

# Could We Predict Adenoma Weight And Postoperative Serum Calcium Level With Preoperative Serum Biochemical Markers In Patients With Primary Hyperparathyroidism?

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## Abstract

### Aims

To determine the relationship of serum phosphate, serum calcium, and serum parathyroid hormone levels with respect to parathyroid adenoma weight and postoperative serum calcium in primary hyperparathyroidism.

### Materials and methods

Eighty patients with single parathyroid adenoma entered the study. Preoperative serum calcium, phosphate, parathyroid hormone, alkaline phosphatase, weight of adenomas and postoperative serum calcium were recorded.

### Results

With respect to adenoma weight, there was a significant correlation with serum calcium and parathyroid hormone ( $p = 0.003$  and  $p = 0.0001$ , respectively). There was no correlation between postoperative serum calcium and serum alkaline phosphatase ( $p = 0.3$ ), serum parathyroid hormone ( $p = 0.3$ ) and adenoma weight ( $p = 0.1$ ).

### Conclusion

Adenoma weight has a positive impact on preoperative serum calcium, parathyroid hormone and alkaline phosphatase. Preoperative serum markers and adenoma weight are unreliable to predict serum calcium level postoperatively, but we can estimate the calcium decline postoperatively with preoperative serum calcium, PTH, alkaline phosphatase level and adenoma weight.

## INTRODUCTION

Primary hyperparathyroidism is a condition characterized by inappropriate excess secretion of parathyroid hormone, leading to hypercalcemia, hypophosphatemia and mild hyperchloremic acidosis. <sup>1</sup> It occurs in one of every 500 women and one of every 2000 men over 40 years in the U.S.A. Single parathyroid adenoma is the etiology of primary hyperparathyroidism in approximately 85-90% of patients. <sup>2</sup> Relationship of preoperative biochemical parameters, serum calcium, serum phosphate, serum calcium, serum alkaline phosphatase and serum parathyroid hormone levels with parathyroid adenoma weight and postoperative serum calcium is controversial. To date, results from different studies, which were retrospective, have

been variable. We designed this prospective study to see whether the preoperative biochemical markers are valuable in predicting parathyroid adenoma weight, and to evaluate factors that may have influence on postoperative serum calcium level. This correlation could help surgeons to predict which patients will be hypocalcemic postoperatively and to manage them correctly.

## MATERIALS AND METHODS

In a prospective study from 2005 to 2007, all patients with primary hyperparathyroidism who underwent parathyroidectomy were enrolled. Exclusion criteria were secondary operation, parathyroid hyperplasia, multiple adenomas and parathyroid carcinoma. Eighty patients with single parathyroid adenoma entered the study. Demographic

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data (sex, age) and preoperative serum calcium, phosphate, parathyroid hormone and alkaline phosphatase were recorded. All patients had these blood parameters measured within 2 months of surgery. All patients underwent resection of parathyroid adenoma by a single surgeon and confirmed with frozen section. Weight of adenomas was measured in milligrams in the operating room. Postoperative serum calcium was measured 24 hours after adenoma resection.

Data were presented as means with standard deviation or binomial percentages where appropriate. Multiple and binary logistic regression were used to explore relationships between biochemical markers with adenoma weight and postoperative serum calcium. Statistical analysis was carried out using SPSS release 13.0 for Windows (SPSS Inc. Chicago, IL, USA) and a p-value <0.05 was considered statistically significant.

### RESULTS

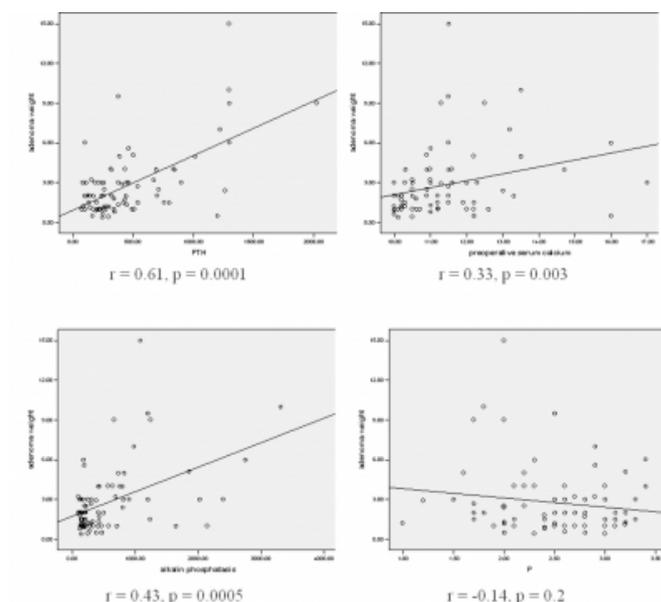
Of 80 patients enrolled, 66 (82.5%) patients were women and 14 (17.5%) were men. The mean age of patients was  $48 \pm 14$  years. Mean preoperative serum calcium was  $11.3 \pm 1.4$  mg/dl, mean parathyroid hormone level  $451.6 \pm 378.8$  ng/l, mean phosphate level  $2.47 \pm 0.52$  mg/dl and mean alkaline phosphatase level  $571.75 \pm 637$  IU/L. Mean adenoma weight was  $2.6 \pm 2.2$  with the range from 0.4 to 10 g and mean 24-hours postoperative serum calcium was  $8.5 \pm 0.6$  mg/dl.

