Predictors of Outcomes of Parathyroidectomy for Primary Hyperparathyroidism: A Retrospective Observational Study

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Introduction: Parathyroidectomy (PTX) is highly effective in treating PHPT. It leads to decreased serum PTH and equalizes calcium/phosphate homeostasis, reduces inflammatory-cardiovascular risk, and improves diastolic and systolic functions within the first-month post-surgery. Moreover, PTX significantly decreased the prevalence of anemia in PHPT patients six months after surgery. Furthermore, PHPT worsens sleeping patterns, but PTX improved the patient's mood and sleep patterns with more deep sleep and fewer nighttime awakenings.

Aim of work: This retrospective study aimed to define the surgical and biochemical outcomes of parathyroidectomy for patients with primary hyperparathyroidism (PHPT) and to identify potential predictors for these outcomes.

Patients and methods: Twenty-nine files of patients who underwent parathyroidectomy for PHPT were analyzed. Preoperative demographic, clinical, radiologic, and biochemical data were collected. Intraoperative (IO) and postoperative (PO) data were gathered. The percentage of PO changes in serum parathormone (PTH) and calcium and the frequency of PO normalization of PTH were evaluated.

Results: Six files (20.8%) indicated normocalcemia, while 23 showed hypercalcemia. Nine patients had recurrent urolithiasis with significantly higher frequency among normocalcemic patients. Postoperative serum PTH levels decreased significantly, and all patients became normocalcemic. PO serum PTH and calcium levels were reduced by ≥50% in 72.4% and by ≥25% in 62.1% of samples, respectively with significant differences in favor of hypercalcemics. Patients were managed as one-day cases after assurance of competence in hemodynamic and respiratory functions. PO complications were identified in 5 files (17.2%) and superficial wound infection is the commonest. The correlation analysis detected a positive significant relationship between preoperative parathyroid volume and preoperative serum PTH and calcium levels, normocalcemia, PO percentage of change in serum PTH and calcium, and the normalization of serum PTH.

Conclusion: This retrospective data analysis confirmed the safety and effectiveness of parathyroidectomy for PHPT patients and supports its feasibility as a one-day procedure. Preoperative assessment of gland volume is crucial for surgical planning and aids in predicting PO biochemical outcomes. Preoperative normocalcemia did not influence surgical outcomes, despite being associated with a higher incidence of urolithiasis.

Key words: Primary hyperparathyroidism, parathyroidectomy, parathyroid gland volume, parathormone.

Introduction

Primary hyperparathyroidism (PHPT) is a significant endocrine disorder and represents one of the common presentations of multiple endocrine neoplasia type 1.[1] Solitary hyperfunctioning parathyroid adenomas constitute the majority of PHPT cases, while multiglandular adenomas account for a smaller fraction. Rarely, PHPT is attributed to parathyroid carcinoma.[2]

Hyperparathyroidism is characterized by excessive secretion of parathyroid hormone (PTH) that leads to increased bone turnover favoring bone resorption,[3] resulting in deregulated calcium and phosphate homeostasis towards hypercalcemia and even persistent hypercalcemia.[4] Furthermore, PHPT is also associated with cardiovascular manifestations, including hypertension, left ventricular hypertrophy, diastolic and systolic dysfunctions, and myocardial and valvular calcifications, along with increased mortality rates.[5]

Parathyroidectomy (PTX) is highly effective in treating PHPT. It leads to decreased serum PTH and equalizes calcium/phosphate homeostasis,[6] reduces inflammatory-cardiovascular risk,[7] and improves diastolic and systolic functions within the first-month post-surgery.[5] Moreover, PTX significantly decreased the prevalence of anemia in PHPT patients six months after surgery.[8] Furthermore, PHPT worsens sleeping patterns, but PTX improved the patient's mood and sleep patterns with more deep sleep and fewer nighttime awakenings.[9]

Aim of work

The aforementioned literature assured the beneficial outcomes of PTX as management for PHPT however, no surgery was immune to complications. This study tried to define the surgical and biochemical outcomes of PTX for cases had PHPT who underwent PTX from Sep 2020 to Dec 2024 and as a trial to define the possible preoperative and intraoperative (IO) predictors for these.

Patients and methods

Retrospective multicenter observational study.

