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Perioperative Management Practices in Thyroid Surgery- Heterogeneity in postoperative hypoparathyroidism management in The Netherlands

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Abstract

Background: One of the most feared complications following thyroid surgery is postoperative hypoparathyroidism, which frequently results in hypocalcemia. In this study, perioperative management practices for thyroid surgery across the Netherlands were evaluated, with focus on differences among healthcare professionals in academic and general hospitals.

Methods: We conducted a 27-question online survey developed in collaboration with the Dutch Thyroid Cancer Group (DTCG). The survey was open from October 31 to December 19, 2023, collected responses from physicians in 24 hospitals, achieving a response rate of 77.0% at the hospital level. Differences in responses were assessed between physician types and between academic and general hospitals using Fisher's exact test.

Results: The survey revealed a significant variation in the definitions of transient and permanent postoperative hypoparathyroidism, preoperative testing for vitamin D levels, and the use of intraoperative techniques to identify parathyroid glands. The definitions provided by surgeons and endocrinologists differed significantly for transient and permanent hypoparathyroidism (p=0.021 and 0.028). There was a significant difference in how hospitals prescribed calcium and/or vitamin D supplements after surgery (p=0.026).

Conclusion: Our findings highlight inconsistencies in defining postoperative hypoparathyroidism and differences in managing postsurgical hypocalcemia in the Netherlands. The varying definitions of postoperative hypoparathyroidism highlight the need for uniform definitions to harmonize clinical and research practices. Consistent perioperative practices are needed to reduce the number of postoperative complications. Future research should focus on optimising preoperative risk factors for postoperative hypocalcaemia, ensuring accurate identification of parathyroid glands during surgery, and investigating the benefits of prophylactic postoperative calcium supplementation.

Keywords: Survey; Thyroidectomy; Perioperative; Calcium management; Surgery; Endocrinology

Introduction

Total thyroidectomy is a surgical procedure for various thyroid disorders [1]. Postoperative hypoparathyroidism with subsequent hypocalcemia is a significant complication of total thyroidectomy [2,3]. The clinical symptoms

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of hypocalcemia may vary, ranging from mild conditions such as paraesthesia to more severe complications, which can be life-threatening, such as laryngospasm and cardiac arrhythmias [4].

While hypocalcaemia after total thyroidectomy is usually transient in nature, it becomes a significant concern if it leads to prolonged hospital stays and/or readmissions [5]. The incidence of persistent hypoparathyroidism after total or complete thyroidectomy is reported to be between 5% and 15% according to previous studies [6-9]. This highlights the need for physicians to implement effective strategies to prevent or mitigate postoperative hypoparathyroidism and subsequent hypocalcemia. In response, European and American thyroid organizations have established guidelines for managing postoperative hypocalcemia, with a focus on preventing symptoms and complications [10-12].

The most important factor for prevention of postoperative hypoparathyroidism is a meticulous surgical technique with identification and preservation of the parathyroid glands. To further prevent clinical effects of inadequate parathyroid function after thyroidectomy several medical strategies can be employed preoperatively and postoperatively [13,14]. Recent guidelines and studies have focused primarily on postoperative supplementation and intraoperative parathyroid identification to prevent hypocalcemia and postoperative hypoparathyroidism [15]. However, at present, the European guidelines do not include any recommendations for preoperative care in patients undergoing thyroid surgery, in contrast to the American guidelines [16,17]. This lack of consensus underscores the need for comprehensive studies on perioperative calcium management.

Therefore, this survey was conducted to examine the perioperative management of patients that undergo total thyroidectomy in the Netherlands, with a particular focus on variations in calcium management. Our study investigated the differences in perioperative management among healthcare professionals in both academic and general hospitals.

Methods

A 27-question online survey was created to address key aspects of perioperative calcium management in patients undergoing thyroidectomy for both benign and malignant conditions. This survey was developed using Qualtrics software, an online survey platform. The survey topics were chosen through discussions among the authors and Dutch Thyroid Cancer Group (DTCG) experts. During these collaborative talks, senior authors and DTCG experts, all experienced in thyroid surgery and/or endocrinology, refined the questions, and shaped the survey's focus. The selected questions aimed to cover ongoing controversial issues in calcium management for thyroid surgery patients.

