Improving Intraoperative Parathyroid Hormone Monitoring with a Multidisciplinary Checklist: A Quality Improvement Initiative

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Abstract

Objective: Intraoperative parathyroid hormone (10PTH) monitoring is crucial during parathyroid surgery to ensure chemical cure. However, delays in processing can prolong operative times. This study evaluates the effectiveness of a checklist to expedite ioPTH assay processes.

Methods: A multidisciplinary checklist was developed to streamline communication and coordination among the perioperative teams. The checklist standardizes ioPTH collection and workflow. Thirty patients treated with use of the checklist were prospectively studied, while 30 patients treated without use of the checklist were retrospectively reviewed. Time intervals for post-15-minute ioPTH assay results were compared using Student's t-tests.

Results: Thirty age-matched patients were included in each group (n=60) involving 5 surgeons. Group A (intervention) and Group B (control) had a mean baseline PTH of 141 and 130 pg/mL and a post-15-minute ioPTH of 70 and 52 pg/mL, respectively. Repeated measurements of ioPTH were not included. The mean time from sample collection to the post-15-minute ioPTH assay result was significantly reduced in Group A as compared to Group B (22.2 vs 32.3 min; p<0.05). The proportional operative time spent awaiting ioPTH assay results was also significantly reduced (24.4 vs 34.1%; p<0.05).

Discussion: The implementation of a simple intraoperative checklist effectively reduces delays in ioPTH assay processing time, creating a more efficient surgical workflow. It is low-cost and requires minimal additional resources.

Implications for Practice: This quality improvement intervention holds promise for broader adoption in parathyroid surgery to reduce delays and optimize patient care.

Introduction

Intraoperative parathyroid hormone (ioPTH) monitoring is a critical adjunct to parathyroidectomy, enabling real-time confirmation of successful excision of hyperfunctioning parathyroid tissue. Advances in assay technology have supported the evolution of focused parathyroidectomy by reducing the need for bilateral neck exploration.

Rapid assays can yield results in 5-20 minutes. Turnaround time (TAT) in the real world, however, ranges anywhere from 20-60 minutes[1]. This discrepancy is often due to systemic workflow issues that significantly prolong operative time[2, 3]. Checklists, which have improved surgical outcomes and communication in other contexts, offer a promising strategy to address these inefficiencies.

This study describes the development and implementation of a multidisciplinary checklist aimed at streamlining ioPTH workflow to improve surgical efficiency without requiring additional resources.

Table 1. Sample processing at OR/STAT Lab

Variable	Time
Sample receipt	1 min
Centrifugation	3 min
Machine recognition/pipetting	2 min
Run and result analysis	9 min
Calling/reporting result	1 min
Total	16 min

Methods

We developed an 8-item multidisciplinary checklist targeting key steps in ioPTH monitoring: operative planning, sample transport, and lab communication. After pilot testing, the checklist was implemented prospectively for 30 consecutive parathyroidectomy cases (Group A; Nov 2024 - Mar 2025) and compared with a retrospective cohort of 30 prior cases (Group B). All procedures were performed by five surgeons at a single institution. Checklist items were verbally reviewed during the presurgical pause and posted in the OR. Inclusion required adult patients undergoing parathyroidectomy with ioPTH monitoring; cases with additional procedures were excluded.

Primary outcomes were ioPTH assay turnaround time (TAT) and percent of operative time spent awaiting results. Data were extracted from the electronic medical record. ioPTH assays were processed using the Roche cobas e411 analyzer in the STAT Lab, with alternate routing to the main lab as needed. An expected time of at least 16 minutes is inherent to the PTH assay process (**Table 1**).

Statistical analysis used Student's t-tests and Chi-squared tests (p<0.05), performed in R (v4.5.0). Sample size was determined by power analysis for medium-to-large effect size.