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Setting

Departments of General and Oncology Surgery, Faculty of Medicine, New Valley, Benha and Assiut Universities, in collaboration with some private surgery centers, Cairo and Al-Mansoura, Egypt.

Study population

Files of cases with PHPT who underwent PTX were explored for data collection.

Ethical consideration

The study protocol was approved by the Ethics Committee, Faculty of Medicine, New Valley University by MNVREC approval number: 20250530009..

Inclusion criteria

The study included files of patients older than 18 years who had PHPT and were well investigated, underwent PTX, and continued postoperative (PO) follow-up for at least 30 days.

Exclusion criteria

The files of patients who had secondary hyperparathyroidism, other lesions that required surgery, missing the required data, and files of patients who missed during follow-up were excluded from this analysis.

The extracted data: Preoperative data including age, gender, body mass index (BMI), the ASA grade, presence of associated medical disorders, the history of previous surgeries, and the presenting manifestations

1. Preoperative radiological, and lab findings especially serum PTH, calcium, and phosphate.
2. Operative procedure, operative time, amount of blood loss, the frequency of intraoperative complications.
3. PO surgical complications including wound-related complications; namely, superficial and deep surgical site infection, wound disruption, organ space infection, deep venous thrombosis, or any surgical complications.
4. The incidence of PO medical morbidities including the development of renal insufficiency, stroke/cardiovascular accident, myocardial infarction, cardiac arrest, sepsis, septic shock, pneumonia, or pulmonary embolism, and urinary tract infection, PO mortality.
5. Follow-up data included the estimated serum levels of PTH, calcium, and phosphate.

Study endpoint

1. The primary endpoint is the effect of PTX on the levels of the estimated lab parameters
2. The secondary endpoint is defining the preoperative predictors for PO normalization of serum PTH and Ca levels estimated at the end of follow-up.

Statistical analysis

The retrieved data were presented as mean, standard deviation (SD), numbers, and percentages and were analyzed using the Unpaired t-test and the Chi-square test to assess the significance of differences between normocalcemic and hypercalcemic patients. The percentages of change versus the preoperative lab data were calculated as the preoperative serum PTH and calcium levels minus the PO levels divided by the preoperative levels and the resultant was multiplied by 100 to get the percentage. The relations between preoperative data and PO outcomes were evaluated using Pearsons' Correlation analysis and were expressed as the Pearsons' correlation coefficient "r". Multivariate Regression analysis and the Receiver Operating Characteristic (ROC) analysis were applied to define the predictors of PO outcomes among the preoperative data. Statistical analyses were conveyed by the IBM® SPSS® Statistics software (Ver. 26, 2019; IBM Corporation; Armonk, USA). The significance of the analysis was evaluated at the cutoff point of P less than 0.05.

Results

Nine files were excluded, four had some missing data, three were for patients who missed during follow-up, two files were for patients who had secondary hyperparathyroidism, and 29 files fulfilling the inclusion criteria were included in this analysis. Preoperative serum calcium levels were in the normal range in 6 files that were categorized as normocalcemic patients (NPHPT group), while the preoperative calcium levels in 23 files were higher than the upper normal level, these files were categorized as hypercalcemic PHPT patients (HPHPT group) as shown in **(Fig. 1).**

Twenty patients (68.9%) were younger than 40 years with a mean age of 36 (±8.6) and the female gender was predominant (69%). The majority of patients were either overweight (44.8%) or obese grade I (41.4%), and only 4 patients (13.8 %) had average weight with a mean BMI of 29.8 (±3.3) kg/m2. Twenty-two patients (75.9%) were non-smokers, while 7 patients (24.1%) were either current (10.3%) or ex-smokers (13.8%). Demographic data of patients categorized according to the preoperative serum calcium levels showed no significant intergroup differences **(Table 1).**

Three patients (10.3%) were asymptomatic, while 26 patients (89.7%) presented with varied

manifestations of PHPT. Sixteen patients (55.2%) had previous recurrent urolithiasis (31%) or fractures (24.1%). Six patients (20.8%) complained of fatigue and 4 patients (13.8%) complained of bone ache. Three patients (10.3%) had controlled diabetes and five (17.2%) patients were hypertensive patients but these patients were controlled. Twenty-four patients (82.8%) had previous surgeries, 8 patients (27.6%) had orthopedic surgeries, 6 patients (20.8%) had urological surgeries and 10 women (34.4%) had previous cesarean section. According to the American Society of Anesthesiologists (ASA) preoperative grading, only 3 (10.3%) patients were of ASA grade II, and 26 patients (89.7%) were of ASA grade I. The differences in the frequencies according to the preoperative clinical data were insignificant between normocalcemic and hypercalcemic patients **(Table 2).** However, the frequency of urolithiasis was significantly (P=0.034) higher among normocalcemic than hypercalcemic patients.