The survey was sent to thyroid surgeons and endocrinologists working in Dutch hospitals performing thyroidectomies. Given that perioperative calcium management for thyroid surgery patients is generally consistent among physicians within the same hospital, response rates were calculated at the hospital level. The survey was initiated on 31 October 2023 and remained accessible for responses until 19 December 2023. To encourage participation, weekly reminders were sent for six weeks to those who had not yet completed the survey. The distribution was exclusively via email. To enhance response rates, we intentionally kept the survey brief, understanding that longer surveys typically reduce participation [18].

The survey included questions about the physicians' experience, procedure volumes, surgical approaches, preoperative imaging techniques, and pre- and postoperative care practices. The survey also included multiple-choice questions on the definitions used for transient and permanent postoperative hypoparathyroidism. On average, it took

Table 1: Demographic Information of Respondents.

Variable		N (%)	
Hospital type	Academic	21 (44.7)	
	General	26 (55.3)	
		Surgeons (n=30)	Endocrinologists (n=17)
Experience (in years)	> 10	17 (56.7)	11 (64.7)
	05-Oct	8 (27.6)	4 (23.5)
	01-May	4 (13.8)	2 (11.8)
	< 1	1 (3.3)	0
Thyroid surgery (cases/year)	> 60	9 (30.0)	N.A.
	40 – 60	9 (30.0)	N.A.
	20 – 40	8 (26.7)	N.A.
	10 – 20	3 (10.0)	N.A.
	< 10	1 (3.3)	0

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less than 10 minutes to complete the survey. We ensured respondent anonymity and restricted access to one response per participant. The collected data were anonymized, summarized, and then prepared for analysis. A detailed version of the survey is available in the supplemental file (eTable 1). Considering the nature of this study, institutional review board (IRB) approval or informed consent was not necessary.

The data were collected using Qualtrics and exported to IBM SPSS Statistics for Windows, Version 27.0 (IBM Corp., Armonk, NY) for statistical analysis. Categorical data are presented as frequencies and percentages. We assessed differences between two groups: by specialty, comparing surgeons and endocrinologists, and by hospital type, contrasting academic and general hospitals. Fisher's (Fisher-Freeman-Halton) exact test, which is suitable for small sample sizes and provides accurate p-values for categorical data, was used for group comparisons. A p-value of ≤ 0.05 was considered statistically significant.

Results

Out of all hospitals surveyed 24 responded, yielding a 77.4% response rate. The response rate was 85.7% for academic hospitals, with 6 out of 7 responding, and 75.0% for general hospitals, with 18 out of 24 responding. A total of 75 physicians were invited for the survey, 47 (62.7%) of whom responded. Among the respondents, 30 (63.8%) were surgeons, and 17 (36.2%) were endocrinologists. The majority, both surgeons (56.7%) and endocrinologists (64.7%), had over ten years of experience. Among the surgeons, 60% conducted more than 40 thyroid surgeries per year. In terms of hospital setting, 44.7% of the respondents worked in academic hospitals, and 55.3% worked in general hospitals. The detailed demographics of all respondents can be found in table 1.

Definitions

The respondents provided varied definitions for hypoparathyroidism. The definition of transient hypoparathyroidism most used by respondents, chosen by 27.7% of them, was identified as *"a decreased serum PTH and a decreased serum calcium level needing calcium or calcitriol supplementation resolved within the first six months after surgery"*. Conversely, the definition of permanent hypoparathyroidism most cited by respondents, selected by 31.9% of them, was *"a decrease in serum PTH and a decrease in calcium levels needing calcium or calcitriol supplementation beyond 6 months after surgery"*. Surgeons and endocrinologists provided differing definitions of hypoparathyroidism. These differences in responses regarding definitions were statistically significant for both transient and permanent hypoparathyroidism (p=0.021 and p=0.028, respectively). No statistically significant differences were found between hospital settings in the definitions of transient and permanent hypoparathyroidism. Table 2 outlines the respondents' characteristics and their responses to definitions of hypoparathyroidism.