Table 2. Characteristics of the cohorts, comparing use of the checklist intervention

Characteristic, n (%)	With checklist (n = 30)	Without checklist (n = 30)	p-value†
Age, year*	67 ± 11	64 ± 11	0.293
Female sex, n (%)	19 (63%)	21 (70%)	0.784§
Surgical indication, n (%)			0.588§
Parathyroid adenoma	21 (70%)	18 (60%)	
Multi-gland hyperplasia	9 (30%)	12 (40%)	

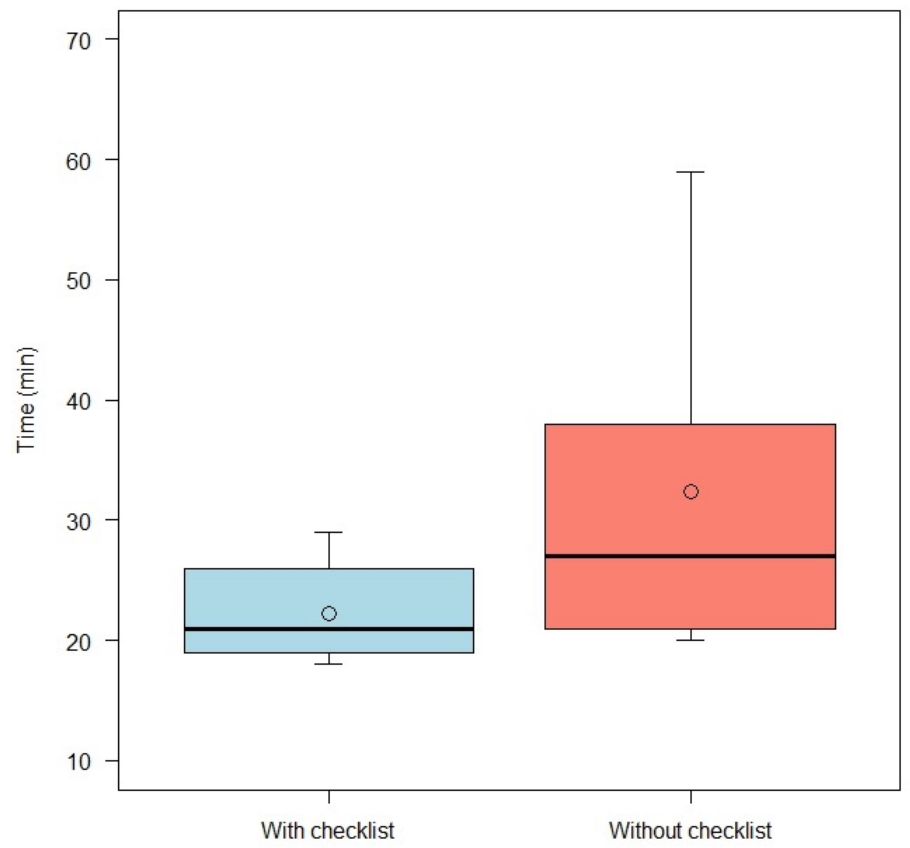
** Mean ± standard deviation*
† From t-test unless otherwise specified
§ From Chi-square test

Table 3. Operative outcomes compared between the two cohorts

Outcome*	With checklist (n = 30)	Without checklist (n = 30)	p-value†
Baseline PTH assay	140.9 ± 78 pg/mL	130.3 ± 54 pg/mL	0.526
Post-15-min ioPTH assay	69.6 ± 67 pg/mL	52.1 ± 41 pg/mL	0.155
Total ioPTH assays, n	1.2 ± 0.6	1.2 ± 0.5	0.789
Minimum PTH	27.8 ± 20 pg/mL	32.8 ± 18 pg/mL	0.301
Maximum PTH	147.4 ± 75 pg/mL	132.7 ± 55 pg/mL	0.663

