

## Study of Evaluation of Radiographic Findings in Primary Hyperparathyroidism Patients at a Tertiary Care Hospital

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### ABSTRACT

**Background:** Primary hyperparathyroidism (pHPT) occurs in roughly 100,000 individuals each year, with a general prevalence ranging from 0.2% to 1%. The present study was conducted for evaluating radiographic findings in primary hyperparathyroidism patients.

**Materials & Methods:** A total of 30 patients were diagnosed with primary hyperparathyroidism (PHPT). Lesions in the parathyroid glands were assessed, with particular attention given to the cervical regions of the patients. Bone mineral density (BMD) was measured using dual-photon absorptiometry for all participants. Additionally, plain radiographs of all skeletal regions were obtained to illustrate the presence of lesions and the extent of skeletal involvement. All data were systematically recorded in a Microsoft Excel spreadsheet and subsequently analyzed using SPSS software.

**Results:** A total of 30 patients were evaluated. The mean age of the patients was 43.8 years. Single and multiple parathyroid adenomas were found to be present in 73.33 percent and 23.33 percent of the patients respectively. Lower BMD values, Increased radiolucency, Pseudo-fractures, Acetabular protrusion, Subperiosteal bone resorption, Subendosteal bone resorption and Brown tumour were found to be present in 53.33 percent, 53.33 percent, 33.33 percent, 63.33 percent,

33.33 percent, 3.33 percent, and 30 percent of the patients respectively.

**Conclusion:** PHPT is a metabolic disorder that can affect multiple systems within the body. Notable alterations are particularly observed in the skeletal system. Imaging techniques play a crucial role in establishing significant diagnostic criteria alongside laboratory results.


**Key words:** Primary Hyperparathyroidism, Radiographic.

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### INTRODUCTION

Primary hyperparathyroidism (pHPT) occurs in roughly 100,000 individuals each year, with a general prevalence ranging from 0.2% to 1%. This condition is more frequently observed in individuals over the age of 65 and is particularly prevalent among postmenopausal women. pHPT is primarily defined by increased serum calcium levels that are accompanied by inappropriately high parathyroid hormone (PTH) concentrations. It represents the leading cause of hypercalcemia in outpatient clinical environments.<sup>1-3</sup>

The prevalence of primary hyperparathyroidism (pHPT) has been increasing, largely due to advancements in detection techniques and their broader application. In the process of diagnosing pHPT, it is essential to exclude secondary causes initially. The findings from the third international workshop on asymptomatic pHPT

indicate that various factors can lead to increased parathyroid hormone (PTH) levels.<sup>4</sup> Certain medications, including bisphosphonates, anticonvulsants, furosemide, and phosphorus, have been identified as potential contributors to elevated PTH. Furthermore, medical conditions such as renal hypercalciuria, chronic kidney disease (with a glomerular filtration rate of less than 60 ml/min), malabsorption syndromes (such as celiac disease and cystic fibrosis), and vitamin D deficiency (characterized by plasma 25-OH vitamin D levels below 50 nmol/L) must also be considered and ruled out. Additional factors to take into account include hypoalbuminemia, hypomagnesemia, and increased levels of calcitonin.<sup>5, 6</sup> Hence; the present study was conducted for evaluating radiographic findings in primary hyperparathyroidism patients.

**MATERIALS & METHODS**

The current research was conducted for evaluating radiographic findings in primary hyperparathyroidism patients. A total of 30 patients were diagnosed with primary hyperparathyroidism (PHPT). The study cohort comprised 17 females and 13 males. Initial evaluations focused on both biochemical and clinical parameters. Lesions in the parathyroid glands were assessed, with particular attention given to the cervical regions of the patients. Bone mineral density (BMD) was measured using dual-photon absorptiometry for all participants. Additionally, plain radiographs of all skeletal regions were obtained to illustrate the presence of lesions and the extent of skeletal involvement. Following a thorough examination of each patient's medical history, symptoms, physical findings, and laboratory results, referrals were made for appropriate imaging studies. All data were systematically recorded in a Microsoft Excel spreadsheet and subsequently analyzed using SPSS software.

**RESULTS**

A total of 30 patients were evaluated. Mean age of the patients was 43.8 years. 56.67 percent of the patients were males while the remaining were females. Among males, mean Calcium levels was 22.7 mg/dL, Phosphorus levels was 2.3 mg/dL, mean PTH levels was 38.6 pmol/L and mean Alkaline phosphatase levels was 229 U/l respectively. Among females, mean Calcium levels was 26.7 mg/dL, Phosphorus levels was 2.1 mg/dL, mean PTH levels was 49.2 pmol/L and mean Alkaline phosphatase levels was 128 U/l respectively. Single and multiple parathyroid adenomas was found to be present in 73.33 percent and 23.33 percent of the patients respectively. Lower BMD values, Increased radiolucency, Pseudo-fractures, Acetabular protrusion, Subperiosteal bone resorption, Subendosteal bone resorption and Brown tumour was found to be present in 53.33 percent, 53.33 percent, 33.33 percent, 63.33 percent, 33.33 percent, 3.33 percent, and 30 percent of the patients respectively.