Preoperative management

According to 70.2% of respondents, consultations with endocrinologists were deemed necessary before thyroid surgery. For total thyroidectomy patients, 44.7% of respondents tested for 25-hydroxy vitamin D (25OHvitD) levels in more than 50% of the cases. Calcium level testing practices also varied among respondents: 48.9% conducted these tests in most cases (>50%), while an equal percentage seldom (<25%) or never performed them preoperatively. Preoperative supplementation practices show that 42.6% of respondents did not prescribe oral calcium and/or vitamin D supplements before thyroid surgery, while 36.2% prescribed these supplements solely in cases of vitamin D deficiency, and 19.1% did so routinely in more than 75% of cases. Statistically significant differences were observed between academic and general hospitals in preoperative testing for 25-hydroxy vitamin D (25OHvitD) levels (p=0.017) and parathyroid hormone (PTH) levels (p=0.036) in patients undergoing thyroid surgery. In academic hospitals, 47.6% of respondents routinely (>75% of the time) tested blood calcium levels before thyroid surgery, and 23.1% did so in general hospitals. Additionally, 38.1% of respondents in academic hospitals routinely (>75% of the time) tested PTH blood levels before surgery, whereas 11.5% did so in general hospitals. There were no statistically significant differences among physician types in their responses on preoperative management. Table 3 presents the respondents' responses regarding preoperative calcium management.

Operative management

Most surgeons (70.0%) reported routinely attempting to identify all parathyroid glands during total thyroidectomy; 90.0% of surgeons do not use fluorescence techniques for this purpose. Of the surgeons reported to use fluorescence techniques, two use indocyanine green (ICG), one uses methylene blue, and three (10%) use autofluorescence for this purpose. None of the surveyed surgeons routinely measured PTH intraoperatively, with one respondent measuring IOPTH in less than 25% of thyroidectomy cases. In cases of potential parathyroid gland ischemia, all but one surgeon (96.7%) opted for auto-transplantation, with decisions varying based on the number of devascularized glands. For these auto-transplantation decisions, 43.3% considered it for any devascularized gland, 36.7% for three at-risk glands, and 16.7% for four at-risk glands. Most surgeons (66.7%) did not usually seek pathological confirmation via frozen section during auto-transplantation, unless faced with uncertainty or cancer. There was a significant variation in the use of

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A.										
Definition of Transient Hypoparathyroidism										
		Decreased serum PTH resolved within 3 months after surgery.	Decreased serum PTH resoved within 6 months after surgery.	Decreased serum calcium needing calcium or calcitriol supplementation resolved within 3 months after surgery.	Decreased serum calcium needing calcium or calcitriol supplementation resolved within 6 months after surgery.	Decreased serum PTH AND a decreased serum calcium needing calcium or calcitriol supplementation resolved within 3 months after surgery.	Decreased serum PTH AND a decreased serum calcium needing calcium or calcitriol supplementation resolved within 6 months after surgery.	Decreased serum PTH OR a decreased serum calcium needing calcium or calcitriol supplementation resolved within 3 months after surgery.	Decreased serum PTH OR a decreased serum calcium needing calcium or calcitriol supplementation resolved within 6 months after surgery.	P-value
Speciality	Surgeon	2 (6.7%)	1 (3.3%)	4 (13.3)	5 (16.7%)	7 (23.3%)	6 (20.0%)	1 (3.3%)	4 (13.3%)	**0.021**
	Endocrinologist	0	2 (11.8%)	0	4 (23.5%)	1 (5.9%)	7 (41.2%)	2 (11.8%)	1 (5.9%)	
Hospital	Academic	1 (4.8%)	2 (4.8%)	1 (4.8%)	6 (28.6%)	4 (19.0%)	6 (28.6%)	0	1 (4.8%)	0.548
	General	1 (3.8%)	1 (3.8%)	3 (11.5%)	3 (11.5%)	4 (15.4%)	7 (26.9%)	3 (11.5%)	4 (15.4%)	

