

## PRESERVING UPPER PARATHYROID GLANDS BILATERALLY TO AVOID POSTOPERATIVE HYPOCALCEMIA

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### ABSTRACT

Post-surgical hypoparathyroidism occurs as hypocalcemia and may be due to multiple mechanisms, including surgery or thyroid gland related. We planned a prospective study to determine the patients at risk for post-surgical hypocalcemia. In the study, there were 45 patients with multinodular goiter, euthyroid, healthy, or with mild diseases who were classified as level I or II according to the ASA Physical Status Classification System (ASA). In addition to the demographics, preoperative and intraoperative (right before closing), PTH levels, and postoperative total and ionized calcium levels on the 6<sup>th</sup> and 24<sup>th</sup> hours were recorded. The patients were divided into two groups. In the first group with 25 patients, parathyroid glands were bilaterally preserved. In the second group with 20 patients, one of the left or right upper parathyroid glands was preserved. Kocher's incision surgical technique was used in the subtotal thyroidectomy operations. Preoperative total calcium levels, not showing any difference in the preoperative samples, differed significantly in the postoperative sixth and 24<sup>th</sup> hours ( $p=0.02$  and  $p=0.001$ , respectively). Despite a similar association in the ionized calcium levels at the 24<sup>th</sup> hour ( $p=0.002$ ), the samples taken at the sixth hour did not differ significantly. In the analysis of the correlation between the patients expressing hypocalcemia symptoms and measured ionized calcium levels, there was a significant difference in the samples obtained at the postoperative 24<sup>th</sup> hour ( $p=0.033$ ), with four patients presenting symptoms in group 2 compared to none in group 1. The significant association in the analysis of the correlation between the patients expressing hypocalcemia symptoms and measured ionized calcium levels at the postoperative 24<sup>th</sup> hour suggested that in addition to a careful dissection, the upper parathyroid glands may be preserved bilaterally in order to avoid postoperative hypocalcemia.

**Keywords:** Parathyroid hormone, thyroidectomy, hypocalcemia

### INTRODUCTION

Thyroid surgeries are one of the most common surgeries performed in general surgery clinics. Due to the vulnerable neighboring parathyroid glands, the need for utmost care during surgery to preserve the gland, including the circulatory network, has been suggested for over a century (Halsted and Evans; Mittendorf and McHenry). Although following the Nobel Prize winner Theodor Kocher's work on the surgical technique, the mortality has been decreased to zero, the complication rates which depend on the surgeon's competency are reported to be between 1 and 4% (Fewins et al.). Amongst the complications, post-surgical hypoparathyroidism has been reported to have an incidence between 0.5 % and 33% in thyroidectomy patients, varying significantly (Higgins et al.). Post-surgical hypoparathyroidism (PoSH) occurs as hypocalcemia and may be due to multiple mechanisms, including surgery or thyroid gland related.

In order to search for a clue in this controversial subject, we planned a prospective study to determine the patients at risk for post-surgical hypocalcemia by saving the parathyroid glands and monitoring parathormone (PTH) intraoperatively.

## MATERIAL AND METHODS

The prospective and cross-sectional study was conducted at arasında Dr.Lütfi Kırdar Kartal Training and Research Hospital General Surgery Clinic between October 1, 2003, and September 30, 2004. There were 45 patients with multinodular goiter, euthyroid, healthy, or with mild diseases who were classified as level I or II according to the ASA Physical Status Classification System (ASA), included in the study. Patients with thyroiditis, toxic goiter, thyroid carcinoma, recurrent goiter, and parathyroid diseases were excluded. In addition to the demographics, preoperative and intraoperative, following thyroidectomy, right before closing, PTH levels, the viability of the visualized parathyroid glands, and postoperative total and ionized calcium levels on the 6<sup>th</sup> and 24<sup>th</sup> hour were recorded. The samples for PTH were collected from the peripheral veins. The presence of symptoms such as paresthesia at hands, feet or the perioral regions, Chvostek sign, tetany, muscle cramps, and fatigue at below total calcium level of 8.1mg/dL or ionized calcium level of 4.5mg/dL were accepted as hypocalcemia symptoms. The patients were divided into two groups. In the first group with 25 patients, parathyroid glands were bilaterally preserved. In the second group with 20 patients, one of the left or right upper parathyroid glands was preserved. Kocher's incision surgical technique was used in the subtotal thyroidectomy operations. The methods for PTH, total and ionized calcium were chemiluminescence immunometric assay, colorimetric arsenazo dye, and ion-selective methods and analyzed with EOS880, Hospitex Diagnostics, Italy and Easylyte, Medica, USA, respectively. Informed consent was obtained from the participants, and they were informed about the research, their right to decline to participate and to withdraw.

Statistical Package for the Social Sciences (SPSS) 10.0 software was used in data analysis. In descriptive analysis, mean, standard deviation, median, frequency, percentage, minimum, and maximum values were calculated. Quantitative data were compared by Student t, and the Fisher Exact Qi-square test was used to compare qualitative data. The critical significance was set as 0.05.

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## RESULTS AND DISCUSSION

The mean age of the study population was  $47.73 \pm 8.96$  (28-60 years) with the mean age  $47.76 \pm 8.25$  for group 1 and  $47.70 \pm 10.0$  for group 2, the majority were female (n=39, 86.67%) and there was no statistical significance regarding age and gender between the two groups ( $p > 0.05$ ).

