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Relationship of Post-Thyroidectomy Hypocalcemia to Surgeon's Experience in a Private Tertiary Hospital

ABSTRACT

Objective: To determine the association of surgeon's experience based on years of practice and incidence of post-thyroidectomy hypocalcemia.

Methods:

Design: Retrospective cohort study

Setting: Tertiary Private Training Hospital

Participants: Records of patients who underwent total thyroidectomy in a private tertiary hospital from January 2003 to December 2018 were retrospectively reviewed. Medical information obtained were patient demographics, surgeon's years of practice, thyroid specimen weight, technique of surgery, histopathologic findings and calcium assay values. Chi-square test and Odds Ratio analysis were used to determine the relationship between the surgeon's experience and post-thyroidectomy hypocalcemia.

Results: Three hundred fourteen (314) patients who underwent total thyroidectomy from 2003 to 2018 were included in the study. Overall rate of post-operative hypocalcemia was 41%. On multivariate analysis, no significant odds ratio was found between surgeons with 5 to 19 years of experience and those with more than 19 years of experience in relation to post-operative hypocalcemia [Odds Ratio 1.4 (95% Confidence Interval 0.7 to 2.6)]. Odds ratios for other variables may be interpreted, however, they could not be generalized over the population where data was gathered since the 95% Confidence Interval includes 1.

Conclusion: The results of this retrospective cohort study suggest that post-thyroidectomy hypocalcemia is not associated with surgeon's experience based on years of practice. Further studies are recommended in a multicenter approach to better generalize to the whole population.

Keywords: *thyroidectomy; hypocalcemia; postoperative complication*

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Philipp J Otolaryngol Head Neck Surg 2023; 38 (2): 31-34

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In thyroid surgery, post-operative hypocalcemia is one of the most common complications noted occurring in about 7% to 25% of cases for transient hypocalcemia and 0.4% to 13.8% for permanent hypocalcemia.¹ Patients with a sudden decrease in the level of serum ionized calcium can face serious and life-threatening complications such as tetany, bronchospasm, mental status changes, seizures, laryngospasm and cardiac arrhythmia.¹ The chances of post-surgery hypocalcemia may be related to the size and degree of invasion of tumor, pathology and extent of the procedure and surgeon experience.¹ Several studies are found determining the impact of surgeon experience with the risk of complications of surgery on different fields of practice with conflicting results.²⁻⁸

According to the surgeons' performance curve, in their mid-career, at the time after their education ends and techniques are well-mastered, they are expected to reach peak performance.⁴ After this period, however, and without appropriate training and ongoing learning, or challenges, a surgeon's performance could decline over time because of mental fatigue due to repetition of a specific procedure over a long time. Surgeons between 35 to 50 years old (5 to 20 years of practice) had better outcomes than their younger and older colleagues.⁴ Thyroidectomies done by surgeons in practice for 20 years or more increased the probability of permanent complications.⁴ This is somewhat supported by another study concluding a significant association between surgeon volume and improved postoperative outcome wherein surgeons with the highest volume had the fewest post-operative complications and incidence of in-hospital mortality.³ Another study concluded that highest volume surgeons had the fewest complications and shortest hospital stay.² However, they noted that postsurgical hypoparathyroidism was not significantly different among groups categorized based on volume of thyroidectomies done over 6 years.²

Due to the conflicting results of previous studies done,^{2,8} this research aims to determine the association of surgeon's experience based on years of practice and the incidence of post-operative complications focusing on hypocalcemia post-thyroidectomy.

METHODS

With Far Eastern University – Nicanor Reyes Medical Foundation Institutional Ethics Review Committee approval (FEU-NRMF IERC 2018-0008), this retrospective cohort study considered for inclusion all patients under the Department of Otolaryngology – Head and Neck Surgery who underwent total thyroidectomy in FEU-NRMF Medical Center from January 2003 to December 2018.

Excluded from the study were those documented with renal disease, parathyroid disorders, had intake of rifampicin, phenytoin,

phenobarbital, bisphosphonates, calcitonin, chloroquine, corticosteroids, and plicamycin, calcium and vitamin D supplementation which may increase or decrease the level of calcium in the body.

The sample size was calculated based on the comparison of the incidence of post-surgery hypocalcemia across different year-duration of surgeon's experience. Assuming that those with 5 to 19 years of experience had an incidence of post-surgery hypocalcemia of 0.6% and those with >19 years of experience, hypothesized to be 6%⁴ with an alpha error of 5%, power of 95%, and a one-tailed alternative hypothesis, the sample size calculated was 98 per group or 196 for 2 groups. Controlling for 3 more variables in the analysis, with an additional 20% for each control variable, the final sample size required was 314.

Utilizing convenience sampling, the charts of patients who underwent total thyroidectomy were retrieved from the medical records section and data collection ended upon the completion of the required sample size of 314.

