

Surgical treatment of hyperparathyroidism using the quick parathyroid assay

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The quick intraoperative parathyroid assay (qPTH) has been proposed as an effective tool in the surgical management of hyperparathyroidism. By measuring intact parathyroid hormone intraoperatively, the qPTH assay may facilitate directed exploration for solitary adenomas and may help guide the extent of resection in hyperplasia. In this study, results of the qPTH assay were analyzed prospectively in 63 consecutive patients who underwent exploration for hyperparathyroidism. Blood samples were drawn prior to surgical incision, prior to gland excision, and 5 and 10 minutes after gland excision. A decline $\geq 50\%$ of the highest preincision or preexcision level within 10 minutes of resection was considered successful. Forty-nine patients (78%) had a solitary parathyroid adenoma. The qPTH assay was successful in 48 (98%) of these patients. One patient showed a delayed decline at 20 minutes. Fourteen patients

(22%) had multiglandular disease: 6 with primary hyperplasia, 4 with hyperplasia secondary to renal failure, and 4 with double adenomas. The assay was successful in all of these patients. It detected multiglandular disease in 8 of 14 patients thought preoperatively to have solitary adenoma. Overall, the qPTH assay was successful in 62 of 63 patients (98%). All patients were normocalcemic after a median follow-up interval of 8 months. These data suggest that the qPTH assay can accurately facilitate directed neck exploration for solitary adenomas, guide the extent of resection for hyperplasia, and identify unknown multiglandular disease. It appears to eliminate the most common cause of parathyroidectomy failure, thereby improving surgical success rates while potentially decreasing morbidity, cost, and operative time.

The quick parathyroid assay (qPTH) has been proposed as an effective tool in the surgical management of hyperparathyroidism. This assay measures the intact portion of parathyroid hormone with results reported in approximately 10 minutes. Most published reports have focused on the use of the qPTH assay in patients with solitary adenomas, while its role in patients with multiglandular disease (i.e., hyperplasia, renal failure, and double adenomas) remains unclear (1, 2). Since 7% to 26% of patients with hyperparathyroidism have multiglandular disease, clarifying the utility of the qPTH assay in this patient population is important in order to improve surgical success rates (3, 4). Also, this assay has the potential to benefit patients requiring subtotal resection (i.e., patients with primary or secondary hyperplasia). If this assay can be used as a confirmatory test to ensure adequate excision of hyperplastic glands, then persistent hypercalcemia and reoperation can be avoided.

The qPTH assay may facilitate directed, unilateral exploration for solitary adenomas, may help guide the extent of resection in hyperplasia (primary and secondary), and may eliminate the most common cause of parathyroidectomy failure, which is failure to recognize multiglandular disease (hyperplasia or double adenomas) at the initial operation. This study evaluates the use of the qPTH assay in patients requiring surgical treatment for hyperparathyroidism.

METHODS

After obtaining institutional review board approval for the study, 63 consecutive patients undergoing surgical exploration for hyperparathyroidism were prospectively enrolled. Preoperative localization tests, including sestamibi scan, ultrasound, or both,

were obtained for all patients. The qPTH assay (Nichols Institute Diagnostics, San Clemente, Calif) was used for all patients, and the assay protocol as described by Irvin was utilized (5). Each kit provides a maximum of 7 assays. Intraoperative blood samples were drawn before surgical incision, before gland excision, 5 minutes after gland excision, and 10 minutes after gland excision. Additional levels were drawn as needed in patients with multiglandular disease. The timing of blood samples for patients with hyperplasia was relative to $3\frac{1}{2}$ gland resection. As established in the literature, an assay decline $\geq 50\%$ of the highest preincision or preexcision level was considered successful (5). Postoperative monitoring included testing of serum calcium levels and continued for a median follow-up interval of 8 months.

RESULTS

Of the 63 patients, 49 (78%) had solitary parathyroid adenoma, and 14 (22%) had multiglandular disease.

Forty-eight (98%) of the 49 patients with solitary adenoma showed an appropriate decline in assay value following adenoma excision (Figure 1). Forty-four (90%) had a successful decline in assay value 5 minutes after excision, and 4 (8%) had a successful decline in assay value 10 minutes after excision. The 49th patient exhibited a 53% decline in assay value 20 minutes after adenoma excision (Figure 2).

