

Research Article

Intraoperative Parathyroid Hormone Monitoring In the Surgical Management of Primary Hyperparathyroidism

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ABSTRACT

Background: Primary hyperparathyroidism (PHPT) is a common endocrine disorder characterized by autonomous overproduction of parathyroid hormone (PTH), leading to hypercalcaemia and its systemic complications. Surgical excision remains the definitive treatment. In recent years, intraoperative parathyroid hormone (ioPTH) monitoring has emerged as a valuable adjunct in parathyroid surgery, particularly in minimally invasive approaches. This article reviews the principles, indications, methodology, and clinical utility of ioPTH monitoring in the management of PHPT, with special reference to its relevance in the Indian healthcare setting. We planned the present study to evaluate the level of PTH intraoperatively and postoperatively and determine the outcome of the surgery.

Materials & Methods: A total of 36 patients scheduled to undergo parathyroidectomy for hyperparathyroidism were involved in the present study. Complete physical examination of all the subjects was carried out. Pre-surgical assessment of all the subjects was done. Minimally invasive parathyroidectomy (MIP) was done in all the patients. A 50% reduction in PTH level from baseline was used as an indication that the exploration was successful. If a parathyroid adenoma was not found or if the PTH did not drop sufficiently after the removal of the gland, the incision was extended and bilateral neck exploration was done.

Results: MIP was carried out in 33 patients, while bilateral neck exploration was required in 3 patients. A significant decline in the mean PTH concentration was seen during surgery and postoperatively. Also we observed a significant fall in the postoperative calcium levels in comparison to the preoperative calcium levels.

Conclusion: Intraoperative PTH monitoring plays a significant and crucial role in assessing the surgical treatment of primary hyperparathyroidism.

Keywords: Intraoperative Parathyroid Hormone, Parathyroid Hormone, Primary Hyperparathyroidism.

INTRODUCTION

Primary hyperparathyroidism is increasingly being diagnosed in India due to greater awareness, routine biochemical screening, and improved imaging modalities. Unlike the classical Western presentation, Indian patients often present at a younger age with symptomatic disease, including skeletal manifestations, renal calculi, and severe hypercalcaemia. Parathyroidectomy is the treatment of choice for PHPT. Traditionally, bilateral neck exploration was the standard surgical approach. However, with advancements in preoperative localisation techniques and the advent of intraoperative PTH monitoring, focused and minimally invasive parathyroidectomy has gained acceptance. Intraoperative PTH monitoring plays a pivotal role in confirming the adequacy of resection and reducing operative failure. Primary

hyperparathyroidism (PHPT) is an endocrine disorder characterized by autonomous production of parathyroid hormone (PTH). Classically characterized as hypercalcaemia in the presence of elevated serum PTH concentration, it is now recognized as a spectrum ranging from inappropriately high or even normal PTH in the setting of high-normal or even normal calcium.¹⁻³ Bilateral neck exploration with direct visualization and identification of all abnormal parathyroid glands with subsequent removal was previously considered the gold standard of care. Experienced surgeons reported to be able to identify affected glands in 95% of cases. Intraoperative parathyroid hormone (ioPTH) assay has allowed a directed parathyroid exploration with cure rates (>97%) comparable with those of bilateral exploration in patients with primary hyperparathyroidism (PHP).⁴⁻⁶

There are many conflicting reports in the literature and some groups have thrown doubt on the clinical usefulness of IOPTH during minimally invasive parathyroidectomy (MIP).⁷ Hence; we planned the present study to evaluate the level of PTH intraoperatively and postoperatively and determine the outcome of the surgery.

MATERIALS & METHODS

The present study was planned in the department of general surgery, Rama Medical College, Hospital & Research Centre, Hapur U.P. (India) and it included evaluation of intraoperative parathyroid hormone in primary hyperparathyroidism patients undergoing surgery. For the present study, we obtained ethical clearance from the ethical committee of the institution. We also obtained written consent from all the subjects after explaining in

detail the entire research protocol. A total of 36 patients scheduled to undergo parathyroidectomy for hyperparathyroidism were involved in the present study. Complete physical examination of all the subjects was carried out. Pre-surgical assessment of all the subjects was done. MIP was done in all the patients. A 50% reduction in PTH level from baseline was used as an indication that the exploration was successful. If a parathyroid adenoma was not found or if the PTH did not drop sufficiently after the removal of the gland, the incision was extended and bilateral neck exploration was done.

Statistical Analysis: All the results were analyzed by SPSS software. Chi - square test and student t test was used for assessment of level of significance.