B.										
Definition of Permanent Hypoparathyroidism										
		Decreased serum PTH ≥ 6 months after surgery.	Decreased serum PTH ≥ 1 year after surgery.	Decreased serum calcium needing calcium or calcitriol supplementation ≥ 6 months after surgery.	Decreased serum decreased serum calcium needing calcium or calcitriol supplementation ≥ 1 year after surgery.	Decreased serum PTH AND a decreased serum calcium needing calcium or calcitriol supplementation ≥ 6 months after surgery.	Decreased serum PTH AND a decreased serum calcium needing calcium or calcitriol supplementation ≥ 1 year after surgery.	Decreased serum PTH OR a decreased serum calcium needing calcium or calcitriol supplementation ≥ 6 months after surgery.	Decreased serum PTH OR a decreased serum calcium needing calcium or calcitriol supplementation ≥ 1 year after surgery.	P-value
Speciality	Surgeon	3 (10.0%)	3 (10.0%)	2 (6.7%)	6 (20.0%)	8 (26.7%)	4 (13.3%)	1 (3.3%)	3 (10.0%)	
	Endocrinologist	0	0	7 (41.2%)	2 (11.8%)	7 (41.2%)	0	1 (5.9%)	0	**0.028**
Hospital	Academic	3 (14.3%)	0	4 (19.0%)	5 (23.8%)	6 (28.6%)	2 (9.5%)	0	1 (4.8%)	0.301
	General	0	3 (11.5%)	5 (19.2%)	3 (11.5%)	9 (34.6%)	2 (7.7%)	2 (7.7%)	2 (7.7%)	

A. Transient Hypoparathyroidism; **B.** Permanent Hypoparathyroidism

Table 2: outlines the respondents' characteristics and their responses to definitions of hypoparathyroidism.

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autofluorescence between surgeons at academic hospitals and those at general hospitals (p=0.026), with autofluorescence being used exclusively in academic hospitals. The responses of the surgeons to questions regarding intraoperative strategies are presented in table 4.

Postoperative Management

Patients typically stayed in the hospital for 24 to 48 hours after an uncomplicated total thyroidectomy, without lateral neck lymph node dissection (86.7%), with two respondents (4.3%) offering same-day discharge. The reasons for not providing same-day discharge were not specified. More than half of the respondents (51.1%) did not routinely prescribe calcium or vitamin D supplements upon discharge. For postoperative hypoparathyroidism detection within the first 24 hours, the most common tests were combined PTH and calcium levels (48.9%), followed by serum calcium (44.7%), and PTH alone (2.1%). To check for permanent postoperative hypoparathyroidism, 85.1% of respondents performed tests during outpatient endocrinology visits, 4.3% at the surgery department, and 10.6% involve both departments. In 75% of the respondents' hospitals, all thyroid surgery patients are required to consult an endocrinologist after surgery. Most endocrinologists (58.8%) prescribed prophylactic calcium and/or vitamin D supplements after surgery, compared to 20.0% of surgeons (p=0.026). There was a significant difference in the requirement for postsurgical endocrinologist consultations for thyroid surgery patients between hospital types, with 57.2% in general hospitals and 88.6% in academic hospitals opting for consultations (p=0.002). Table 5 summarizes the responses on postoperative calcium management.

