the potentially fatal consequences of hypocalcemia materialized. They were all treated promptly.

Monitoring serum calcium levels helps identify and manage calcium and vitamin- D supplements early, lowering the morbidity associated with total thyroidectomy. Post-operative hypocalcemia is still a common complication that can be prevented by identifying risk factors and by using appropriate, careful surgical technique

References:

1. Fahmy, F. F.; Gillett, D.; Lolen, Y.; Shotton, J. C. Management of Serum Calcium Levels in Post-Thyroidectomy Patients. Clin Otolaryngol Allied Sci 2004, 29 (6), 735–739. https://doi.org/10.1111/j.1365-2273.2004.00895.x.
2. Asari, R.; Passler, C.; Kaczirek, K.; Scheuba, C.; Niederle, B. Hypoparathyroidism after Total

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 15(4), 169-178 | ISSN:2251-6727

Thyroidectomy: A Prospective Study. Arch Surg 2008, 143 (2), 132–137; discussion 138. https://doi.org/10.1001/archsurg.2007.55.

3. Abboud, B.; Sargi, Z.; Akkam, M.; Sleilaty, F. Risk Factors for Postthyroidectomy Hypocalcemia. J Am Coll Surg 2002, 195 (4), 456–461. https://doi.org/10.1016/s1072-7515(02)01310-8.
4. Thomusch, O.; Machens, A.; Sekulla, C.; Ukkat, J.; Lippert, H.; Gastinger, I.; Dralle, H. Multivariate Analysis of Risk Factors for Postoperative Complications in Benign Goiter Surgery: Prospective Multicenter Study in Germany. World J Surg 2000, 24 (11), 1335–1341. https://doi.org/10.1007/s002680010221.
5. McHenry, C. R.; Speroff, T.; Wentworth, D.; Murphy, T. Risk Factors for Postthyroidectomy Hypocalcemia. Surgery 1994, 116 (4), 641–647; discussion 647-648.
6. Bellantone, R.; Lombardi, C. P.; Raffaelli, M.; Boscherini, M.; Alesina, P. F.; De Crea, C.; Traini, E.; Princi, P. Is Routine Supplementation Therapy (Calcium and Vitamin D) Useful after Total Thyroidectomy? Surgery 2002, 132 (6), 1109–1112; discussion 1112-1113. https://doi.org/10.1067/msy.2002.128617.
7. Roh, J.-L.; Park, C. I. Routine Oral Calcium and Vitamin D Supplements for Prevention of Hypocalcemia after Total Thyroidectomy. Am J Surg 2006, 192 (5), 675–678. https://doi.org/10.1016/j.amjsurg.2006.03.010.
8. Sosa, J. A.; Bowman, H. M.; Tielsch, J. M.; Powe, N. R.; Gordon, T. A.; Udelsman, R. The Importance of Surgeon Experience for Clinical and Economic Outcomes From Thyroidectomy. Annals of Surgery 1998, 228 (3), 320.
9. Kandil, E.; Noureldine, S. I.; Abbas, A.; Tufano, R. P. The Impact of Surgical Volume on Patient Outcomes Following Thyroid Surgery. Surgery 2013, 154 (6), 1346–1352; discussion 1352-1353. https://doi.org/10.1016/j.surg.2013.04.068.
10. Vescan, A.; Witterick, I.; Freeman, J. Parathyroid Hormone as a Predictor of Hypocalcemia after Thyroidectomy. Laryngoscope 2005, 115 (12), 2105–2108. https://doi.org/10.1097/01.MLG.0000181504.69230.87.
11. Pisaniello, D.; Parmeggiani, D.; Piatto, A.; Avenia, N.; d'Ajello, M.; Monacelli, M.; Calzolari, F.; Sanguinetti, A.; Parmeggiani, U.; Sperlongano, P. Which Therapy to Prevent Post-Thyroidectomy Hypocalcemia? G Chir 2005, 26 (10), 357–361.
12. Pattou, F.; Combemale, F.; Fabre, S.; Carnaille, B.; Decoulx, M.; Wemeau, J. L.; Racadot, A.; Proye, C. Hypocalcemia Following Thyroid Surgery: Incidence and Prediction of Outcome. World J Surg 1998, 22 (7), 718–724. https://doi.org/10.1007/s002689900459.
13. Higgins, K. M.; Mandell, D. L.; Govindaraj, S.; Genden, E. M.; Mechanick, J. I.; Bergman, D. A.; Diamond, E. J.; Urken, M. L. The Role of Intraoperative Rapid Parathyroid Hormone Monitoring for Predicting Thyroidectomy-Related Hypocalcemia. Arch Otolaryngol Head Neck Surg 2004, 130 (1), 63–67. https://doi.org/10.1001/archotol.130.1.63.
14. Edafe, O.; Antakia, R.; Laskar, N.; Uttley, L.; Balasubramanian, S. P. Systematic Review and Meta-Analysis of Predictors of Post-Thyroidectomy Hypocalcaemia. Br J Surg 2014, 101 (4), 307–320. https://doi.org/10.1002/bjs.9384.
15. Erbil, Y.; Barbaros, U.; Temel, B.; Turkoglu, U.; Işsever, H.; Bozbora, A.; Ozarmağan, S.; Tezelman, S. The Impact of Age, Vitamin D(3) Level, and Incidental Parathyroidectomy on Postoperative Hypocalcemia after Total or near Total Thyroidectomy. Am J Surg 2009, 197 (4), 439–446. https://doi.org/10.1016