



**THE NEXUS OF UNINTENTIONAL PARATHYROIDECTOMY,
HYPOPARATHYROIDISM, AND POSTOPERATIVE PTH MONITORING IN
THYROID SURGERY-A RECORD BASED STUDY**

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Background- Hypoparathyroidism stands as a significant side effect following thyroidectomy. Yet, the potential correlation between hypoparathyroidism and the quantity of preserved parathyroid glands remains unclear.

Objectives- To assess the incidence of Unintentional Parathyroidectomy (UIP) and its correlation with hypoparathyroidism and to determine the essential minimum number of preserved parathyroid glands to prevent its occurrence.

Methods- From October 2022 to September 2023, a retrospective analysis was performed at the surgery department of a tertiary care teaching hospital. Using a purposeful sampling method, around 250 individuals who underwent thyroidectomy were selected. The study excluded patients with severe chronic renal insufficiency, those who underwent parathyroid gland auto-transplantation, individuals with a history of neck irradiation, and cases of thyroidectomy in patients with primary hyperparathyroidism. Prior to participation, written informed consent was obtained from all subjects, and the institutional ethics committee approved the study.

Results- Unintentional Parathyroidectomy occurred in 18.4% of the patients; one parathyroid gland in 16%, two in 1.5%, and three in 0.9%. Transient hypoparathyroidism was increased when Unintentional Parathyroidectomy (UIP) occurred. There was no significant relationship between the number of parathyroid glands preserved and permanent hypoparathyroidism (P= 0.16).

Conclusions- preserving at least one functional parathyroid gland is crucial in averting post-thyroid surgery hypoparathyroidism. Furthermore, vigilant postoperative monitoring of parathyroid hormone levels stands as a critical measure for early detection and tailored intervention strategies, particularly for at-risk patients.

Keywords- Parathyroid, Hypocalcaemia, Hypoparathyroidism, Thyroidectomy,

Introduction

Hypoparathyroidism is one of the main side effects of thyroidectomy. According to a recent meta-analysis, the median incidence of temporary and permanent hypoparathyroidism following thyroidectomy ranges from 19% to 38% and 0% to 3%, respectively.¹ Postoperative hypoparathyroidism increases the need for medication and biochemical testing and a prolonged hospital stay raises the overall expense of a thyroidectomy.^{2,3,4} Maintaining the parathyroid gland and its blood supply is the best strategy for reducing hypoparathyroidism after thyroidectomy. The association between the quantity of preserved parathyroid glands and the prevalence of hypoparathyroidism remains unclear. Therefore, the rationale behind the study was to evaluate the clinical characteristics and the frequency of hypoparathyroidism according to the number of parathyroid glands preserved during thyroidectomy and to determine the minimum number of parathyroid glands that need to be preserved to prevent hypoparathyroidism.

Materials and Methods

From October 2022 to September 2023, a retrospective analysis was performed at the surgery department of a tertiary care teaching hospital. Using a purposeful sampling method, around 250 individuals who underwent thyroidectomy were selected. The study excluded patients with severe chronic renal insufficiency, those who underwent parathyroid gland auto-transplantation, individuals with a history of neck irradiation and cases of thyroidectomy in patients with primary hyperparathyroidism. Prior to participation, written informed consent was obtained from all subjects, and the institutional ethics committee approved the study.

Methodology-

Analyses were conducted on the patient's information, based on indication for surgery, the number of parathyroid glands that were preserved, the number that was incidentally found in the surgical specimens, the requirement for intravenous calcium supplementation, hypoparathyroidism and other surgical complications. To safeguard the parathyroid glands and their associated vasculature during thyroidectomy, the surgical technique employed included capsular dissection and the identification of parathyroid glands. Efforts were made to identify both the superior and inferior parathyroid glands. The number of parathyroid glands preserved

was calculated by deducting the number of parathyroid glands in a particular specimen from four. In general, it is not always possible to identify every parathyroid gland during thyroidectomy. Parathyroid function was measured as intact parathyroid hormone (iPTH), so it was used as an index of parathyroid gland function. iPTH was estimated by the electro chemiluminescence immunoassay (ECLIA) on Elecsys immunoassay analyser. Preoperatively, the study evaluated baseline levels of iPTH, total calcium (Ca) and ionized Ca. Postoperative measurements were taken immediately after the surgery, at the 24-hour mark, 6 months post-surgery, and as required based on clinical needs. All patients were followed up for at least six months after surgery.