Table 3: Preoperative Management: Survey Insights on Thyroid Patients

		Speciality			Hospital		
		Surgeon (n=30)	Endocrinologist (n=17)	P-value	Academic (n=21)	General (n=26)	P-value
Preoperative Endocrinology Consult	Yes	20 (66.7%)	13 (76.5%)	0.529	13 (61.9%)	20 (76.9%)	0.342
	No	10 (33.3%)	4 (23.5%)		8 (38.1%)	6 (23.1%)	
Preoperative 25OHvitD Blood Levels Tested	Yes, >75%	8 (26.7%)	8 (47.1%)	0.603	10 (47.6%)	6 (23.1%)	**0.017**
	Yes, 51-75%	4 (13.3%)	1 (5.9%)		1 (4.8%)	4 (15.4%)	
	Yes, 26-50%	4 (13.3%)	1 (5.9%)		2 (9.5%)	3 (11.5%)	
	Yes, 1-25%	2 (6.7%)	2 (11.8%)		4 (19.0%)	0	
	No	12 (40.0%)	5 (29.4%)		4 (19.0%)	13 (50.0%)	
Preoperative PTH Blood Levels Tested	Yes, >75%	7 (23.3%)	4 (23.5%)	0.835	8 (38.1%)	3 (11.5%)	**0.036**
	Yes, 51-75%	2 (6.7%)	0		0	2 (7.7%)	
	Yes, 26-50%	2 (6.7%)	1 (5.9%)		1 (4.8%)	2 (7.7%)	
	Yes, 1-25%	2 (6.7%)	0		2 (9.5%)	0	
	No	17 (56.7%)	12 (70.6%)		10 (47.6%)	19 (73.1%)	
Preoperative Calcium Blood Levels Tested	Yes, >75%	9 (30.0%)	9 (52.9%)	0.198	10 (47.6%)	8 (30.8%)	0.812
	Yes, 51-75%	2 (6.7%)	3 (17.6%)		2 (9.5%)	3 (11.5%)	
	Yes, 26-50%	1 (3.3%)	0		0	1 (3.8%)	
	Yes, 1-25%	2 (6.7%)	0		1 (4.8%)	1 (3.8%)	
	No	16 (53.3%)	5 (29.4%)		8 (38.1%)	13 (50.0%)	
Preoperative Oral Calcium and Vit D supplements	Yes, >75%	5 (16.7%)	4 (23.5%)	0.423	4 (19.0%)	5 (19.2%)	0.857
	Yes, 51-75%	0	0		0	0	
	Yes, 26-50%	0	0		0	0	
	Yes, 1-25%	1 (3.3%)	0		1 (4.8%)	0	
	In case of vit D deficiency	9 (30.0%)	8 (47.1%)		8 (38.1%)	9 (34.6%)	
	No	15 (50.0%)	5 (29.4%)		8 (38.1%)	12 (46.2%)	

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Table 4: Intraoperative Management: Survey Insights on Thyroid Patients

		Surgeon (n=30)	Hospital		
			Academic (n=13)	General (n=17)	P-value
Intraoperative Parathyroid Gland Identification	Yes	21 (70.0%)	9 (69.2%)	12 (70.6%)	0.633
	No	5 (16.7%)	3 (23.1%)	2 (11.7%)	
	Selectively	4 (13.3%)	1 (7.7%)	3 (17.6%)	
Intraoperative Fluorescence (dye) use to identify PGs	Yes, > 75%	1 (3.3%)	1 (7.7%)	0	0.07
	Yes, < 50%	2 (6.7%)	2 (15.4%)	0	
	No	27 (90.0%)	10 (76.9%)	17 (100%)	
Which Fluorescence (dye) used to identify PGs	Indocyanine Green (ICG)	2 (66.7%)	2 (15.4%)	N.A.	-
	Methylene Blue	1 (33.3%)	1 (7.7%)	N.A.	
	5-aminolevulinec acid	0	0	N.A.	
Intraoperative auto-fluorescence use to identify PGs	Yes, >50%	2 (6.6%)	3 (25.1%)	0	**0.026**
	Yes, < 25%	1 (3.3%)	1 (7.7%)	0	
	No	27 (90.0%)	9 (69.2%)	17 (100%)	
Intraoperative PTH measurements	Yes, < 25%	1 (3.3%)	1 (7.7%)	0	0.433
	No	29 (96.6%)	12 (92.3%)	17 (100%)	
When do you consider performing parathyroid gland autotransplantation?	3 PGs at risk	11 (36.7%)	4 (30.8%)	7 (41.2%)	0.401
	4 PGs at risk	5 (16.7%)	1 (7.7%)	4 (23.5%)	
	Never	1 (3.3%)	1 (7.7%)	0	
	Yes, for any devascularized gland	13 (43.3%)	7 (53.8%)	6 (35.3%)	
Use of frozen section (pathological confirmation)	Yes	7 (23.3%)	4 (30.8%)	3 (17.6%)	0.446
	No	20 (66.7%)	7 (53.8%)	13 (76.5%)	
	Selectively	3 (10.0%)	2 (15.4%)	1 (5.9%)	

