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Authors: Andrzej J. Lorek, Katarzyna Steinhof-Radwańska, Wojciech Zarębski, Anna Barczyk-Gutkowska, Joanna Lorek, Zoran Stojčev, Jarosław Pasek, Karol Krzyluk

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The prevalence of hypoparathyroidism after thyroid surgery depending on the diagnosis, the extent of the procedure, and the presence of parathyroid glands in the postoperative examination

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Andrzej Lorek¹, Katarzyna Steinhof-Radwańska², Wojciech Zarębski¹, Anna Barczyk-Gutkowska², Joanna Lorek³, Zoran Stojčev¹, Jarosław Pasek⁴, Karol Szyluk⁵

¹*Department of Oncological Surgery, Prof. Kornel Gibiński Independent Public Central Clinical Hospital, Medical University of Silesia in Katowice, Poland*

²*Department of Radiology and Nuclear Medicine, Prof. Kornel Gibiński Independent Public Central Clinical Hospital, Medical University of Silesia in Katowice, Poland*

³*Ludwik Rydygier Specialist Hospital in Kraków, Poland*

⁴*Faculty of Health Sciences, Jan Długosz University in Częstochowa, Poland*

⁵*District Hospital of Orthopaedics and Trauma Surgery, Piekary Śląskie, Poland*

Corresponding author: dr n. med. Andrzej Lorek, Department of Oncological Surgery, Medical University of Silesia in Katowice, 40–952 Katowice, ul. Ceglana 35, Poland, tel: (+48) 32 358 13 15, mob: (+48) 601 424 323, e-mail: chir.onkologiczna@szpitalceglana.pl; e-mail: ajlorek@o2.pl

Introduction

Postoperative hypoparathyroidism can be one of the complications associated with total thyroid removal due to cancer or benign goitre.

Material and methods: We aimed to evaluate the prevalence of hypoparathyroidism in patients operated on due to thyroid cancer and nodular goitre, including procedures performed between January 2015 and March 2019 at the Department of Oncological Surgery of the Medical University of Silesia in Katowice.

The studied group consisted of 595 patients operated on due to cancer and benign nodular goitres. Calcium (Ca) and phosphate metabolism was assessed using parathyroid hormone (PTH) and ionised calcium tests four hours after the surgery. Ionised calcium was checked 30 days after the procedure. Patients who had borderline or below-normal PTH levels in the postoperative period were also subjected to PTH testing after 30 days. In patients with low PTH levels, supplementation with calcium and vitamin D3 was introduced after the surgery.

Results: Compared to patients operated on for benign goitres, those diagnosed with cancer were significantly more likely to have PTH levels below 15 pg/mL and serum ionised calcium levels below 4 mg/dL 30 days after the surgery. The recovery rate was 65.05% vs. 82.6% ($p < 0.003$) and 64.2% vs. 84.25% ($p < 0.001$). The results were similar among patients who underwent lateral and central lymphadenectomy — 33.3% vs. 67.3% ($p < 0.021$) and 25.6% vs. 67.6% ($p < 0.018$). In patients with mild goitres, no significant differences in the recovery rate were observed — 82.6% vs. 92.8% ($p < 0.327$) and 84.25% vs. 92.3% ($p < 0.437$). Patients in whom parathyroid glands were found in the postoperative material were significantly more likely to have decreased PTH and calcium levels 30 days after the procedure. The recovery rate was 64.1% vs. 78.9% ($p < 0.027$) and 58.06% vs. 80.8% ($p < 0.004$).

Conclusions: Hypoparathyroidism is not an uncommon occurrence after thyroidectomy, even in facilities with extensive experience in this matter. Compared to total thyroid removal due to benign goitre, surgery for cancer with associated central and lateral lymphadenectomy significantly increases the risk of postoperative hypoparathyroidism. In surgical practice, it is reasonable to conduct routine Ca and PTH level checks immediately after the procedure and 30 days after thyroidectomy.

