

Pulmonary function tests in patients with primary hyperparathyroidism

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ABSTRACT

Context: There is limited information on respiratory muscle functions in patients with primary hyperparathyroidism (PHPT). **AIM:** To assess respiratory muscle dysfunction in patients with PHPT. **Setting and Design:** This prospective study was carried between January 2005 and December 2006 by the Department of Endocrinology at the Postgraduate Institute of Medical Education and Research, Chandigarh. **Materials and Methods:** PHPT was defined as elevated parathyroid hormone in the presence of hypercalcemia. Spirometry was performed using a dry rolling seal spirometer and spirometric indices like forced vital capacity (FVC), forced expiratory volume in first second (FEV₁), and FEV₁/FVC ratio were measured using standard guidelines. **Results:** Thirty patients were studied with a mean age of 37.1 ± 2.4 years and 18 were women. The most common presenting symptoms were fatigue (75.0%) and bone pain (60.70%). The mean (±SD) of percentage predicted FVE₁, FVC, FEV₁/FVC ratio, PEF, and FEF were 98.7 ± 16.1, 93.9 ± 14.7, 84.5 ± 3.4, 89.3 ± 22.5, and 99.7 ± 33.6, respectively. Two had obstructive lung disease and two had restrictive lung disease. We did not find correlation with preoperative serum calcium, phosphate, and PTH with FVE₁, FVC, FEV₁/FVC ratio, PEF, and FEF. **Conclusion:** Elevated calcium, low phosphate, and elevated PTH levels in patients with moderate to severe PHPT do not significantly affect respiratory muscle functions.

Key words: Primary hyperparathyroidism, pulmonary function test, restrictive lung disease

INTRODUCTION

Primary hyperparathyroidism (PHPT) is characterized by elevated corrected calcium with elevated intact parathyroid hormone (PTH). After the advent of multichannel biochemical screening, presentation of PHPT changed from symptomatic to asymptomatic PHPT in the West.^[1] However, the presentation of PHPT in the developing countries like India is still symptomatic. The common presentation of PHPT in India is bone pain, muscle pain, and/or fatigue.^[2] This aches and pains are possibly

due to associated hypercalcemia, hypophosphatemia, and anemia. Calcium is important for muscle contraction while phosphate for generation of adenosine triphosphate, the energy substance. Therefore, imbalance in calcium and phosphate homeostasis may result in muscle contraction abnormalities and fatigue. Studies have reported reduced muscle strength in PHPT, which improves after parathyroidectomy.^[3,4] Taking into account aforementioned fact, we hypothesized that respiratory muscle should also have similar effects like skeletal muscle and hence, patients with PHPT should have respiratory muscle dysfunction resulting in restrictive pulmonary disease.

MATERIALS AND METHODS

This prospective study was carried out at the Postgraduate Institute of Medical Education and Research, Chandigarh, India, between January 2005 and December 2006. PHPT was defined as elevated PTH in the presence of hypercalcemia.

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Patients with secondary or tertiary hyperparathyroidism and existing pulmonary disease or any other comorbidity (fracture, kyphosis, scoliosis, pancreatitis, etc.) that can affect respiration were excluded. The written informed consent was obtained from all the cases and the Institute's ethics committee approved the study protocol.

Pulmonary function testing

Spirometry was performed using a dry rolling seal spirometer (Spiro RS232; P K Morgan Ltd., Kent, UK). Spirometric indices such as forced vital capacity (FVC), forced expiratory volume in first second (FEV₁), and FEV₁/FVC ratio were measured by experienced technicians for all subjects using standard guidelines.^[1] The highest measurements from among three technically acceptable and reproducible maneuvers were expressed at body temperature and pressure saturated with water vapor. The predicted value for each of these measured parameters was calculated using reference equations for healthy north Indian adults, previously derived at our center.^[2] Lower limit of normal (LLN) for each parameter was calculated as the difference between the predicted value and 1.645 times the standard error of estimate of the relevant regression equation. This value represented the lower 90% confidence limit, and any observed value below the corresponding LLN was considered abnormal.^[3] FEV₁, FVC, and FEV₁/FVC ratio were used as basic parameters to interpret spirometry data.^[3] Presence of FEV₁/FVC ratio less than the LLN for that subject was categorized as an obstructive pattern. Presence of FVC less than the LLN, associated with a normal FEV₁/VC ratio, was categorized as a restrictive pattern.

