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Original Article

Comparison of Preoperative and Postoperative Serum Calcium and Parathyroid Hormone Levels

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Abstract:

Introduction: *Thyroidectomy is a preferred operation for various thyroid disorders in various forms and extent. Postoperative hypocalcaemia and hypoparathyroidism are the common complications. So measuring calcium and PTH level pre and postoperatively is important in planning management of thyroid disease. It can predict the risk of a surgery.*

Aim of the study: *The Aim of the study is to compare serum calcium and parathyroid hormone levels in preoperative and postoperative studies.*

Methods: *A prospective observational study was conducted in the Head and Neck Surgery Division of the Department of Otolaryngology-Head & Neck Surgery, BSMMU, Shahbag, Dhaka from August 2022 to January 2023. 35 patients underwent parathyroidectomy. The data was collected and analyzed using SPSS 26.0 (Statistical Package for the Social Science). The statistical significance was set to p<0.05.*

Result: *In this series, the majority of the patients (19, 54.29%) were in the 58 to 68 years age group. Among them, the majority (71.0%) of the patients were female. It was observed that the majority (54%) of the study subjects were symptomatic and 46% of the patients were asymptomatic. Here, 3(8.5%), 6(17.1%), and 2 (5.7%) patients presented with osteitis fibrosa cystica, nephrolithiasis, and neuropsychiatric syndrome respectively. Moreover, 14(40.0%) patients had muscle weakness, and 18 (51.0%) subjects presented with fatigue. In this study, parathyroid adenoma was found in 85.75% and 74.90% of patients in symptomatic and asymptomatic patients respectively. Preoperative PTH and calcium levels, and postoperative calcium levels in SPHPT and ASPHPT were found statistically significant.*

Conclusion*: This study provides evidence supporting the enduring advantages of parathyroidectomy in individuals with primary hyperparathyroidism (PHPT). The observed reduction in pre-operative symptoms seems to be a significant factor contributing to the enhanced quality of life (QOL) experienced by these patients over the long term.*

Keywords*: Primary Hyperparathyroidism, Parathyroidectomy, Hypercalcemia, Surgical outcome.*

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Introduction:

Primary hyperparathyroidism (PHPT) is a frequently common endocrine disorder, characterized by a prevalence ranging from 0.1% to 1%. It exhibits a notable inclination toward affecting females and is strongly associated with the aging process.[1,2] In contemporary times, the identification of primary hyperparathyroidism (PHPT) frequently occurs incidentally during routine biochemical testing. In its manifestation, PHPT is often categorized as asymptomatic, distinguishing it from more severe cases that present with classical bone, renal, and neuropsychiatric manifestations. Despite being labeled as asymptomatic, many individuals with relatively mild hypercalcemia may still experience symptoms potentially linked to PHPT. However, the extent to which these symptoms align with biochemical markers of severity and their reversibility with surgical intervention remains uncertain.[3]A recent study suggests that a substantial portion of PHPT cases may go undiagnosed. The study indicates that only 31% of hypercalcemic patients had their PTH levels measured, highlighting a potential under-recognition of PHPT in clinical assessments.[4] In recent times, there has been a growing acknowledgment of the normo-calcemic variant of PHPT. However, it's essential to note that this aspect falls outside the scope of our current investigation.[5] Elevated levels of parathyroid hormone in primary hyper-parathyroidism contribute to bone demineralization, heightening the risk of fractures.[6] Moreover, this condition is characterized by elevated calcium levels in the urine, indeed escalating the risk of developing kidney and urinary tract stones. The excess Ca in the urine can form crystals, which may then aggregate and form stones within the kidneys or other parts of the urinary system.[7] Elevated Calcium levels and parathyroid hormone in the context of primary hyperparathyroidism have been associated with certain cardiovascular complications.

The relationship between primary hyperparathyroidism and atherosclerosis, as well as an increased risk of acute myocardial infarction (heart attack), has been noted in some studies.[8,9] Arterial hypertension, not showing regression with surgery, has been reported in cases of primary hyperpara-thyroidism. Additionally, individuals with this condition may experience stomach and duodenal ulcers, as well as episodes of acute and chronic pancreatitis. The mechanisms linking primary hyperparathyroidism to these conditions are complex and may involve various physiological factors related to the elevated levels of parathyroid hormone and Ca.[10,11] The clinical representation of primary hyperparathyroidism (PHPT) encompasses three distinct phenotypes. These include target organ involvement affecting the renal and skeletal systems, mild asymptomatic hypercalcemia, and more recent recognition of high PTH levels within consistently normal albumin-corrected and ionized serum calcium values.