**Table 1: Biochemical profile**

Variable	Males	Females
Calcium levels (mg/dL)	22.7	26.7
Phosphorus levels (mg/dL)	2.3	2.1
PTH levels (pmol/L)	38.6	49.2
Alkaline phosphatase levels (U/l)	229	128

**Table 2: Ultrasound findings**

Ultrasound findings	Number	Percentage
Single parathyroid adenoma	22	73.33
Multiple parathyroid adenoma	7	23.33
Parathyroid carcinoma	1	33.33
Total	30	100

**Table 3: Imaging findings**

Imaging findings	Number	Percentage
Lower BMD values	16	53.33
Increased radiolucency	16	53.33
Pseudo-fractures	10	33.33
Acetabular protrusion	19	63.33
Subperiosteal bone resorption	10	33.33
Subendosteal bone resorption	1	3.33
Brown tumour	9	30

**DISCUSSION**

pHPT has seen a rise in diagnoses since the 1970s, coinciding with the advent of automated laboratory techniques that enabled widespread serum calcium measurement. Despite this increase, prevalence rates vary globally; in regions where diagnosis is less effective, patients often exhibit more severe manifestations of the disease, including larger parathyroid tumors and the classic

symptoms associated with parathyroid bone disease or renal stone disorders, along with renal dysfunction. Conversely, in areas with effective diagnostic practices, there is a growing trend of patients presenting with milder hypercalcemia and atypical symptoms, such as psychiatric issues, weakness, and fatigue. This has led to ongoing discussions regarding the necessity of

surgical intervention for patients exhibiting the mildest forms of pHPT and non-traditional symptoms, with some experts suggesting that conservative management and regular follow-up by internists may be equally viable.<sup>7,8</sup>

Primary hyperparathyroidism is diagnosed when PTH is elevated, in the context of hypercalcemia, in a patient with no history of renal disease. This is usually a result of inappropriate parathyroid hormone secretion from one or more of the parathyroid glands. Biochemical measurement of "intact" or "total" PTH is performed through immunoradiometric (IRMA) and immunochemiluminescent assays. These "second-generation" assays have traditionally measured both the 1–84 amino acid sequence of PTH (considered the biologically active fragment) and other large fragments (with uncertain biological activity), such as the truncated 7–84 amino acid sequence PTH which can accumulate in patients with renal insufficiency. Measurement of PTH, widely called the "bioactive" or "3rd-generation assays" are considered the most precise method for measuring biologically active PTH using methods such as a two-site IRMA, a chemiluminescent enzymatic assay, or enzyme-linked immunosorbent assay (ELISA).<sup>9-12</sup>

A total of 30 patients were evaluated. The mean age of the patients was 43.8 years. 56.67 percent of the patients were males while the remaining were females. Among males, mean Calcium levels was 22.7 mg/dL, Phosphorus levels was 2.3 mg/dL, mean PTH levels was 38.6 pmol/L and mean Alkaline phosphatase levels was 229 U/l respectively. Among females, mean Calcium levels was 26.7 mg/dL, Phosphorus levels was 2.1 mg/dL, mean PTH levels was 49.2 pmol/L and mean Alkaline phosphatase levels was 128 U/l respectively. Single and multiple parathyroid adenomas were found to be present in 73.33 percent and 23.33 percent of the patients respectively. Polat P et al assessed the spectrum of radiographic findings in primary hyperparathyroidism (PHPT). The study group consisted of 16 women and 7 men whose Ca levels were at least two or three times higher than normal. The average age was 55.3 in women and 49.4 in men. We detected carcinoma in 1, hyperplasia in 1, multiple adenomas in 4, single adenoma in 17 patients. The most common finding in the skeletal system was the decreased bone mineral density (BMD) and the complete loss of the lamina durae dentium. BMD was found lower in women than in men. This result attributed the increased number of postmenopausal patients in our study group. The second most common finding in our study group was subperiosteal bone resorption. Brown tumors (BTs) were located at maxilla in one, widespread in one, mandibula in two, long tubular bones in four patients. Renal stone disease was found in five, spastic colon in two, gastric ulcer in one, mitral valve calcification in one patients.<sup>13</sup>

In the present study, lower BMD values, Increased radiolucency, Pseudo-fractures, Acetabular protrusion, Subperiosteal bone resorption, Subendosteal bone resorption and Brown tumour was found to be present in 53.33 percent, 53.33 percent, 33.33 percent, 63.33 percent, 33.33 percent, 3.33 percent, and 30 percent of the patients respectively. Sukan A et al evaluated the efficacy of dual-phase <sup>99m</sup>Tc-methoxyisobutyl nitrile (MIBI) parathyroid scintigraphy (PS) and ultrasound (US) in primary (pHPT) and secondary (sHPT) hyperparathyroidism. Histopathology revealed 30 solitary adenomas and 71 hyperplastic glands in 55 patients. The remaining patients'

histopathology revealed normal parathyroid, thyroid, or lymph nodes. The sensitivities of MIBI and US in pHPT were 70% and 60%, respectively. It was 60% for both procedures in sHPT. The overall sensitivity of combined US + MIBI in pHPT and sHPT was 81% and 71%, respectively. The overall specificity of MIBI and US was 87% and 91%; positive predictive value (PPV) was 94% and 92%, respectively. MIBI and US identified the parathyroid pathology in 92% and 85% of patients in the non-concomitant thyroid disease group, and in 53% and 47% of patients in the concomitancy thyroid disease group, respectively. The weight of the gland between primary and secondary hyperparathyroidism did not reveal a significant difference (P=0.4). Significant differences were found with respect to age, PTH, Ca, and P levels between the pHPT and sHPT (P<0.001). Intact PTH levels showed significant differences between MIBI positive and negative patients (P=0.013), and also US positive and negative patients. A significant negative correlation was found between iPTH and Ca at sHPT. The concomitant of thyroid disease greatly influences scintigraphic and ultrasonographic detection of parathyroid pathology in pHPT and sHPT.<sup>14</sup>

## CONCLUSION

PHPT is a metabolic disorder that can affect multiple systems within the body. Notable alterations are particularly observed in the skeletal system. Imaging techniques play a crucial role in establishing significant diagnostic criteria alongside laboratory results.

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