Clinical research assistants filled-up the data collection tool using review of patient's medical records. Data on patient demographics, surgeon's years of practice, thyroid specimen weight, technique of surgery, histopathologic findings and calcium assay values were collected and filled out in the form. Thyroid specimen weight, technique of surgery, histopathologic findings served as possible risk factors that may influence the incidence of post-operative hypocalcemia. Surgeon's length of experience based on years of practice was obtained from the Department of Otolaryngology – Head and Neck Surgery database and was separated into 2 categories: 5 to 19 years of practice and 20 years of practice or more. These categories were patterned from a previous study done by Duclos *et al.*⁴

The independent variable was surgeon's length of experience, defined as the number of years spent in practice at the time thyroidectomy was performed. The dependent variable was post-operative hypocalcemia, defined as serum ionized calcium below 1.12mmol/L extracted six hours post-thyroidectomy. Confounders included thyroid specimen weight (as described in the histopathologic form compared to the normal weight of the thyroid gland which is 15 to 25g in adults); histopathologic findings (whether benign or malignant); technique of surgery (conventional ligature, mono or bipolar diathermy or harmonic scalpel).

Data analysis

All data was gathered by the researcher through review of patient's medical records and encoded in a tabulated form using SPSS for Windows version 20 (IBM Corp., Armonk NY, USA). Comparison of the incidence of hypocalcemia across different years of experience of the



surgeons was done using univariate and multivariate analysis. Chi square test was used for univariate analysis. Unadjusted Odds Ratios were also calculated. Multiple logistic regression was then utilized. Level of significance was set at $\alpha = .05$.

RESULTS

Three hundred fourteen (314) patients who underwent total thyroidectomy from 2003 to 2018 in FEU-NRMF Medical Center were included in the study. 268 or 278 were female while 46 were male. One hundred twenty nine patients (41%) had post-operative hypocalcemia as evidenced by 6 hours serum ionized calcium less than 1.12mmol/L.

Comparison of patient's demographics, surgeon's techniques, and surgical outcome post-operatively between surgeons with 5 to 19 years of experience and those surgeons with 20 years of experience or more is detailed in *Table 1*. T-test was performed to compare patient's age and surgeons with 5 to 19 years of experience and surgeons with 20 or more years of experience. There was statistical difference in the mean age of patients between surgeons with 5 to 19 years of experience ($M=41.0$, $SD=12.7$) and surgeons with experience of 20 years or more ($M=48.0$, $SD=12.0$; $t(312)=-3.663$, $p=.002$). T-test was also performed to compare thyroid weight of patient's operated on and compared between two groups of surgeons. There was no statistical difference in the mean thyroid weight between surgeons with 5 to 19 years of experience ($M=46.8$, $SD=42.5$) and surgeons with experience of 20 years or more ($M=32.2$, $SD=30.8$); $t(312)=2.34$, $p=.28$. Chi-square test was performed to examine the relation of surgeon's technique, gender and histopathologic result to surgeon's experience. The relationship between these variables were not significant, $\chi^2(1, N=314) = 2.692$, $p=.101$, $\chi^2(1, N=314)=2.109$, $p=.146$ and $\chi^2(1, N=314)=.802$, $p=.370$, respectively.

Univariate analysis showed that at $\alpha = .05$ level of significance, the incidence of hypocalcemia was not associated with surgeon's years of practice. (*Table 2*) Also, there were no statistically significant differences found with respect to the other variables. Post-operative hypocalcemia was not associated with the surgeon's technique, thyroid specimen weight and histopathology result.

Multivariate analyses of factors independently associated with post-operative hypocalcemia were computed with adjustment for both surgeon and patient factors. (*Table 3*) No significant odds ratio was found. Even though the other odds ratios may be interpreted, they could not be generalized over the population where data was gathered since the 95% Confidence Interval includes 1. Thus, it is reasonable to say that whether the surgeon had more experience, or the histopathologic result was benign, the odds of having hypocalcemia was not statistically elevated or reduced.

Table 1. Demographic and clinical characteristics by surgeons years of practice

		Surgeon's Experience (years)				P-Value
		5 to 19		20 or more		
Patient Age in years (mean +/- standard deviation)		41.0 +/- 12.7		48.0 +/- 12.0		.002
Gender	Female	227	86.6%	41	78.8%	.146
	Male	35	13.4%	11	21.2%	
Surgeon's Technique	Conventional	249	95.0%	52	100.0%	.101
	Harmonic	13	5.0%	0	0.0%	
Thyroid Weight in grams (mean +/- standard deviation)		46.8 +/- 42.5		32.2 +/- 30.8		.280
Histopathologic Result	Benign	178	67.9%	32	61.5%	.370
	Malignant	84	32.1%	20	38.5%	