Table 1. Distribution of subjects according to age group

Parameter		n
Age group (years)	Less than 40	10
	40-60	14
	More than 60	12
Gender	Males	15
	Females	21

Table 2. Distribution of subjects according to Surgical Procedure

Surgical Procedure	n
Minimal Invasive Parathyroidectomy	33
Bilateral Neck Exploration	3
Total	36

Table 3. Comparison of Pre-Op and Post-Op PTH Values

PTH assay	PTH assay	p- value
Pre-operative (ng/L)	256.5	0.001 (Significant)
Intra-operative 10 mins (ng/L)	128.4	
Intra-operative 30 mins (ng/L)	64.8	
Post-operative 24 hours (ng/L)	37.1	

Table 4. Comparison of Pre - Operative and Post - Operative Serum Calcium Values

S. Calcium (mg/dl)	Mean	SD	p value
Pre - Operative	13.2	2.3	0.000 (Significant)
Post - Operative	9.1	1.4	

RESULTS

In the present study, a total of 36 patients were analysed. Mean age of the patients of the present study was 48.5 years. Majority of the patients belonged to the age group of 40 to 60 years. There were 15 males and 21 females in the present study. MIP was carried out in 33 patients, while bilateral neck exploration was required in 3 patients. A significant decline in the mean PTH concentration was seen during

surgery and postoperatively. Also we observed a significant fall in the postoperative calcium levels in comparison to the preoperative calcium levels.

DISCUSSION

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.⁸ The only cure for primary hyperparathyroidism due to parathyroid adenomas is surgical resection of the culprit gland or glands. In 2008, The Third International Workshop on Asymptomatic Primary Hyperparathyroidism revised the indications for surgery in asymptomatic patients—these include age less than 50 years, serum calcium 0.25 mmol/L above the upper limit of normal, creatinine clearance <-2.5 at any site, and/or previous fragility fracture.⁹ In the present study, a total of 36 patients were analysed. Mean age of the patients of the present study was 48.5 years. Majority of the patients belonged to the age group of 40 to 60 years. There were 15 males and 21 females in the present study. Rolighed L et al illustrated the performance of the intraoperative PTH measurement as a predictor of successful cure. 143 patients with primary hyperparathyroidism (pHPT) underwent a parathyroid operation (bilateral neck exploration with identification of all parathyroid glands) with intraoperative measurements of plasma PTH (immediately prior to surgery (T0) and 5 minutes after gland excision (T5)). A positive test result was defined as plasma PTH values at T5 below 20% of T0 or a value in the normal range below 7.6 pmol/l. Hence T5 values above 20% of T0 and above 7.6 pmol/l were considered test negative. 122 patients (85%) were test positive and cured, 11 patients (8%) were test negative but cured, and 10 patients (7%) were test negative and not cured by the primary operation. Consequently, the sensitivity of the test was 0.92 and the specificity 1.00. The rapid PTH test used is a reliable predictor of a successful outcome in pHPT patients undergoing parathyroid surgery.¹⁰ MIP was carried out in 33 patients, while bilateral neck exploration was required in 3 patients. A significant decline in the mean PTH concentration was seen during surgery and postoperatively. Also we observed a significant fall in the postoperative calcium levels in comparison to the preoperative calcium levels. Sartori PV et al compared focused parathyroidectomy success rates with and without IOPTH in patients with concordant preoperative imaging. Retrospective cohort study involving 599 consecutive patients underwent surgery for PH from 2012 to 2017. Patients with discordant preoperative imaging were excluded. 426 patients underwent focused parathyroidectomy (214 patients without IOPTH and 212 with IOPTH) and were

considered for the statistical analysis. In case of insufficient IOPTH decay (less than 50%), a bilateral exploration was carried out. The IOPTH group and the non-IOPTH group were similar for demographics and preoperative PTH and calcaemia. 413 patients were cured and disease persistence rates between groups were not significantly different ($p > 0.05$). Although further testing and randomized controlled trials are required to validate our findings, our data show that IOPTH does not seem to improve the outcome in patients with concordant preoperative imaging undergoing focused parathyroidectomy.¹¹

Cayo AK et al determined the utility of ioPTH monitoring for MGD. Data were prospectively collected on 755 patients with 1HPT who underwent parathyroidectomy. PTH samples were collected preincision, and then at 5, 10, and 15 min after excision of suspected abnormal parathyroid gland(s). Surgical cure was defined as a drop of greater than 50% in PTH level. Of the 755 patients, 163 (21.5%) were found to have MGD on pathology. Intraoperative PTH monitoring was used in 161 of these cases. In 146/161 cases (90.7%), the ioPTH level fell by at least 50% after removal of all suspected abnormal glands. All of these patients (100%) remained normocalcemic postoperatively. In 15/161 cases (9.3%), the PTH level did not fall by >50%. For 11/15 cases (73%), patients remained hypercalcemic postoperatively or had recurrence. However, in the remaining four cases, the patients became normocalcemic postoperatively despite failure of the PTH to fall by >50%. In each of these patients, PTH levels fell by 40- 50%. ioPTH monitoring accurately predicted success or failure of parathyroidectomy in 97.5% (157/161) of patients with MGD. A fall of ioPTH by >50% can be used as a highly accurate predictor of cure in patients with MGD.¹²

CONCLUSION

Under the light of above obtained data, the authors conclude that intraoperative PTH monitoring plays a significant and crucial role in assessing the surgical treatment of primary hyperparathyroidism. However; further studies are recommended.

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