Preoperative ultrasonographic assessment of the parathyroid gland volume (PGV) showed that 18 patients (62%) had PGV ranging between 1 and 1.99 ml, 5 patients (17.2%) had glandular volume of ≥2 ml, and 6 patients (20.8%) had PGV of <1 ml. All patients with PGV ≥2 ml was hypercalcemic, and the occurrence of gland volume in the range of 1-1.99 ml was insignificantly (P=0.099) higher among hypercalcemic patients. The mean value of PGV was significantly (P=0.014) lower in normocalcemic compared to hypercalcemic patients.

All patients showed serum PTH levels higher than the documented normal PTH level; i.e. 10-65 pg/ml. The estimated preoperative serum PTH levels were significantly (P=0.026) higher in HPHPT than in NPHPT. However, patients' frequency according to the preoperative serum PTH showed an insignificant (P=0.190) difference between HPHPT and NPHPT patients. Preoperative serum calcium levels were significantly (P=0.0004) lower in NPHPT than in HPHPT. On the contrary, 18 patients (62.1%) had hypophosphatemia with a significantly (P=0.01) higher frequency of hypophosphatemia among HPHPT patients **(Table 3)**.

The mean operative time was 92±14.4 minutes and it was <90 min in 14 patients (48.3%), while was >90 min in 15 patients (51.7%). The mean volume of intraoperative blood loss was 170±24.1 ml. All patients were managed as a day-case after assurance of the absence of hemodynamic or respiratory complications with a mean duration of PO hospital stay of 13±4.2 hours. Seventeen patients (58.6%) were home discharged within less than 12 hours and 12 patients (41.4%) stayed in the hospital for 12-24 hours. Five patients (17.2%) developed PO complications and these patients stayed in the hospital for a longer duration but were discharged after assurance of compensation. One patient (3.4%) had bleeding that necessitated wound exploration and the detected minor bleeders were managed with either diathermy coagulation or by application of coagulant foam piece. Three patients (10.3%) developed superficial wound infection during follow-up visits and were managed conservatively till complete resolution. One patient (3.4%) developed vocal cord injury and laryngoscopic examination under intravenous sedation detected minor unilateral cord weak movement indicating only partial injury without affecting respiration but there was mild affection of phonation that resolved during follow-up **(Table 4).**

Postoperative serum PTH levels decreased significantly (P<0.001) compared to preoperative levels. Moreover, PO serum PTH levels were in the normal range in 20 patients (69%) and were in the range of 65-100 pg/ml in samples of 9 patients (31%) with a significant (P<0.001) difference compared to the preoperative frequency according to serum PTH levels.

No patient remained hypercalcemic postoperatively, and serum calcium levels decreased to the normal range in samples from 27 patients (93.1%), but two patients (6.9%) developed hypocalcemia. The frequency of patients according to serum calcium showed a significant (P<0.001) difference compared to preoperative frequency. Further, the mean PO serum calcium level was significantly (P=0.0001) lower than the preoperative level.

The percentage of decrease in PTH was <50% in 8 patients (27.6%) and was ≥50% in 21 patients (72.4%) with an average percentage of decrease of 56.45 (±9.5). Similarly, the extent of the decrease in serum calcium was <25% in 11 patients (37.9%) and ≥25% in 18 patients (62.1%) with an average percentage of decrease of 22.48 (±11.7%) as shown in **(Table 5).**

The percentage of decrease in serum PTH in PO samples of HPHPT (59.1±7.6) was significantly (P<0.001) higher compared to the percentage of decrease in PO samples of NPHPT (26.4±9.5%). Similarly, the percentage of decrease in PO serum calcium was significantly (P<0.001) higher in samples of HPHPT (46.2±8.5) than in samples of NPHPT (7.5±4.8).