### CORRELATION BETWEEN ADENOMA WEIGHT AND OTHER PARAMETERS

There was no correlation between patient age and sex and adenoma weight. But there was a positive correlation between preoperative serum calcium ( $r = 0.33$ ,  $p = 0.003$ ), parathyroid hormone ( $r = 0.61$ ,  $p = 0.0001$ ), alkaline phosphatase ( $r = 0.43$ ,  $p = 0.0005$ ) and adenoma weight. There was no correlation between preoperative serum phosphate and adenoma weight ( $r = -0.14$ ,  $p = 0.2$ ). (Fig. 1)

**Figure 1**

Figure 1: Correlation of adenoma weight with PTH, serum calcium, alkaline phosphatase and serum phosphate (P)

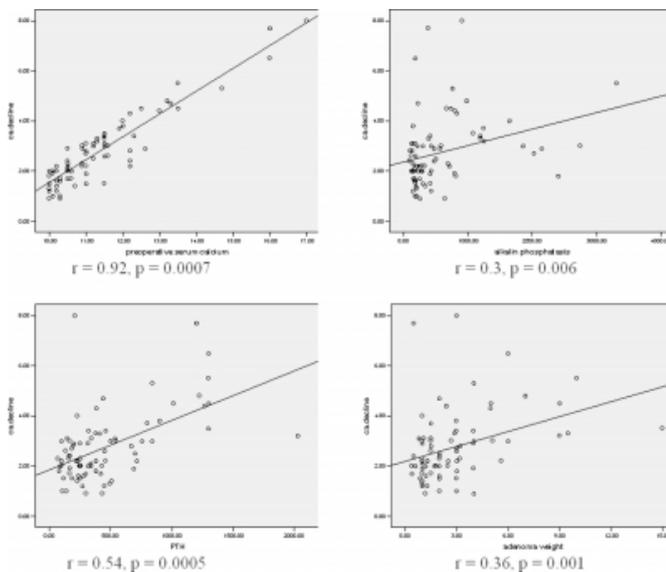


### CORRELATION BETWEEN POSTOPERATIVE SERUM CALCIUM AND OTHER PARAMETERS

There was a weak correlation between postoperative calcium and preoperative serum calcium ( $r = 0.23$ ,  $p = 0.03$ ). Also there was non-significant negative correlation between postoperative serum calcium and the preoperative serum alkaline phosphatase level ( $r = -0.11$ ,  $p = 0.3$ ), serum parathyroid hormone level ( $r = -0.11$ ,  $p = 0.3$ ) and adenoma weight ( $r = -0.17$ ,  $p = 0.1$ ). We calculated calcium decline as: preoperative serum calcium – postoperative serum calcium. With regard to calcium decline, there was correlation between serum calcium decline after adenoma resection and preoperative serum calcium ( $r = 0.92$ ,  $p = 0.0007$ ), parathyroid hormone level ( $r = 0.54$ ,  $p = 0.0005$ ), alkaline phosphatase level ( $r = 0.3$ ,  $p = 0.006$ ) and adenoma weight ( $r = 0.36$ ,  $p = 0.001$ ). (Fig. 2)

**Figure 2**

Figure 2: Correlation of postoperative calcium decline with PTH, preoperative serum calcium, alkaline phosphatase and adenoma weight



**DISCUSSION**

Correlation between serum PTH and adenoma weight has been studied by some authors <sup>4,5,6,7,8</sup> as well as serum calcium and adenoma size or mass <sup>4,5,9</sup>; however, results from different studies have been variable and even sometimes paradoxical. Rutledge et al. <sup>10</sup> found a statistically significant but weak correlation ( $r = 0.16$ ; Pearson's coefficient) between adenoma weight and preoperative calcium and PTH, while Dubost et al. <sup>11</sup>, Wagner <sup>12</sup> and Randhawa <sup>7</sup> found no relationship between serum calcium and PTH levels and adenoma weight or volume. A recent study of 63 single adenomas by Bindlish et al. <sup>4</sup> demonstrated statistically significant correlations between preoperative serum calcium and PTH with adenoma weight ( $p = 0.001$ ). Likewise, Hedback et al. <sup>13</sup> found a correlation ( $p < 0.001$ ) between preoperative serum calcium and adenoma weight in 713 patients with single parathyroid gland disease operated on between 1956 and 1982.

Further studies examined the relationship between adenoma size and weight and postoperative hypocalcemia with conflicting results. Zamboni et al. <sup>14</sup> reported correlation between hypocalcemia and adenoma weight ( $p < 0.001$ ), but Strickland et al. <sup>15</sup> found no statistically significant correlation between mean preoperative serum calcium, PTH and adenoma weight and postoperative serum calcium level.

We found a positive correlation between serum calcium,

PTH and alkaline phosphatase levels with respect to adenoma weight. This means that in patients with higher preoperative serum calcium, parathyroid hormone and alkaline phosphatase level, we can predict heavier and larger adenomas in primary hyperparathyroidism. Our study has shown differences when some of the other studies have not, likely because of the exclusion of patients with double adenoma and hyperplasia. This study also had a large sample size; which has contributed to the positive results.

With regard to postoperative serum calcium, preoperative serum markers and adenoma weight are not reliable to predict postoperative serum calcium, but they can be used to predict calcium decline postoperatively. We suggest a study to evaluate the correlation of calcium decline after adenoma resection with hypocalcemic symptoms in hyperparathyroid patients. This will help to use prophylactic calcium in postoperative patients.

**CONCLUSION**

Adenoma weight has a positive impact on preoperative serum calcium, parathyroid hormone and alkaline phosphatase levels, and these parameters can be used to predict adenoma weight and size in primary hyperparathyroid patients. Preoperative serum markers and adenoma weight are unreliable to predict serum calcium level postoperatively, but we can estimate calcium decline postoperatively with preoperative serum calcium, PTH, alkaline phosphatase level and adenoma weight.

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