Key words: nodular goitre; thyroid cancer; surgical treatment; complications; hypoparathyroidism

Introduction

Complications after thyroidectomy include bleeding, hoarseness of throat, dysphagia, paresis, laryngeal nerve palsy and hypoparathyroidism, and less commonly, tracheal instability, lymphorrhoea, and occasionally thyroid storm [1, 2]. Postoperative hypoparathyroidism may constitute one of the complications associated with thyroidectomy due to cancer and benign goitre. It is usually caused by removal, damage, or ischaemia of the parathyroid glands [3, 4].

Material and methods

A retrospective study on 595 patients with total thyroid removal caused by cancer and benign nodular goitre was performed between 2015 and March 2019 at the Department of Oncological Surgery of the Medical University of Silesia in Katowice. The study was conducted in order to assess the prevalence of hypoparathyroidism, defined as serum levels of parathyroid hormone (PTH) < 15 pg/mL (normal 15–60 pg/mL) and ionised calcium (Ca) < 4 mg/dL (4–5.2 mg/dL) at four hours and 30 days after surgery, as well as factors that may influence it.

In the case of cancer, the scope of the surgery included total extracapsular removal of the thyroid gland with the central lymphatic system and, in some instances, lateral lymphadenectomy. In terms of goitres, the procedure

involved total extracapsular thyroidectomy. The procedures were performed by four surgeons with years of experience.

Parathyroid hormone and Ca levels were not determined before surgery. The check was performed four hours after the surgery, and the calcium level was tested the following day. The calcium level was also measured 30 days after the surgery. In patients with borderline or below normal PTH levels in the postoperative period, the PTH was also checked. All patients with low PTH levels received calcium supplementation at 3 g/day and alphacalcidol at 2.0 µg/day. In patients with decreased PTH levels as at 30 days after surgery, supplementation with calcium and Alfadiol was maintained for another three months.

The study included an analysis of the prevalence of hypoparathyroidism according to:

1. The diagnosis: cancer, benign goitres, goitres with inflammation (Hashimoto's disease).
2. The extent of the surgery: central or lateral lymphadenectomy.
3. The presence of parathyroid glands in postoperative histopathological material (H-P).

The percentage of patients who had normalised levels of PTH and Ca within 30 days of the procedure compared to those characterised by abnormal levels immediately after the procedure (recovery rate) was calculated. The odds ratio is the ratio of the chance of recovery (i.e. normalising PTH or Ca levels if they were below normal immediately after the surgery) in the case of a procedure performed in the cancer group compared to that of a procedure performed in the group diagnosed with benign goitres.

Statistical analysis

The condition of patients, which is assessed regarding hypoparathyroidism, measured by way of PTH and Ca level testing after the surgery and 30 days after the procedure, is summarised in the table below. To determine the existence of significant differences between the patient groups, the results were compared using the chi-square test and Dunn's post-hoc test. The χ^2 test was used to examine whether the existing differences in the number of healed patients (who had normalised the levels under study) were significant. OR values with 95% confidence interval for the compared groups were calculated.

Results

The study covered 595 patients, including 508 (85.3%) women and 87 (14.6%) men, aged 6 to 86 years, with an average of 53 years. 225 cancers, 336 nodular goitres, and 30 nodular goitres with inflammation were diagnosed in the H-P.

Decreased PTH and Ca levels in the group of patients diagnosed with hypoparathyroidism, who did not regain normal parathyroid gland function immediately after the surgery and 30 days after the procedure, and the effect of the diagnosis, the type of procedure, and the presence of parathyroid glands in H-P on postoperative hypoparathyroidism, are presented in Table 1.