The preoperative PGV showed positive significant correlations with preoperative serum PTH and calcium levels and the presence of normocalcemia. Also, the preoperative PGV showed a positive significant correlation with the % of PO change in serum PTH and calcium, and with the PO normalization of serum PTH. However, a positive insignificant correlation was found between the preoperative PGV and the frequency of PO complications including hypocalcemia **(Table 6).**

Regression analysis for the correlated variates defined high preoperative PGV as a negative significant (β=-0.563, P=0.004) and the percentage of change in serum PTH as a positive significant (β=0.394, P=0.034) predictor for normalization of PTH levels at the end of follow-up. The percentage of PO change in serum calcium was a positive insignificant (β=0.274, P=0.096) predictor for PO normalization of serum PTH. However, ROC curve analysis denied the significance of any of these variates as a predictor for PO normalization or as a predictor for PO complications including hypocalcemia **(Table 7, Fig. 2).**

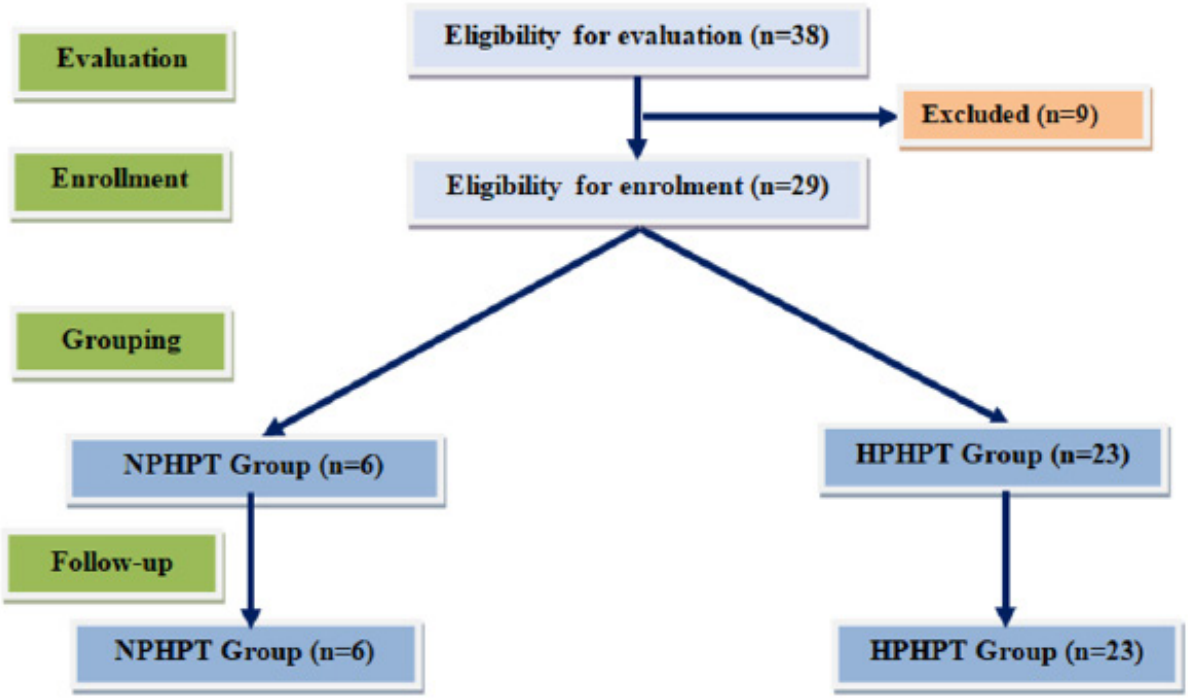

Fig 1: Flowchart of the analyzed files.