Statistical Analysis-

The statistical analysis utilized SPSS software version 22.0 for Windows, Mac, and Linux platforms. The results were presented in numerical values and percentages, analyzed via frequency and percentage distribution. The Chi-square test was employed to determine associations among variables. A critical value of P (<0.05) was considered to indicate a significant difference in comparisons.

Results-

In the course of the study period, a total of 250 patients (69 males, 181 females) underwent thyroidectomy in our department. Patient ages ranged from 16 to 80 years, with a mean age of 51.4, but there was no significant difference between the mean age of patients with and without Unintentional Parathyroidectomy. The histopathological analysis of the excised specimen revealed benign conditions in 177 cases (70.8%) and malignancy in 73 cases (29.2%). (**Table 1**). Papillary carcinoma was found to be the most common malignancy and multinodular goitre identified as the most prevalent benign pathological abnormality.

Table 1: Demographic profile and Unintentional Parathyroidectomy		
	Number	Percentage
Sex		
Male	69	27.6%
Female	181	72.4%
Age	51.4±10.4	Range 16–80 years
Thyroid pathology		
Benign	177	70.80%
Malignant	73	29.20%
Unintentional Parathyroidectomy	46	18.4%

Number of removed PGs		
One	40	16%
Two	4	1.6%
Three	2	0.8%
Location of removed PGs		
Intrathyroidal	21	45.65%
Subcapsular	19	41.30%
Extracapsular	6	13.05%
Histology of removed PGs		
Normal	43	93.47 %
Hyperplasia without atypia	2	4.36%
Adenoma	1	2.17%

In the current investigation, Unintentional Parathyroidectomy (UIP) was observed in 18.4% (46) of the patients, with one parathyroid gland affected in 16% (40), two in 1.5% (4), and three in 0.9% (2). Transient hypoparathyroidism was increased when UIP occurred (odds ratio 1.63, 95% confidence interval 1.07 to 3.13, P = 0.03). When all parathyroid glands are preserved, temporary hypoparathyroidism is reduced compared to when three or fewer glands are preserved; however, permanent hypoparathyroidism remains unaffected. In 45.65% (21/46) of instances, the parathyroid glands (PGs) were entirely intrathyroidal, enclosed by thyroid parenchyma. In 19 cases (41.3%), they were situated in a subcapsular position, whereas 6 cases (13%) were located outside the thyroid capsule. Out of the removed parathyroid glands, the vast majority (93.47%, 43/46) were normal. In two patients, mild hyperplasia without atypia was observed, and in one case, an adenoma was detected. (**Table 1**).

In the present study, risk factors for Unintentional Parathyroidectomy included thyroidectomy

Table 2	Unintentional Parathyroidectomy				Total
	N=0	N=1	N=2	N=3	
Thyroid Pathology					
MNG	88	10	2	1	101 (40.4%)
Toxic MNG	7	3	0	0	10 (4%)
Graves' disease	3	1	0	0	4 (1.6%)
Recurrent MNG	1	3	0	0	4 (1.6%)
Thyroiditis	42	9	0	0	51 (20.4%)
Follicular adenoma	7	0	0	0	7 (2.8%)
PTC	53	13	1	0	67 (26.8%)
Follicular carcinoma	3	1	0	0	4 (1.6%)
Anaplastic carcinoma	0	0	1	1	2 (0.8%)
Total	206	40	4	2	250
Serum calcium and parathyroid hormone levels after thyroidectomy					
Serum calcium level at POD1 (mg/dL)	8.81 ±0.11	8.69 ±0.20		8.74 ±0.09	
Immediate postoperative Parathormone level (pg/mL)	41.4326 ±7.778	35.0294 ±9.942		39.4535 ±6.215	
Biochemical hypocalcaemia at POD1	17(8.33%)	9(18.36%)		26(10.4%)	