Table 1. Number of patients with parathyroid hormone (PTH) and calcium (Ca) levels below normal in each group under study (1 — cancer, 2 — benign goitre), as well as differences in the recovery rate and odds ratio values for PTH and Ca as of the day of the surgery and 30 days after the procedure

Parameter	Proportion of the healed patients			χ^2	p	OR	CI 95%		p
	Group	Group 1	Group 2				Lower	Upper	
PTH	Cancer vs. Goitres	65.05% (67/103)	82.64% (100/121)	9.081	0.003	0.391	0.210	0.727	0.216
	Cancer vs. Inflammation	65.05% (67/103)	92.86% (13/14)	4.408	0.036	0.143	0.018	1.139	0.917
	Goitres vs. Inflammation	82.64% (100/121)	92.86% (13/14)	0.959	0.327	0.366	0.045	2.955	1.358
Ca	Cancer vs. Goitres	64.20% (52/81)	84.25% (123/146)	11.858	0.001	0.335	0.177	0.633	0.100
	Cancer vs. Inflammation	64.20% (52/81)	92.31% (12/13)	4.074	0.044	0.149	0.018	1.208	0.957
	Goitres vs. Inflammation	84.25% (123/146)	92.31% (12/13)	0.605	0.437	0.446	0.055	3.596	1.356
PTH	Parathyroid gland Present vs. Absent	64.15% (34/53)	78.92% (146/185)	4.875	0.027	0.478	0.246	0.928	0.660
Ca	Parathyroid gland Present vs. Absent	58.06% (18/31)	80.86% (169/209)	8.154	0.004	0.328	0.148	0.724	0.304
PTH	Central vs. Lateral lymphadenectomy	67.35% (66/98)	33.33% (4/12)	5.345	0.021	4.125	1.156	4.723	0.029
Ca	Central vs. Lateral lymphadenectomy	67.61% (48/71)	25.00% (2/8)	5.617	0.018	6.261	1.172	33.449	0.032

OR — odds ratio; CI — confidence interval

The outpatient follow-up check performed six months after the surgery revealed persistent symptoms of hypoparathyroidism in seven (1.1%) patients included in the study group with decreased PTH levels after the procedure, which required continued calcium and alphacalcidol supplementation.

Discussion

In the study, out of 225 patients operated for cancer, 29 (12.8%) were diagnosed with hypoparathyroidism 30 days after the surgery; in the group of patients who underwent central lymphadenectomy, it was 23 (10.4%), while in those after lateral lymphadenectomy it was 6 (23%). Among 336 persons diagnosed with mild goitres, decreased PTH levels were observed in 23 (6.8%), while among those with goitres and associated inflammation decreased PTH levels were observed in 1 (2.9%). The prevalence is comparable to that reported in the literature, which is between 6.9% and 46% [5, 6].

In the study, parathyroid gland removal was performed on 85 (14.2%) persons, resulting in hypoparathyroidism in 13 (2.1%) patients after 30 days, which is lower than the rate reported in the literature on the subject, which ranges from 6.4% to 31.1% [7, 8]. However, it still shows that incidental parathyroid gland removal is possible and expected.

The study included a comparison of the prevalence of hypoparathyroidism depending on the diagnosis (H-P): cancer, benign goitre, and goitre with inflammation. In terms of the extent of the removal, it includes central and lateral lymphadenectomy, as well as the presence of the removed parathyroid gland in H-P. The study revealed that in significantly more cases, hypoparathyroidism persisting 30 days after the surgery accompanies resection of thyroid cancer with central and lateral lymphadenectomy and removal of parathyroid glands compared to benign goitre and goitre with associated inflammation. This appears to be consistent with data contained in the literature on the subject, where central lymphadenectomy during thyroid removal due to cancer is the most common risk factor for hypoparathyroidism [9, 10].

The study was limited because not all patients with low PTH levels after 30 days after the surgery appeared for a follow-up check in subsequent months. Therefore, the number of patients with decreased PTH levels six months after the procedure may be underestimated and amount to more than seven.

Conclusions

Hypoparathyroidism is not an uncommon occurrence after thyroidectomy, even in facilities with extensive experience in this matter. Compared to total thyroid removal due to benign goitre, surgery for cancer with associated central and lateral lymphadenectomy significantly increases the risk of postoperative hypoparathyroidism. In surgical practice, it is reasonable to conduct routine Ca and PTH level checks after the procedure and 30 days after thyroidectomy.

Competitive interests

The authors declare that they have no conflict of interest.