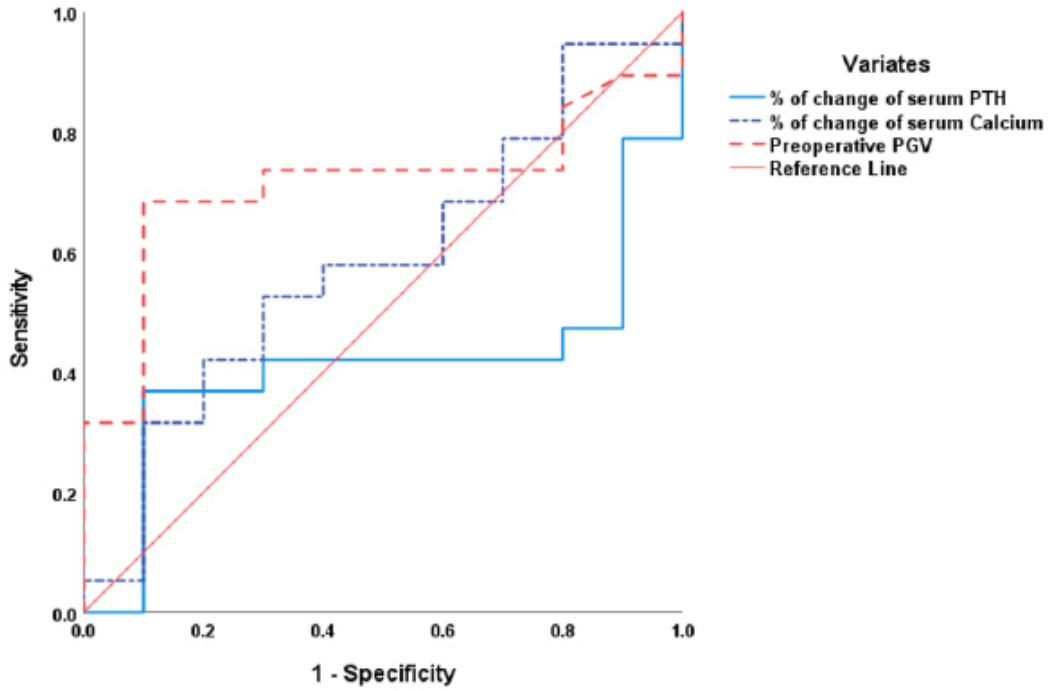

Fig 2: ROC curve for the studied preoperative PGV and the percentage of change of serum PTH and calcium as predictors for PO normalization of serum PTH.

Table 1: Patients' demographic data

Data Group		Total (n=29)	NPHPT (n=6)	HPHPT (n=23)	P value
Age (Years)	<30	7 (24.1%)	2 (33.3%)	5 (21.7%)	0.735
	30-39	13 (44.8%)	2 (33.3%)	11 (47.9%)	
	40-49	7 (24.1%)	2 (33.3%)	5 (21.7%)	
	≥50	2 (6.9%)	0	2 (8.7%)	
	Average (±SD)	36 (±8.6)	34.2 (±7.9)	36.5 (±8.9)	0.570
Gender	Males	9 (31%)	1 (16.7%)	8 (34.8%)	0.393
	Females	20 (69%)	5 (83.3%)	15 (65.2%)	
Body mass index (kg/m²)	Average weight	4 (13.8%)	2 (33.3%)	2 (8.7%)	0.196
	Overweight	13 (44.8%)	3 (50%)	10 (43.5%)	
	Obese	12 (41.4%)	1 (16.7%)	11 (47.8%)	
	Average (±SD)	29.8±3.3	27.4 (±3)	30.4 (±3.4)	0.054
Smoking	Current	3 (10.3%)	1 (16.7%)	2 (8.7%)	0.499
	Ex-smokers	4 (13.8%)	0	4 (17.4%)	
	Non-smokers	22 (75.9%)	5 (83.3%)	17 (73.9%)	

Table 2: Patients' preoperative clinical data

Data Group		Total (n=29)	N-PHPT (n=6)	H-PHPT (n=23)	P value
Manifestations of PHPT	Asymptomatic	3 (10.3%)	0	3 (13%)	0.214
	Previous urolithiasis	9 (31%)	4 (66.6%)	5 (21.7%)	
	Previous fracture	7 (24.1%)	0	7 (30.4%)	
	Fatigue	6 (20.8%)	1 (16.7%)	5 (21.7%)	
	Bone ache	4 (13.8%)	1 (16.7%)	3 (13%)	
Comorbidities	No	21 (72.5%)	3 (50%)	18 (78.3%)	0.377
	Diabetes mellitus	3 (10.3%)	1 (16.7%)	2 (8.7%)	
	Hypertension	5 (17.2%)	2 (33.3%)	3 (13%)	
Frequency of previous surgeries	No	5 (17.2%)	5 (83.3%)	19 (82.6%)	0.850
	Yes	24 (82.8%)	1 (16.7%)	4 (17.4%)	
Type of surgeries	Orthopedic	8 (27.6%)	1 (16.7%)	7 (13%)	0.126
	Urological	6 (20.8%)	3 (50%)	3 (30.4%)	
	Cesarean section	10 (34.4%)	1 (16.7%)	9 (39.1%)	
ASA grade	Grade I	26 (89.%)	5 (83.3%)	21 (91.3%)	0.568
	Grade II	3 (10.3%)	1 (16.7%)	2 (8.7%)	