Table 2. Distribution of surgeon and patient characteristics regarding post-thyroidectomy hypocalcemia (univariate analysis)

		Hypocalcemia				P-Value
		(+) (+)		(-) (-)		
Surgeon's Experience (years)	5 to 19	111	86.0%	151	81.6%	.299
	20 or more	18	14.0%	34	18.4%	
Surgeon's Technique	Conventional	127	98.4%	174	94.1%	.054
	Harmonic	2	1.6%	11	5.9%	
Thyroid Weight in grams (mean +/- standard deviation)		55.8 +/- 50.0		36.9 +/- 31.9		.052
Histopathologic Result	Benign	86	66.7%	124	67.0%	.947
	Malignant	43	33.3%	61	33.0%	

Table 3. Factors independently associated with the occurrence of post-operative hypocalcemia (multivariate analysis)

		Hypocalcemia				Odds Analysis	
		(+) (+)		(-) (-)		Odds Ratio	95% CI
Surgeon's Experience (years)	5 to 19	111	86.0%	151	81.6%	1.4	0.7, 2.6
	20 or more	18	14.0%	34	18.4%		
Surgeon's Technique	Conventional	127	98.4%	174	94.1%	4.0	0.9, 18.4
	Harmonic	2	1.6%	11	5.9%		
Histopathologic Result	Benign	86	66.7%	124	67.0%	1.0	0.6, 1.6
	Malignant	43	33.3%	61	33.0%		

DISCUSSION

There is an increase in the national prevalence of goiters in the Philippines⁵ which may suggest an increase in the number of thyroid surgeries. Post-thyroidectomy hypocalcemia is one of the most common complications noted after total thyroidectomy.¹ This study aimed to determine the association between the incidence of post-

thyroidectomy hypocalcemia and surgeon's experience based on years of practice.

In this retrospective cohort study, the odds of having post-thyroidectomy hypocalcemia were not associated with the surgeon experience based on years of practice. This study finding differs compared with the a previous study done by Duclos, *et al.*, wherein surgeons with 5 to 20 years of experience had better outcomes than their younger and older counterparts.⁴ Several prior studies have been made about the association between higher surgeon volume and better patient outcomes.^{2,3} This study also contradicts previous studies done by Kandil *et al.*, Adam *et al.*, Sanchez *et al.*, and Liang *et al.*,^{3,5-7} wherein surgeons with the highest volume had the fewest post-operative complications and incidence of in-hospital mortality. However, it was noted in a study done by Sosa, *et al.* that surgeons with the most number of thyroidectomies done had fewer complications, the incidence of post-thyroidectomy hypocalcemia was not significantly different among the groups compared.² This finding in our study may be because despite the longer years of experience of older surgeons or exposure of younger surgeons to new technology, both groups in the study still followed the same conventional technique in thyroidectomy, as seen in *Table 1*: 95% and 100% for surgeons with 5 to 19 years of experience and 20 or more experience, respectively. Also, the technique of thyroidectomy has not changed over the past and is highly reproducible.⁴

Another reason might be because thyroidectomy does not require a surgeon to learn how to use a specific equipment to be able to perform the surgery unlike other otolaryngologic cases such as endoscopic sinus surgery, mastoidectomy, micro laryngeal surgery, etc., requiring exposure to plenty of cases.

There was statistical difference in the mean age of patients operated on between surgeons with 5 to 19 years of experience and surgeons with experience of 20 years or more. Surgeons with more years of experience tend to have relatively older patients. It may be supported by a study done by Papaleontiou, *et al.*, which found that most physicians would refer an older patient to a high-volume thyroid surgeon⁸ which may correlate to a surgeon's experience.

There are several limitations to this study. Recruitment of sample was done through chart review, wherein all data were gathered retrospectively. Convenience sampling was utilized due to lack of time and difficulty in retrieving some of the charts included from the year 2003 to 2018. Another limitation of the study is that not all histopathologic reports contain the thyroid specimen weight. Therefore, only those with thyroid specimen weight were recorded and included in the statistical analysis that may not be representative of the whole population. Also, a decrease in 6 hours post-operative serum ionized calcium might have

occurred transiently. Permanent post-operative hypocalcemia might be a better variable to measure. Another limitation of the study is there were fewer surgeons with 20 or more years of experience, which also may not be representative of the whole population. Finally, all the data was secondarily obtained from records, and their accuracy and veracity cannot be fully assured.

Despite these limitations, the study could still provide insights on the relationship of post-thyroidectomy hypocalcemia and surgeon experience, because to the best of our knowledge, there is no previous research in the Philippines on this relationship. Further studies can be done in a multicenter approach and modifying the sampling technique to probability sampling to randomize the study population and generate a better generalization to the whole population.

In summary, the results of this retrospective cohort study suggest that post-thyroidectomy hypocalcemia is not associated with surgeon's experience based on years of practice.

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