The prevalence of these phenotypes in a given country can be triggered by several factors. The extent to which biochemical screening is applied, the importance of routine check-up of PTH levels in the evaluation of low bone density or osteoporosis and vitamin D deficiency by medical centers or practitioners can all contribute to the predominance of a particular clinical presentation in a population. Understanding these factors is crucial for tailoring diagnostic and therapeutic approaches to the specific characteristics and needs of individuals with primary

hyperparathyroidism.[12] In recent years, surgery has become a more prevalent treatment approach for primary hyperparathyroidism. Low bone mineral density has supplanted renal calculi as the most common indication for surgical intervention in this case. This shift reflects an evolving understanding of the disease and its manifestations, emphasizing the importance of addressing bone health concerns in addition to managing complications like kidney stones. The decision for surgery is often taken based on a combination of factors, including the severity of symptoms, calcium levels and parathyroid hormone, and the presence of complications related to bone health and other organs.[13]

The benefits of surgical intervention for individuals with symptomatic PHPT are widely acknowledged. There is a consensus that parathyroidectomy is warranted in patients exhibiting the classic symptoms associated with hyperparathyroidism. The aim of the current study is to compare serum calcium and parathyroid hormone levels in preoperative and postoperative studies.

Methods:

This prospective cross-sectional study was conducted from August 2022 to January 2023 in the Head and Neck Surgery division of the Department of Otolaryngology-Head & Neck Surgery and Endocrine Surgery at Bangabandhu Sheikh Mujib Medical University (BSMMU), Shahbag, Dhaka. After receiving Institutional Review Board approval, 35 patients were diagnosed with primary, persistent, or recurrent hyperparathyroidism, who met inclusion criteria and underwent parathyroidectomy. Patients with secondary, tertiary, or familial hyperparathyroidism were excluded. Data were collected and Statistical analysis, including repetitive measures and descriptive statistics, was performed using SPSS 26.0, with a significance level of $p<0.05$.

Results:

Following are the results in tabulated form with figures.

Table-I:
Age distribution of the study subjects (N=35)

Age (years)	n=35	Percentage (%)
25-35	1	2.85
36-46	1	2.85
47-57	3	8.57
58-68	19	54.29
≥69	11	31.42
Mean ±SD	63.10± 15.50	

In this series, the majority of the patients (19, 54.29%) were in the 58 to 68 years age group, followed by, (11, 31.42%) were in ≥69 years age group.

It was observed that the majority (71.0%) of the patients were female. [Figure 4.1]

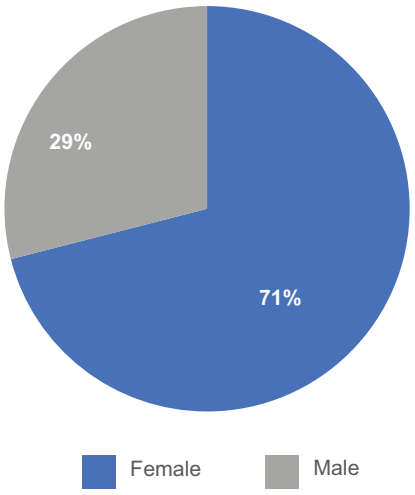

Figure 1: *Sex distribution of the respondents*

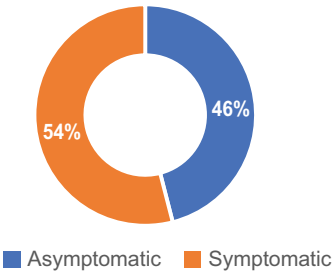

Figure 2: *Distribution of patients according to clinical presentation*

It was observed that the majority (54%) of the study subjects were symptomatic. 46% of the patients did not show clinical symptoms.

In this series, 3 (8.5%), 6 (17.1%), and 2 (5.7%) patients presented with osteitis fibrosa cystica, nephrolithiasis, and neuropsychiatric syndrome respectively. Moreover, 14 (40.0%) patients had muscle weakness, and 18 (51.0%) subjects presented with fatigue.

In this study, parathyroid adenoma was found in 85.75% and 74.28% of patients in symptomatic and asymptomatic patients respectively. Other pathologies were parathyroid hyperplasia, parathyroid carcinoma, and parathyroid adenoma with hyperplasia. [Table III]

Table II:
Distribution of patients according to classical and non-classical manifestations of PHPT (N=35)

Symptoms	n=35	Percentage (%)
Classical		
Osteitis fibrosa cystica	3	8.5
Nephrolithiasis	6	17.1
Neuropsychiatric syndrome	2	5.7
Non-classical		
Muscle weakness	14	40
Fatigue	18	51

Table III:
Distribution of patients according to type of pathology (N=35)

