IS IOPTH WARANTED IN 4D-CT/US LOCALIZED SINGLE GLAND PRIMARY HYPERPARATHYROIDISM?

Thomas E. Heineman BA, David I. Kutler MD FACS, Marc A. Cohen MD and William I. Kuhel MD FACS
Weill Cornell Medical College, Department of Otolaryngology – Head and Neck Surgery, New York, NY

INTRODUCTION

In 2011 we reported over a decade of experience using a modified 4D-CT plus ultrasound (Mod 4D-CT/US) to localize abnormal parathyroid glands. At our center we have achieved 94% sensitivity and 96% specificity in lateralizing the hyperfunctioning parathyroid glands to one side of the neck with this protocol.

In addition to preoperative imaging, some surgeons use intraoperative parathyroid hormone (IOPTH) monitoring in order to try identifying patients who may have multigland disease. The most widely accepted standard is the Miami Criteria, which is defined as an IOPTH drop of 50% or more when comparing the pre-excision PTH level to a sample drawn ten minutes post-gland excision. The reported sensitivity and specificity of the Miami criteria for cure is 97.3% and 97.6%, respectively. While these values are often quoted, a ten-year prospective study using IOPTH in previously unexplored parathyroidectomy cases found a 93.4% cure rate. Other studies have documented similar results.

This study represents the first attempt, to our knowledge, to examine the utility of IOPTH monitoring in patients with primary hyperparathyroidism who have a single, concordant gland localized by Mod 4D-CT/US.

METHODS

Patients for this study were drawn from consecutive directed parathyroidectomies performed between December 2001 and June 2013 by the senior authors. All patients had primary hyperparathyroidism and underwent a Mod 4D-CT/US study preoperatively that showed findings on both studies that were consistent with a single adenoma. Additionally, these patients had preoperative, intraoperative, and postoperative parathyroid hormone levels drawn. This study received Weill Cornell IRB approval.

RESULTS

Of 356 patients who underwent parathyroid surgery, 169 met the inclusion criteria for this study—IOPTH monitoring used intraoperatively with a single adenoma localized on both 4D-CT and sonogram preoperatively. Five patients (3.0%) had persistent hyperparathyroidism after removal of one gland despite an IOPTH level that met the Miami criteria. Seven patients (4.1%) who had multigland disease that was not appreciated on the preoperative localization studies were identified intraoperatively because the IOPTH level remained elevated. Ten patients (5.9%) were cured despite an IOPTH that did not meet Miami criteria. Over half of the patients observed to have a persistently elevated IOPTH level (59%), had already achieved surgical cure and required no further intervention.

We observed an IOPTH PPV of 96.7% and an NPV of 58.8%. The number needed to screen (NNS) with IOPTH monitoring to prevent one case of missed multigland disease in our series was 25.

The authors have performed 13 procedures without IOPTH monitoring, all of which have been cures without complication.

DISCUSSION

This is the first study to our knowledge to investigate the pitfalls of IOPTH when a Mod 4D-CT/US protocol localizes a single enlarged parathyroid gland.

- We found that in some cases IOPTH monitoring prompted futile neck explorations and increased the complexity of surgical decision-making, forcing the surgeon to make a judgment as to whether equivocal glands were diseased or normal based on visual inspection. Figure 1 displays a decision tree that illustrates the complexity of the decision-making that can occur when the IOPTH does not meet the Miami criteria following resection of the suspected adenoma.

- It is important to recognize that most patients with primary hyperparathyroidism have a mild biochemical abnormality and are asymptomatic. We feel it is inappropriate to remove potentially normal parathyroid glands, when the patient may already be cured surgically following the resection of the suspected single adenoma.

- Greater than 50% of the IOPTH assays that did not meet Miami criteria were false negatives. The differential outcome of our cohort with or without IOPTH monitoring is given in Figure 2.

- This study is not the first to report the problems that can occur with IOPTH monitoring. Ozimek et al. examined the validity of IOPTH in 235 cases of PHPT, reporting a NPV of 54%.

- As with any medical testing, increasing the threshold for positivity results in an increase in false negatives.

- Omission of IOPTH monitoring is only possible when preoperative localization is sufficiently accurate to predict single gland disease.

- 4D-CT/US-based parathyroid visualization protocols are dependent on the skill of the radiologist and the surgeon to interpret the study correctly.

- We acknowledge that one of the weaknesses of our study is its retrospective nature.

CONCLUSION

In summary, Mod 4D-CT/US localization studies can provide sufficient accuracy in patients with single gland primary hyperparathyroidism to forgo intraoperative parathyroid hormone monitoring, thereby avoiding a complex decision analysis and potential surgical complications associated with IOPTH monitoring.

REFERENCES