Laboratory methods

Serum intact PTH [reference range (RR), 15–65 pg/ml] and 25-hydroxyvitamin D (25-OHD; RR 11.1–41.9 ng/ml) were measured by chemiluminescence assay using commercially available kits (DiaSorin Inc., Stillwater, MN). Other biochemical parameters [corrected serum calcium (RR) 8.6–10.2 mg/dl, inorganic phosphate (RR) 2.7–4.5 mg/dl, serum albumin (RR) 3.4–4.8 mg/dl, and alkaline phosphatase (RR) 40–129 IU/L] were measured by autoanalyzer (Roche Diagnostics, Modular P 800).

Statistic analysis

The statistical analysis was carried out using SPSS. Continuous variables were described as mean \pm SD and categorical variables were described as frequencies and proportions. Pearson product moment correlation was used to correlate the serum calcium, phosphate, and iPTH with the parameters of pulmonary function test. All statistical tests were two-sided and performed at a significance level of $P < 0.05$.

RESULTS

Thirty patients were studied with a mean age of 37.1 \pm 2.4 years (32.1–42.03; 95% CI) and women:men ratio of 18:12. The most common presenting symptoms were fatigue (75.0%) and bone pain (60.70%). Mean (\pm SD) of serum calcium, phosphate, alkaline phosphatase, PTH, and 25 (OH) D levels were 10.61 mg/dl (\pm 1.17), 3.19 (\pm 0.47) mg/dl, 45.87 (\pm 50.3) IU, 967.44 (\pm 744.0) pg/ml, and 25 (\pm 27.65) ng/ml, respectively. The mean (\pm SD) of percentage predicted FVE1, FVC, FEV₁/FVC ratio, PEF, and FEF were 98.7 \pm 16.1, 93.9 \pm 14.7, 84.5 \pm 3.4, 89.3 \pm 22.5, and 99.7 \pm 33.6, respectively. Two patients were identified to have obstructive lung disease and two had restrictive lung disease as per the criteria described in methodology. Using multivariate analysis, we did not find any correlation with preoperative serum calcium and predicted FVE1 ($P = 0.9$), FVC ($P = 0.8$), FEV₁/FVC ratio ($P = 0.6$), PEF ($P = 0.5$), and FEF ($P = 0.7$). Similarly, we did not find correlation between preoperative phosphate and PTH levels with any of pulmonary function test parameters.

DISCUSSION

We investigated the effect of elevated calcium, low phosphate, and high PTH levels with respiratory muscle function using pulmonary function test. We did not find any significant abnormalities in pulmonary function test in PHPT patients and these parameters did not correlate with calcium, phosphate, or PTH levels.

Not all but few studies on muscle function and strength showed improvement in muscle function after curative parathyroidectomy. This difference in results may be due to difference in sample size, preoperative calcium levels, and methods used to test muscle function.^[3-5] We did not find any significant alteration in respiratory muscle functions in patients with moderate to severe PHPT and this result is in consonance with other studies.^[6] Negative findings of our study may be due to small sample size and mildly reduced serum phosphate level which may not be sufficiently low to cause respiratory muscle dysfunction.

Limitations of the study are (1) we did not evaluate parameters of pulmonary function tests after parathyroid surgery in same subjects, (2) small sample size, (3) we did not use body plethysmography for estimation of pulmonary function test, and (4) we did not carry out bone scan to look for thoracic cage involvement. However, prospective study design and first Indian study to document respiratory muscle functions in moderate to severe hyperparathyroidism are major strengths.

In conclusion, elevated calcium, low phosphate, and elevated PTH levels in patients with moderate to severe PHPT do not significantly affect respiratory muscle functions. However, these findings should be confirmed in a large prospective study.

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