done for malignant diseases ($P=.003$) and in patient with thyroiditis ($P=.004$). As anticipated, performing central compartmental neck node dissection elevated the likelihood of parathyroid removal and posed a potential risk of ischemia to the preserved glands. The correlation between thyroiditis and an elevated risk of Unintentional Parathyroidectomy (UIP) can be attributed to the adhesions caused by recurrent inflammations and increased bleeding, both of which may lead to operative challenges. There were significant differences in the rates of biochemical hypocalcaemia and parathormone levels on postoperative day 1 between the two groups. Biochemical hypocalcemia on postoperative day 1 was observed in 18.4% of patients with

Unintentional Parathyroidectomy and 8.3% of patients without it. (OR 1.74, 95% CI 1.38–2.7, $p < 0.008$). There was no relation between the number of preserved parathyroid glands and permanent hypoparathyroidism. (**Table 2**).

Discussion-

Unintentional Parathyroidectomy and hypocalcaemia are well-recognized complications of thyroid surgery. In the present study Unintentional Parathyroidectomy (UIP) occurred in 18.4% of the patients; one parathyroid gland in 16%, two in 1.5%, and three in 0.9%. Transient hypoparathyroidism was increased when UIP occurred (odds ratio 1.63, 95% confidence interval 1.07 to 3.13, $P = 0.03$). Demographic factors like young age and female sex have been identified in previous studies as potential risk factors for UIP. However, in our study, we found no significant differences in age or sex between patients with and without UIP, contradicting these findings, which were based on univariate analysis and not confirmed through multivariate models.^{4,5,6} Cavicchi O et al. sought to pinpoint variables associated with transient hypoparathyroidism following thyroid surgery. Their results emphasize that the increased occurrence of transient hypoparathyroidism is connected to the extent of surgery involving central and/or lateral neck lymph nodes, primarily due to the heightened likelihood of inadvertent parathyroidectomy or devascularization of the parathyroid gland.⁷

Sasson AR et al. conducted a retrospective analysis at a tertiary referral cancer centre to investigate potential risks linked to UIP and concluded that the inclusion of a concomitant modified radical neck dissection was linked to a higher risk of inadvertent parathyroidectomy ($P = 0.05$). However, despite this association, incidental parathyroidectomy did not demonstrate a significant correlation with postoperative hypocalcemia ($P = 0.99$), while multivariate analysis highlighted total thyroidectomy as an independent risk factor for postoperative hypocalcemia ($P = 0.008$).⁸ Thomusch et al. conducted a study involving 5846 patients with both benign and malignant thyroid disease who underwent thyroid surgery. Recorded observations were systematically gathered through questionnaires distributed across 45 hospitals. The study revealed an overall incidence of transient and permanent hypoparathyroidism at 7.3% and 1.5%, respectively. Logistic regression analysis identified several independent risk factors for transient hypoparathyroidism, including total thyroidectomy (odds ratio [OR], 4.7), female gender (OR, 1.9), Graves' disease (OR, 1.9), recurrent goiter (OR, 1.7), and bilateral central ligation of the inferior thyroid artery (OR, 1.7).⁹

Hypoparathyroidism is a multifactorial situation resulting from factors such as direct parathyroid gland injury, devascularization, venous drainage obstruction, and inadvertent parathyroid gland extraction. Therefore, evaluating hypocalcemia solely based on one or a few parathyroid glands without considering the status of the remaining glands may not provide an accurate assessment.¹⁰

Conclusion-

The preservation of at least one functioning parathyroid gland is essential to prevent hypoparathyroidism following thyroid surgery. The findings underscore the significance of heightened surgical precision and meticulous techniques aimed at minimizing unintentional

parathyroidectomy, thereby mitigating the risk of postoperative hypoparathyroidism. Moreover, the critical importance of vigilant and systematic postoperative PTH monitoring has been highlighted as a key component in early detection, management, and tailored intervention strategies for patients at risk

Conflict of Interest- None declared

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