Table 3: Preoperative investigations

Items Group			Total (n=29)	NPHPT (n=6)	HPHPT (n=23)	P value
Radiological volume assessment	<1 (ml)		6 (20.8%)	3 (50%)	3 (13%)	0.099
	1-1.99 (ml)		18 (62%)	3 (50%)	15 (65.2%)	
	≥2 (ml)		5 (17.2%)	0	5 (21.8%)	
	Average (±SD)		1.56 (±0.46)	1.17 (±0.4)	1.67 (±0.42)	0.014
Lab investigations	Serum PTH (pg/ml)	<100	6 (20.7%)	3 (50%)	4 (17.4%)	0.190
		100-199	19 (65.5%)	3 (50%)	15 (65.2%)	
		>200	4 (13.8%)	0	4 (17.4%)	
		Average (±SD)	136.2 (±43.6)	101.55 (±26.9)	145.2 (±42.9)	0.026
	Serum calcium (mg/dl)	Normocalcemia	6 (20.7%)	6 (100%)	0	<0.001
		Hypercalcemia	23 (79.3%)	0	23 (100%)	
		Average (±SD)	12.41 (±2.5)	9.13 (±0.48)	13.27 (±2.04)	0.0004
	Serum phosphate (mg/ml)	Normal	11 (37.9%)	5 (83.3%)	6 (26.1%)	0.01
		Hypophosphatemia	18 (62.1%)	1 (16.7%)	17 (73.9%)	
		Average (±SD)	2.26 (±0.83)	3.32 (±0.67)	1.98 (±0.62)	0.0001

Table 4: Operative and PO data

Data		Findings
Operative time (min)	60-90	14 (48.3%)
	>90	15 (51.7%)
	Average (±SD)	92 (±14.4)
Intraoperative blood loss (ml)	Average (±SD)	170 (±24.1)
PO length of hospital stays (h)	<12	17 (58.6%)
	12-24	12 (41.4%)
	Average (±SD)	13 (±4.2)
Frequency of PO complications	Bleeding necessitated reoperation	1 (3.4%)
	Vocal cord injury	1 (3.4%)
	Wound infection	3 (10.3%)

Table 5: The estimated PO serum levels of PTH and calcium and its relation to the preoperative levels

Parameters	Variables			Preoperative	PO	P
Serum PTH (pg/ml)	Average (±SD)			136 (±43.8)	59 (±20.1)	<0.001
	Frequency	Normal (<65)		0	20 (69%)	<0.001
		65-100		6 (20.8%)	9 (31%)	
		100-199		19 (65.5%)	0	
		>200		4 (13.7%)	0	
	Percentage of change	Average (±SD)			56.45 (±9.5)	
		Frequency	<50		8 (27.6%)	
			≥50		21 (72.4%)	
Serum calcium (mg/l)	Average (±SD)			12.41 (±3.34)	9.35 (±1.82)	0.0001
	Frequency	Hypocalcemia		0	2 (6.9%)	<0.001
		Normocalcemia		6 (20.7%)	27 (93.1%)	
		Hypercalcemia		23 (79.3%)	0	
	Percentage of change	Frequency	<25		11 (37.9%)	
			≥25		18 (62.1%)	
		Average (±SD)			22.48 (±11.7)	

Table 6: correlation between preoperative PGV and serum PTH and Calcium levels and PO variables

Variates		R	P
Preoperative	serum PTH	0.527	0.003
	serum calcium	0.385	0.039
	Normocalcemia	0.426	0.021
% of PO change in serum	PTH	0.373	0.046
	Calcium	0.380	0.042
PO normalization of serum PTH		0.416	0.025
PO complications		0.278	0.145