**Table 1. Summary of the results**

		Group 1		Group 2		
		n	%	n	%	<i>p</i>
Gender	Female	22	88	17	85	1.000
	Male	3	12	3	15	
		Mean SD		Mean SD		
Age		47.76±8.25		47.70±10.0		0.983

<b>PTH pg/mL</b>	<b>Preoperative</b>	42.72±11.84		28.15±8.71	<b>0.001</b>	
	<b>Perioperative</b>	109.00±3.87		54.42±19.92	<b>0.001</b>	
<b>Calcium mg/dl</b>	<b>Preoperative</b>	9.13±0.21		9.11±0.15	0.758	
	<b>Postop 6<sup>th</sup> hour</b>	8.34±0.21		8.16±0.26	<b>0.020</b>	
	<b>Postop 24<sup>th</sup> hour</b>	8.68±0.29		8.10±0.42	<b>0.001</b>	
<b>Ionized Calcium mg/dl</b>	<b>Postop 6<sup>th</sup> hour</b>	4.64±0.13		4.58±0.21	0.218	
	<b>Postop 24<sup>th</sup> hour</b>	4.71±0.13		4.54±0.20	<b>0.002</b>	
		<b>Group 1</b>		<b>Group 2</b>		
		<b>n</b>	<b>%</b>	<b>n</b>	<b>%</b>	<b>p</b>
<b>Ionized Calcium hour</b>	<b>6<sup>th</sup> Hypocalcemia symptoms</b>	2	8	3	15	0,642
	<b>No symptoms</b>	23	92	17	85	
<b>Ionized Calcium hour</b>	<b>24<sup>th</sup> Hypocalcemia symptoms</b>	None	0	4	20	0,033
	<b>No symptoms</b>	25	100	16	80	
		<b>Group 1</b>		<b>Group 2</b>		
<b>Ionized calcium</b>		<b>Ionized Ca 6<sup>th</sup> hour</b>	<b>Ionized Ca 24<sup>th</sup> hour</b>	<b>Ionized Ca 6<sup>th</sup> hour</b>	<b>Ionized Ca 24<sup>th</sup> hour</b>	
<b>Perioperative PTH pg/mL</b>		0.264	0.076	0.155	0.295	r
		0.202	0.717	0.514	0.207	p

There was a significant difference in preoperative and perioperative mean PTH levels between the groups, albeit both remaining in the normal levels ( $p=0.001$ ).

Preoperative total calcium levels, not showing any difference in the preoperative samples, differed significantly in the postoperative sixth and 24<sup>th</sup> hours ( $p=0.02$  and  $p=0.001$ , respectively). Despite a

similar association in the ionized calcium levels at the 24<sup>th</sup> hour ( $p=0.002$ ), the samples taken at the sixth hour did not differ significantly.

In the analysis of the correlation between the patients expressing hypocalcemia symptoms and measured ionized calcium levels, there was a significant difference in the samples obtained at the postoperative 24<sup>th</sup> hour ( $p=0,033$ ), with four patients presenting symptoms in group 2 compared to none in group 1.

One of the patients who presented hypocalcemia symptoms received intravenous calcium infusion, and two others were treated by oral calcium and vitamin D. All patients were discharged after total, and ionized calcium levels returned to normal levels.

Knowing that a slight manipulation of parathyroids may disrupt the glands' function and cause a dramatic change in the PTH concentration, we have tried to avoid unnecessary manipulations and visualized and preserved upper parathyroid glands bilaterally in group 1 and preserved either one of the glands in the group 2 (Giovannini et al.). In clinical studies, researchers aim to detect the patients at risk for hypocalcemia and decrease the overall hospitalization duration. Lo et al., in an analysis of 100 patients, measured PTH intraoperatively and monitored parathyroid functions and suggested that hypocalcemic patients had significantly lower quick PTH values following thyroidectomy and a normal or less than 75% decline in quick PTH after thyroidectomy could accurately identify normocalcemic patients during surgery (Lo et al.). Warren et al. reported that the intraoperative PTH level did not correlate with postoperative calcium levels in the parathyroid group and intraoperative PTH levels greater than 15 pg/mL after total or completion thyroidectomy indicate a low risk of postoperative hypocalcemia in a retrospective analysis of 23 thyroidectomy patients (Warren et al.). The analyses in our study failed to produce a specific limit for PTH to determine the patients at risk for postoperative hypocalcemia. Even though there were no differences in the patients presenting hypocalcemia symptoms in the first sixth-hours between the groups, there was a significant difference in the 24<sup>th</sup>-hour analysis between the groups ( $p=0,033$ ). The sensitivity of PTH predicting calcium levels is reported to be between 89 and 97% in different studies (Garner and Leight; Irvin and Deriso). Postoperative follow-up of plasma calcium levels, a commonly used method for patients for risk of hypocalcemia, which in many cases resulted in prolonged hospital stay was reported as inadequate for the first 24 hours following surgery (Adams et al.). Similarly, in a study analyzing 64 cases undergoing curative parathyroidectomy, calcium measurement in the early postoperative period was found of little value in predicting the onset of hypocalcemic symptoms (Wong et al.). Moreover, the decrease in calcium levels in the first 24 hours was reported to be related to other conditions as well; however, PTH levels remain stable in other surgeries (Demeester-Mirkin et al.). In patients with low TSH levels and females, it was reported that that hypocalcemia was seen more frequently compared to other patients (Bove et al.). In our study, there were no differences detected regarding gender. The small sample size of the study may be a factor in addition to the vast number of females compared to the overall study population (female  $n=39$ , 86.67%).

## CONCLUSION

In our study, even though we have not been able to detect a specific limit for PTH levels to determine the patients at risk for postoperative hypocalcemia, the significant association in the analysis of the correlation between the patients expressing hypocalcemia symptoms and measured ionized calcium levels at the postoperative 24<sup>th</sup> hour suggested that in addition to a careful dissection the upper parathyroid glands may be preserved bilaterally in order to avoid postoperative hypocalcemia. Future studies with a greater number of study populations are required to provide accurate results to verify our results.

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