Six (43%) of the 14 patients with multiglandular disease had primary hyperplasia, 4 (29%) had hyperplasia secondary to re-

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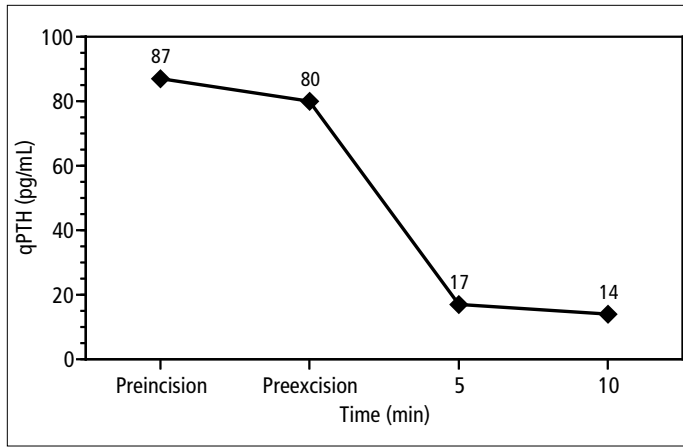


Figure 1. qPTH assay values in a patient with a single adenoma.

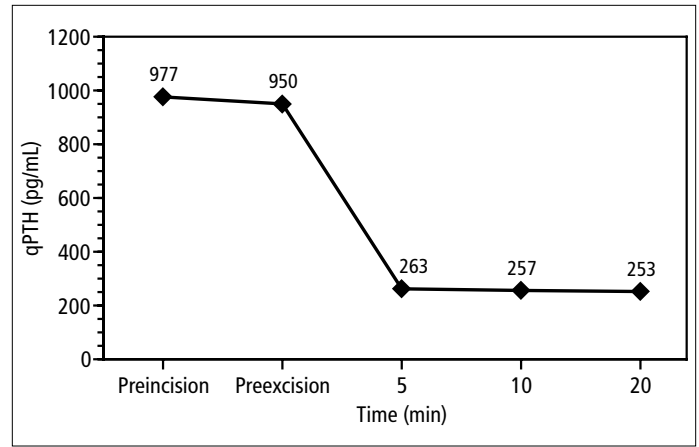


Figure 3. qPTH assay values in a patient with renal failure who underwent 3½ gland resection.

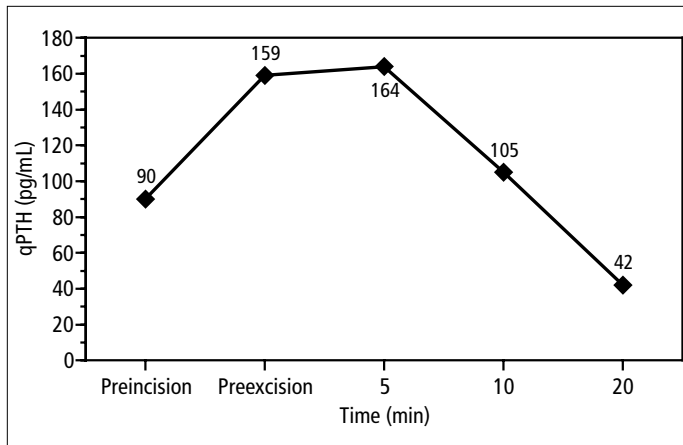


Figure 2. qPTH assay values in a patient with delayed decline in qPTH level.

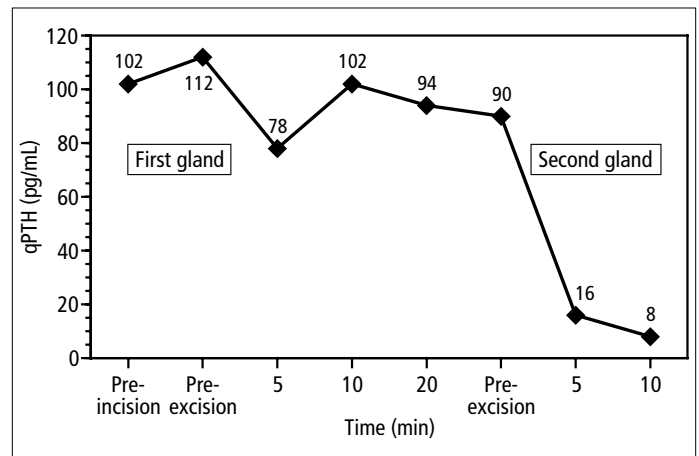


Figure 4. qPTH assay values in a patient whose sestamibi scan inaccurately suggested single adenoma. The patient was found to have a double adenoma.

nal failure (Figure 3), and 4 (29%) had double adenomas. Eight of these patients—4 with primary hyperplasia and 4 with double adenomas—were thought preoperatively to have uniglandular disease (Figure 4). All patients with multiglandular disease showed an appropriate decline in assay value within 10 minutes after excision, and all the patients with renal failure exhibited an appropriate decline in assay value 5 minutes after 3½ gland resection.