Table 7: The ROC curve analysis for the predictors for PO normalization of serum PTH

Variates	AUC	Std. error	P	95% CI
Preoperative parathyroid gland volume	0.713	0.098	0.063	0.521-0.906
% of PO change in serum PTH	0.411	0.109	0.435	0.196-0.525
% of PO change in serum calcium	0.584	0.111	0.463	0.366-0.803

Discussion

The current retrospective analytical study identified several interesting points; the estimated preoperative serum calcium revealed 6 normocalcemic PHPT patients (NPHPT group), resulting in a frequency of NPHPT of 20.8% among patients with PHPT. Similarly, Yankova et al.[10] and Balachandra et al.[11] retrospectively found frequencies of normocalcemia at 15.2% and 19.3%, respectively, among patients with PHPT, while Halimi et al.[12] indicated a frequency of NPHPT of 40%. This discrepancy in the detected frequency of normocalcemia among patients with PHPT may be attributed to racial differences and variations in vitamin D levels where the frequency of NPHPT was documented to be significantly higher in patients with hypovitaminosis D.[13,14]

Verification of clinical presentation defined a significantly (P=0.034) higher frequency of urolithiasis among normocalcemic than hypercalcemic patients (66.6% vs. 21.7%). These findings coincide with Xie et al.[15] who detected renal calculi in 33.3% of PHPT patients, and Victor et al.[16] who identified renal calcifications in 26.5% of patients with NPHPT and concluded that occult renal calcifications are common in NPHPT and are associated with increased serum PTH and 24-hour urinary calcium. Also, Gheorghe et al.[17] recommended that more extensive screening in patients with kidney stones might lead to the discovery of NPHPT, a more recent phenotype of PHPT. Moreover, Balachandra et al.[11] reported that normocalcemic patients were more likely to report preoperative symptoms of kidney stones compared to patients with hypercalcemia (53.3% vs. 30.4%, p<0.001).

Further, three patients were free of symptoms related to PHPT, which was discovered during routine investigations, for a frequency of asymptomatic patients of 10.3%. In line with this finding, Bhattacharya et al.[18] documented that asymptomatic HPT constitutes 15.8% of all PHPT.

Twenty-six patients presented with variant symptoms including fatigue, bone ache, and previous bone fractures that were more common among HPHPT than NPHPT but with insignificant differences. Per these data, Xie et al.[15] found that the main clinical manifestations of PHPT were bone pain, kidney stones, nausea, and fatigue. Also, Montgomery et al.[19] concluded that patients with PHPT who report fatigue present with a more complex disease with a higher incidence of multiglandular disease and NPHPT. Recently, Balachandra et al.[11] detected no significant difference in preoperative fatigue, bone pain, or fractures between HPHPT and NPHPT patients.

Postoperative serum PTH levels decreased significantly compared to preoperative levels, and no patient remained hypercalcemic; serum calcium levels returned to the normal range in 93.1% of samples. Additionally, PO serum PTH and calcium levels were reduced by ≥50% in 72.4% and by ≥25% in 62.1% of samples. In line with these data, Joseau et al.[20] and Frey et al.[21] reported a cure rate as judged by PO serum levels of PTH and calcium of 96.2% and 95%, respectively. Also, Dhingani et al.[22] detected an average decrease in serum PTH and calcium levels of 69.9% and 20.6%, respectively after the excision of the parathyroid adenoma and all patients were normocalcemic on follow-up. Additionally, Klein et al.[23] reported that 90% of patients who were operated on were normocalcemic at the end of follow-up. Recently, Wu et al.[24] found serum calcium and PTH levels were significantly lower immediately after treatment than at baseline.

The percentage of change in PO serum PTH and Ca levels was more pronounced in hypercalcemic than normocalcemic patients with significant intergroup differences. Similarly, Balachandra et al.[11] detected

significantly less PO cure among normocalcemic than hypercalcemic patients, and serum PTH was still high at 6-month PO in these normocalcemic patients. On the contrary, Osorio-Silla et al.[25] reported similar benefits of parathyroidectomy in terms of bone improvement for normocalcemic and hypercalcemic PHPT.