References

1. Tsai SH, Chien SC, Nguyen PA, et al. Incidences of Hypothyroidism Associated With Surgical Procedures for Thyroid Disorders: A Nationwide Population-Based Study. *Front Pharmacol*. 2019; 10: 1378, doi: [10.3389/fphar.2019.01378](https://doi.org/10.3389/fphar.2019.01378), indexed in Pubmed: [31920634](https://pubmed.ncbi.nlm.nih.gov/31920634/).
2. Fortuny JV, Guigard S, Karenovics W, et al. Surgery of the thyroid: recent developments and perspective. *Swiss Med Wkly*. 2015; 145: w14144, doi: [10.4414/smww.2015.14144](https://doi.org/10.4414/smww.2015.14144), indexed in Pubmed: [26218498](https://pubmed.ncbi.nlm.nih.gov/26218498/).
3. Caulley L, Johnson-Obaseki S, Luo L, et al. Risk factors for postoperative complications in total thyroidectomy: A retrospective, risk-adjusted analysis from the National Surgical Quality Improvement Program. *Medicine (Baltimore)*. 2017; 96(5): e5752, doi: [10.1097/MD.0000000000005752](https://doi.org/10.1097/MD.0000000000005752), indexed in Pubmed: [28151852](https://pubmed.ncbi.nlm.nih.gov/28151852/).
4. Aggeli C, Zografos GN, Nixon A, et al. Postoperative hypoparathyroidism after thyroid surgery. *Hellenic J Surg*. 2015; 87(1): 106–110, doi: [10.1007/s13126-015-0193-6](https://doi.org/10.1007/s13126-015-0193-6).
5. Păduraru DN, Ion D, Carsote M, et al. Post-thyroidectomy Hypocalcemia — Risk Factors and Management. *Chirurgia (Bucur)*. 2019; 114(5): 564–570, doi: [10.21614/chirurgia.114.5.564](https://doi.org/10.21614/chirurgia.114.5.564), indexed in Pubmed: [31670631](https://pubmed.ncbi.nlm.nih.gov/31670631/).
6. Dedivitis RA, Aires FT, Cernea CR. Hypoparathyroidism after thyroidectomy: prevention, assessment and management. *Curr Opin Otolaryngol Head Neck Surg*. 2017; 25(2): 142–146, doi: [10.1097/MOO.0000000000000346](https://doi.org/10.1097/MOO.0000000000000346), indexed in Pubmed: [28267706](https://pubmed.ncbi.nlm.nih.gov/28267706/).
7. Neagoe RM, Cvasciuc IT, Muresan M, et al. Incidental parathyroidectomy during thyroid surgery: risk, prevention and controversies; an evidence-based review. *Acta Endocrinol (Buchar)*. 2017; 13(4): 467–475, doi: [10.4183/aeb.2017.467](https://doi.org/10.4183/aeb.2017.467), indexed in Pubmed: [31149218](https://pubmed.ncbi.nlm.nih.gov/31149218/).
8. Almquist M, Hallgrimsson P, Nordenström E, et al. Prediction of permanent hypoparathyroidism after total thyroidectomy. *World J Surg*. 2014; 38(10): 2613–2620, doi: [10.1007/s00268-014-2622-z](https://doi.org/10.1007/s00268-014-2622-z), indexed in Pubmed: [24791907](https://pubmed.ncbi.nlm.nih.gov/24791907/).
9. Campos NS, Cardoso LP, Tanios RT, et al. Risk factors for incidental parathyroidectomy during thyroidectomy. *Braz J Otorhinolaryngol*. 2012; 78(1): 57–61, doi: [10.1590/s1808-86942012000100009](https://doi.org/10.1590/s1808-86942012000100009), indexed in Pubmed: [22392239](https://pubmed.ncbi.nlm.nih.gov/22392239/).
10. Du W, Fang Q, Zhang Xu, et al. Unintentional parathyroidectomy during total thyroidectomy surgery: A single surgeon's experience. *Medicine (Baltimore)*. 2017; 96(11): e6411, doi: [10.1097/MD.00000000000006411](https://doi.org/10.1097/MD.00000000000006411), indexed in Pubmed: [28296787](https://pubmed.ncbi.nlm.nih.gov/28296787/).