Pathological type	Symptomatic PHPT n (%)	Asymptomatic PHPT n (%)
Parathyroid adenoma	30 (85.75)	26 (74.28)
Parathyroid hyperplasia	3 (8.57)	7 (20.00)
Parathyroid carcinoma	0 (0.00)	1 (2.85)
Parathyroid adenoma with hyperplasia	1 (2.85)	1 (2.85)

Table IV:
Preoperative and postoperative levels of serum calcium and PTH (N=35)

Levels	SPHPT	ASPHPT	p-value
Preoperative PTH (uIU/ml) ± SD	1110.70±1058.10	435.98 ± 396.14	< 0.01
Postoperative PTH(uIU/ml) ± SD	31.94 ± 47.55	63.48 ± 192.00	0.031
Preoperative Ca (mmol/L) ± SD	3.12 ± 0.51	2.80 ± 0.38	< 0.01
Postoperative Ca(mmol/L) ± SD	2.42 ± 0.39	2.31 ± 0.23	< 0.01

SPHPT; Symptomatic Primary Hyperparathyroidism, ASPHPT; Asymptomatic Primary Hyperparathyroidism

It was observed that preoperative PTH and calcium levels and postoperative calcium levels in SPHPT and ASPHPT were statistically significant.

Discussion:

Primary hyperparathyroidism (PHPT) is a prevalent endocrine disorder characterized by elevated blood calcium levels (hypercalcemia) and increased or inappropriately normal parathyroid hormone (PTH) levels. This condition is commonly identified through routine biochemical screening and is frequently observed in individuals aged 50 and above, with a notable predominance in women, three to four times higher than in men. In regions where routine multichannel screening is in place, PHPT is often diagnosed earlier, even in asymptomatic cases. Conversely, in areas lacking routine biochemical testing, PHPT tends to manifest with symptoms like skeletal complications or kidney stone formation (nephrolithiasis).

The recommended approach to managing PHPT involves parathyroidectomy (PTx), a surgical procedure aimed at removing the overactive parathyroid glands. For individuals with symptomatic PHPT, PTx is considered necessary. Recent guidelines offer criteria for surgical intervention in asymptomatic patients, but there is also a consideration for surgery in asymptomatic cases that do not meet the established criteria, particularly if the patient expresses a preference for this option. Individuals diagnosed with PHPT should collaborate closely with their healthcare providers to determine the most suitable course of action based on their unique symptoms, overall health, and personal preferences. Regular monitoring of calcium and PTH levels, along with bone density assessments, may be part of the ongoing management plan for individuals with PHPT.[5] Parathyroidectomy (PTX) is the treatment of choice for symptomatic primary hyperparathyroidism (PHPT). This study intended to assess the surgical outcome of parathyroidectomy in PHPT.[14]

In this series, the majority of the patients (19, 54.29%) were in the 58 to 68 years age group, followed by, (11, 31.42%) were in e”69 years age group. It was observed that the majority (71.0%) of the patients were female. In a study by Miller, B.S. et al. peak incidence was at age 56–60 years with 61–65 in females and age 56–60 in males.[15] However, the mean age was 41 ± 14 years with a female: male ratio of 2.4:1 according to a study by Bhadada, S.K et al. 2018.[16] Shah, V.N. et al. also showed a female preponderance in their study which was similar to the present study.[17] It was observed that the majority (54%) of the study subjects were symptomatic. 46% of the patients did not show clinical symptoms.In the study of Arya, A.K.,et al., of the 554 patients, 54 (10%) patients had asymptomatic PHPT.[18] Regarding the clinical features, 3 (8.5%), 6 (17.1%), and 2 (5.7%) patients presented with osteitis fibrosa cystica, nephrolithiasis, and neuropsychiatric syndrome respectively. Moreover, 14 (40.0%) patients had muscle weakness, and 18 (51.0%) subjects presented with fatigue. These features were found similar to multiple studies [19-21].

In this study, parathyroid adenoma was found in 85.75% and 74.90% of patients in symptomatic and asymptomatic patients respectively. Other pathologies were parathyroid hyperplasia, parathyroid carcinoma, and parathyroid adenoma with hyperplasia. It was observed that preoperative PTH and calcium levels, and postoperative calcium levels in SPHPT and ASPHPT were statistically significant in the present study. The preoperative and postoperative biochemical values were similar to the study of Yu, Q. et al.[22] These findings underscore

the effectiveness of the intervention or treatment in promoting a substantial and widespread improvement in subjective assessments of well-being, both for those initially asymptomatic and those presenting with symptoms.

Conclusion:

This prospective study provides evidence supporting the enduring advantages of parathyroidectomy in individuals with primary hyperparathyroidism (PHPT). The observed reduction in pre-operative symptoms seems to be a significant factor contributing to these patient's life.

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