Correlation analysis identified a positive significant relationship between preoperative parathyroid gland volume (PGV) and preoperative serum PTH and calcium levels, the presence of normocalcemia, the percentage of postoperative change in serum PTH and calcium, and the postoperative normalization of serum PTH. Regression analysis of the correlated variables indicated that high preoperative PGV was a negatively significant predictor, while the percentage of change in serum PTH was a positively significant predictor for the normalization of PTH levels at the end of follow-up. In contrast, the relationship between the percentage of postoperative change in serum calcium and the postoperative normalization of serum PTH was a positive insignificant predictor. Furthermore, the ROC curve analysis ruled out the significance of any of these variables as predictors for postoperative normalization of serum PTH or postoperative complications, including hypocalcemia.

In line with these findings, Kilinç et al.[26] found higher parathyroid adenoma size is associated with higher preoperative calcium and PTH. Also, Huang et al.[27] reported a positive correlation between lesion volume and preoperative serum calcium, PTH, and alkaline phosphatase.

Nakai et al.[28] suggested that the preoperative serum intact PTH value is associated with the tumor volume of the parathyroid lesion responsible for PHPT, which in turn relates to postoperative serum PTH. Thus, estimating the tumor size would provide data to plan appropriate surgical strategies. Also, Liu et al.[29] found that preoperative PTH level, maximum tumor volume, and number of glands ablated are predictors for treatment failure. Additionally, Fiore et al.[30] found a parathyroid gland volume >2 ml was associated with higher preoperative PTH, hypercalcemia and hypophosphatemia, and hypovitaminosis D. Still, gland volume does not seem to impact the clinical manifestations or the incidence of perioperative complications. Moreover, Kwon et al.[31] reported that a small volume of the parathyroid tumor was significantly associated with a higher rate of false negatives using technetium-99m-sestamibi single-photon emission computed tomography and may affect surgical outcomes.

All cases were managed as one-day cases with a mean duration of hospital stay of 13 hour. In support of such a policy, Annesi et al.[32] documented the safety of same-day parathyroidectomies and documented that complications such as PO hematoma or hypocalcemia were not mitigated by increased LOS or inpatient surgery.

The file revision identified five instances of PO complications, accounting for 17.2%. One case resulted in bleeding that necessitated revision surgery but was managed without extensive manipulation. Another case exhibited partial cord hemiparesis, which affected phonation but not breathing, and resolved spontaneously. Three cases experienced superficial wound infections that were managed conservatively. Similarly, Wu et al,[24] retrospectively, reported an incidence of transient hoarseness after radiofrequency ablation for the management of PHPT and found it had resolved during follow-up. A meta-analysis detected incidence rates of 27.9%, 7.5%, and 20.0% for total, major, and minor complications, respectively.[33]

Fortunately, no one of the enrolled patients had a huge parathyroid gland and no patient developed the criteria diagnostic of hungry bone syndrome (HBS) during the immediate follow-up period. Further, PO serum PTH returned to the normal range (10-65 pg/ml) in 69% and was in the range of 65-100 pg/ml in 31% of patients, so no patient had a severe drop in PTH and only two patients had PO hypocalcemia. In line with this explanation, previous studies documented early PO appearance of manifestations of HBS that was attributed to rapid, profound, and prolonged hypocalcemia associated with hypophosphatemia and hypomagnesemia, and is exacerbated by suppressed parathyroid hormone (PTH) levels, which follows parathyroidectomy in patients with severe primary hyperparathyroidism (PHPT) and preoperative high bone turnover.[34,35]

Conclusion

This retrospective data analysis of patients who underwent parathyroidectomy for PHPT confirmed its safety and effectiveness. Additionally, the data obtained documented the feasibility of managing such cases as one-day procedures without imposing extra morbidities. Preoperative assessment of gland volume is essential for surgical planning and allows for the prediction of biochemical outcomes following parathyroidectomy. Preoperative normocalcemia did not affect surgical outcomes, despite being linked to a higher incidence of urolithiasis. Patients presenting with fatigue, bone ache, and urolithiasis should be thoroughly investigated for HPT.

Limitations

The small sample size is one of the study's limitations. The estimation of serum levels of vitamin D and its variation due to parathyroidectomy is missing.

Recommendations

A wider scale study including large volume hospitals is mandatory to establish the obtained results. Also, prospective studies were required for proper confirmation of the data obtained retrospectively.

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