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Table 5: Postoperative Management: Survey Insights on Thyroid Patients.

		Speciality			Hospital		
		Surgeon (n=30)	Endocrinologist (n=17)	P-value	Academic (n=21)	General (n=26)	P-value
Postoperative discharge	Same-day discharge (<24h)	2 (6.7%)	0	0.654	1 (4.8%)	1 (3.8%)	1
	24-48 hours	26 (86.7%)	15 (86.7%)		18 (85.8%)	23 (88.4%)	
	>48 hours	0	0		0	0	
	Other	2 (6.7%)	2 (11.8%)		2 (9.5%)	2 (7.7%)	
Prophylactic postoperative calcium and/or vit D	Yes	6 (20.0%)	10 (58.8%)	**0.026**	7 (33.3%)	9 (34.6%)	0.766
	Yes, prescription with instruction to patient to start when symptoms occur	2 (6.7%)	1 (5.9%)		2 (9.5%)	1 (3.8%)	
	No	20 (66.7%)	4 (23.5%)		11 (52.4%)	13 (50.0%)	
	Other	2 (6.7%)	2 (11.8%)		1 (4.8%)	3 (11.5%)	
Biochemical hypoparathyroidism evaluation (<24h)	PTH levels	1 (3.3%)	0	0.854	1 (4.8%)	0	0.497
	Serum Calcium levels	13 (43.3%)	8 (47.1%)		11 (52.4%)	10 (38.5%)	
	PTH and calcium levels	14 (46.7%)	9 (52.9%)		9 (42.9%)	14 (53.8%)	
	Other	2 (6.7%)	0		0	2 (7.7%)	
PERMANENT hypoparathyroidism evaluation	Biochemically during visit to outpatient clinic of surgical department	1 (3.3%)	1 (5.9%)	0.829	0	2 (7.7%)	0.673
	Biochemically during visit to outpatient clinic of endocrinology department	25 (83.3%)	15 (88.2%)		19 (90.5%)	21 (80.8%)	
	Biochemically via general practitioner	0	0		0	0	
	Other, please specify	4 (13.3%)	1 (5.9%)		2 (9.5%)	3 (11.5%)	
Postoperative endocrinologist consult	Yes	20 (66.7%)	15 (88.2%)	0.089	12 (57.2%)	23 (88.6%)	**0.002**
	No	9 (30.0%)	1 (5.9%)		9 (42.9%)	1 (3.8%)	
	Other	1 (3.3%)	1 (5.9%)		0	2 (7.7%)	
Initial management strategy for patients with symptomatic postoperative hypoparathyroidism (calcium ion of 0.85-1.00 mmol/L or total calcium of < 1.9 mmol/L)	IV calcium infusion	3 (10.0%)	2 (11.8%)	0.589	3 (14.3%)	2 (7.7%)	0.762
	High dose oral calcium and active vitamin D supplementation	17 (56.7%)	7 (41.2%)		9 (42.9%)	15 (57.7%)	
	Both	4 (13.3%)	5 (29.4%)		4 (19%)	5 (19.2%)	
	Other, please specify	6 (20.0%)	3 (17.6%)		5 (23.8%)	4 (15.4%)	
Do pathologists record number of PGs in surgical specimen?	Yes	28 (93.4%)	16 (94.1%)	1	20 (95.2%)	24 (92.3%)	1
	No	1 (3.3%)	1 (5.9%)		1 (4.8%)	1 (3.8%)	
	Other, please specify	1 (3.3%)	0		0	1 (3.8%)	