At a median follow-up interval of 8 months, all 63 patients were normocalcemic.

DISCUSSION

Surgery is a well-established treatment for hyperparathyroidism, although it still carries a failure rate of 3% to 10% (4, 6). The qPTH assay has the potential to reduce this failure rate by identifying unsuspected multiglandular disease. In this study, 8 patients thought to have solitary adenoma by preoperative localization tests were found to actually have multiglandular disease. The qPTH assay was used as a guide to continue searching for hyperfunctioning tissue when the assay value did not fall appropriately after excision of the suspected adenoma. This represents an intraoperative change in surgical decision-making in 13% of patients in our series and likely prevented operative failure in these patients.

The qPTH assay has been successfully utilized in patients with uniglandular disease by several authors (7–10). Our data

confirm their findings, with a 98% success rate in this study. Our data show that most patients with solitary adenoma have an appropriate decline in assay value 5 minutes after gland excision. This finding may be useful when striving to decrease operative time and cost. Furthermore, using the qPTH assay in conjunction with preoperative localization tests allows directed, unilateral exploration, which may decrease the risk of postoperative hypoparathyroidism and potential injury to recurrent laryngeal nerves.

In this study, one patient showed a delayed decline of the assay value, with a 53% drop at 20 minutes after adenoma excision. Since the value had not dropped 10 minutes after gland excision, the contralateral neck was explored, and 3 normal parathyroid glands were identified. Repeat of the assay 20 minutes after excision yielded a decline of >50% and confirmed that all abnormal tissue had been excised. With this result, the surgeon completed the operative procedure confident that no hyperfunctioning tissue remained. The reason for delayed decline in assay value remains unclear, although it may be due to individual variation in parathyroid hormone metabolism or an unrecognized spike in the qPTH value. Two to five percent of patients can be expected to demonstrate this delayed-decline phenomenon (11, 12).

Efficacy of the qPTH assay in patients with primary and secondary hyperplasia has been unclear in the literature (1, 7). In

this study, we found normal postoperative calcium levels in these patients when using the 50% decline guidelines as originally established by Irvin et al (8). In patients with renal failure, our data showed that not only was the qPTH successful in predicting postoperative normocalcemia, but assay levels dropped appropriately 5 minutes after subtotal resection, which is consistent with results for most patients with uniglandular disease. Therefore, renal metabolism does not appear to be a significant factor when using the qPTH assay to predict clinical success after subtotal gland resection in patients with renal failure. The sample size for the subpopulation in this study was small, and accrual of these patients continues. Continued follow-up of patients with hyperplasia will be necessary to ensure a long-term surgical cure of their disease.

The qPTH assay can also function as a guide during re-exploration for persistent hypercalcemia after previous autotransplantation. Using the qPTH assay in a stepwise fashion while excising hyperplastic tissue signals to the surgeon when an adequate amount of tissue has been removed. Consequently, reoperation for persistent hypercalcemia can be avoided.

In conclusion, our data support intraoperative use of the qPTH assay for both uniglandular and multiglandular parathyroid disease. The qPTH assay can accurately facilitate directed neck exploration for patients with solitary adenomas, which may decrease surgical morbidity by avoiding unnecessary bilateral exploration, decrease operative costs, and allow parathyroidectomy to be performed as an outpatient procedure when appropriate. In addition, the assay can accurately guide the extent of gland resection in patients with primary or secondary hyperplasia to predict clinical cure. Consequently, reoperation for persistent hypercalcemia due to inadequately excised hyperplastic tissue is avoided. Results for use of this assay in patients with renal failure is congruent with results reported for other patients, and therefore the qPTH assay should be considered a useful tool for parathyroidectomy in secondary hyperparathyroidism. We have also shown that the qPTH assay can reliably eliminate the most

common cause of parathyroidectomy failure, thereby improving surgical success rates for hyperparathyroidism.

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