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Discussion

Perioperative calcium management in thyroid surgery patients is important for patient outcomes. Our study investigated the differences in perioperative management among healthcare professionals in both academic and general hospitals in the Netherlands with a particular focus on variations in calcium suppletion management. Our study highlights the diverse approaches to preoperative, intraoperative and postoperative care in calcium management. Our findings underscore the need for standardized definitions to ensure uniform, high-quality research practices [19].

Definitions

The survey results indicated that healthcare professionals have varying definitions of hypoparathyroidism following thyroid surgery. Transient hypoparathyroidism was defined by a reduction in serum PTH and calcium levels requiring supplementation resolving within six months post-surgery in 27.7% of participants, while permanent hypoparathyroidism, according to 31.9% of respondents, need ongoing calcium or calcitriol supplementation beyond 6 months after surgery. The differences in both transient and permanent postoperative hypoparathyroidism definitions between surgeons and endocrinologists were statistically significant. These findings may be attributed to the small sample size of the study and variations in how questions were interpreted. Therefore, it is important to further explore these differences among healthcare professionals in larger cohorts to better understand the discrepancies that were identified. The incidence of hypoparathyroidism following thyroid surgery has been found to vary considerably in previous research. One possible reason for this variation may be the differing definitions of the condition employed in the various studies [20,21]. This variation underscores the need for standardized definitions to harmonize clinical and research practices. The focus of future research should be to conduct a Delphi study in order to come up with a unified set of definitions.

Preoperative Management

Responses on the preoperative management of thyroid surgery patients varied among respondents, yet no significant differences were noted between the types of physicians regarding their approaches. However, significant statistical differences were observed in preoperative testing for 25-hydroxy vitamin D (25OHvitD) levels ($p=0.017$) and parathyroid hormone (PTH) levels ($p=0.036$) between academic and general hospitals. Despite their potential benefits, only 44.7% of healthcare professionals routinely test for 25-hydroxy vitamin D, and 42.6% do not prescribe calcium and vitamin D supplements preoperatively [5,22]. Several predictors and risk factors for the development of postoperative hypocalcemia have been identified [23]. While the British Association of Endocrine and Thyroid Surgeons (BAETS) and the European Society of Endocrinology (ESE) focus on post-surgery hypocalcemia management without advocating preoperative measures [24,25], the American Thyroid Association (ATA) emphasizes preoperative testing and supplementation to reduce hypocalcemia risks following surgery [10]. Evidence indicates that correcting preoperative vitamin D deficiencies can decrease transient hypocalcemia after thyroidectomy, reducing symptom duration and length of hospital stay [26,27]. Therefore, ATA guidelines recommend testing serum calcium, parathyroid, and vitamin D levels before thyroidectomy. If deficiencies are identified, initiating corrective supplementation preoperatively is advised, even if it delays a total or complete thyroidectomy [28-30]. Although postponing surgery for patients with severe vitamin D deficiencies might reduce the risk of postsurgical complications, contrasting studies have shown that preoperative vitamin D levels might not significantly impact hypocalcemia rates after surgery [31]. This discrepancy underscores the need for further investigation into the role of preoperative vitamin D supplementation [13,31]. However, considering preoperative predictors of hypocalcaemia, such as vitamin D status, and population characteristics may improve patient care and reduce hospitalisation and associated costs.

Intraoperative Management

Although many surgeons prioritize identifying all parathyroid glands during thyroid surgery, they do not frequently use fluorescence techniques such as ICG and/or autofluorescence for this purpose. In our study, the use of fluorescence techniques, including autofluorescence, was only used in academic hospitals. Reluctance towards the use of these techniques might be related to factors such as resource availability, perceived efficacy, and the learning curve associated with new technologies [32]. Numerous studies have demonstrated the efficacy of fluorescence-guided surgery in identifying and preserving parathyroid glands during thyroidectomy [33,34]. Despite the substantial evidence demonstrating the efficacy of fluorescence techniques in localising parathyroid glands, the limited adoption of these techniques in clinical practice suggests that there are still challenges in implementing research findings into clinical practice [35]. In accordance with the ATA guidelines, the Dutch guidelines focus on identifying and preserving all parathyroid glands during thyroidectomy. Additionally, any inadvertently excised parathyroid glands should be inspected and possibly re-implanted [36]. However, neither the European nor the Dutch guidelines cover preoperative optimization or the use of intraoperative technical aids [24,25]. The individual preferences and experiences of surgeons regarding operative strategies may have a significant impact on the incidence of postoperative hypocalcaemia. Consequently, standardising intraoperative practices could help to reduce the incidence of postoperative hypoparathyroidism and subsequent hypocalcemia.

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Postoperative Management

The majority (86.7%) of total thyroidectomy patients are hospitalized for 24 to 48 hours, with only two surveyed providers offering same-day discharge, indicating a conservative post-surgery approach that is in line with guidelines advocating close postoperative monitoring [25]. This survey revealed significant variations in postoperative practices, especially regarding supplement prescriptions (p=0.026) and post-surgery endocrinologist consultations (p=0.002). More than half (51.1%) of providers do not prescribe routine calcium or vitamin D supplements upon discharge. Prophylactic calcium and calcitriol are suggested by some to support recovery in temporarily dysfunctional ("stunned") parathyroid glands [37]. Building on this, a recent study tested a symptom-based treatment algorithm for managing hypocalcemia after thyroid surgery, comparing it to a traditional biochemical approach [38]. It found that the new algorithm significantly reduced the need for calcium and alfacalcidol supplementation during the first postoperative year and at 12 months follow-up, although it did lead to an increase in calcium-related emergency visits and hospital readmissions. These results underscore the potential for more individualized treatment strategies. This is particularly relevant as current ATA guidelines recommend prophylactic calcium supplementation without routine lab assessments to manage postoperative hypocalcemia following total or complete thyroidectomy [39,40]. However, routine supplementation in low-risk patients may lead to unnecessary treatment and potential toxicity. In contrast, the BAETS guidelines recommend checking serum-corrected calcium levels within 12 hours postoperatively to facilitate early hypocalcemia treatment. Since serum calcium levels usually normalize within a month, standard prophylactic calcium supplementation is not advised in the Netherlands, in parallel to European guidelines [36]. The Dutch guideline emphasizes daily monitoring of serum calcium during the initial postoperative period, even when all parathyroid glands are preserved. These differences between guidelines highlight the need for further research into the role of prophylactic supplementation after thyroid surgery. Despite these differences, all guidelines agree that any low calcium levels detected in the immediate postoperative period should be corrected promptly.

Our study, a national survey with a limited sample size, may not fully represent global practice and has limitations. Extended cohort studies are recommended to increase the robustness of the data and to improve the understanding of the management of postoperative hypocalcaemia nationally and internationally. Interpretation bias may limit this study, as variations in respondents' understanding and responses to survey questions may affect overall results and comparability. Despite the limitations of our small survey, it has yielded sufficient information to identify differences in perioperative practice patterns.

In conclusion, our study highlighted differences in perioperative management among healthcare professionals in the Netherlands regarding calcium management. The varying definitions of postoperative hypoparathyroidism highlight the need for uniform definitions to harmonize clinical and research practices. Future research should focus on optimising preoperative risk factors for postoperative hypocalcaemia, such as vitamin D levels, ensuring accurate identification of parathyroid glands during surgery, and investigating the benefits of prophylactic postoperative calcium supplementation.

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Informed Consent Statement

Not applicable.

Data Availability Statement

The datasets generated or analyzed during the current study are included in this published article.

Conflict of interests

The authors declare no competing interests. All the authors have read the manuscript and declare no conflict of interest related to the submitted study

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