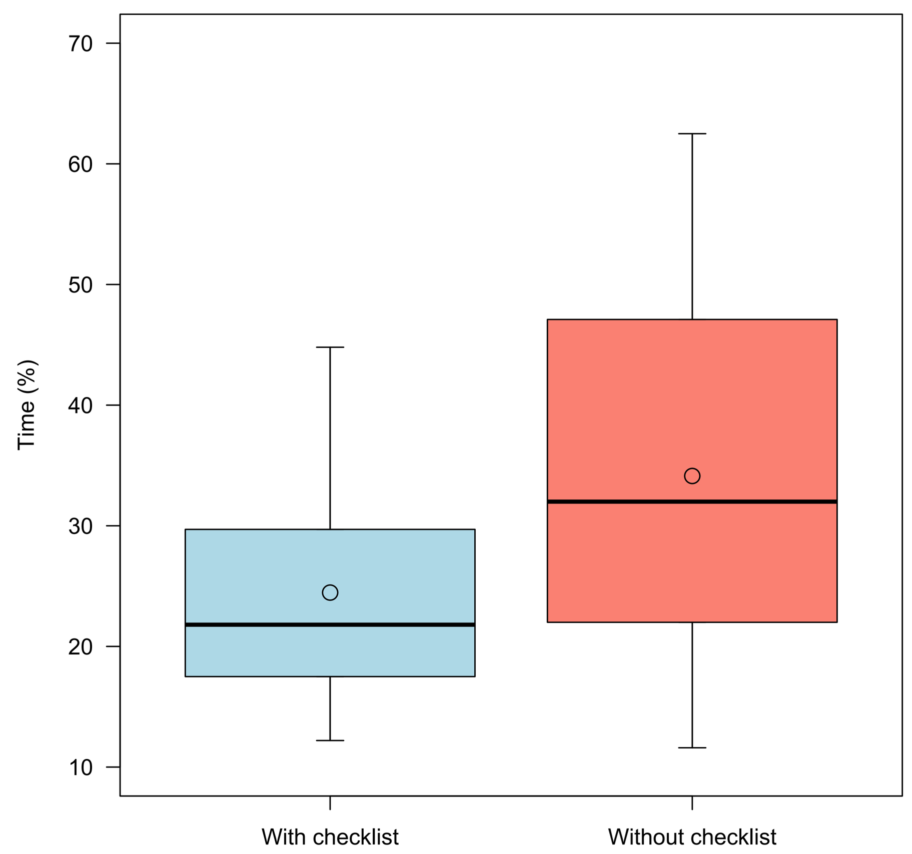
** Mean ± standard deviation*
† From t-test unless otherwise specified

Figure 1. Turnaround time following the post-15-minute intraoperative parathyroid hormone assay



Legend: Box and whisker plot demonstrates a significant difference in the time elapsed following the post-15-min ioPTH assay. The black line within each box designates the median time, with the upper and lower borders of the box corresponding to the upper and lower quartiles. The circle represents the average. The vertical lines extending from the boxes depict the highest and lowest values recorded.

Figure 2. Proportion of total operative time spent awaiting the post-15-minute intraoperative parathyroid hormone assay results



Legend: Box and whisker plot demonstrates a significant difference in the overall percentage of operative time spent awaiting ioPTH results. The black line within each box designates the median percentage, with the upper and lower borders of the box corresponding the upper and lower quartiles. The circle represents the average. The vertical lines extending from the boxes depict the highest and lowest percentages recorded.

Results

As summarized in **Table 2**, 60 patients were included in the study, with 30 age- and sex-matched patients in each group. The mean age was 66.7 with a standard deviation (±) of 11 years in Group A and 63.7 ± 11 years in Group B. Parathyroid adenoma was the most common indication for parathyroidectomy, while parathyroid hyperplasia accounted for 30% and 40% of cases in Group A and Group B, respectively.

Mean baseline PTH levels were 140.9 ± 78 pg/mL in Group A and 130.3 ± 54 pg/mL in Group B. Post–15-minute ioPTH levels decreased to 69.6 ± 67 pg/mL in Group A and to 52.0 ± 41 pg/mL in Group B. The mean number of ioPTH assays collected was identical (1.2) in both groups. Subgroup analysis for different indications was not performed. The mean maximum and minimum PTH values, which account for all perioperative sampling, were 147.4 ± 75 pg/mL and 27.8 ± 20 pg/mL in Group A (81% reduction) vs 132.7 ± 55 pg/mL and 32.8 ± 18 pg/mL in Group B (75% reduction). These data are presented in **Table 3**. No statistically significant differences were observed between groups.

Mean ioPTH assay TAT was significantly less in Group A as compared to Group B: 22.2 min [95% confidence interval (CI): 20.8, 23.6] vs 33.3 min [CI: 25.9, 38.7], respectively ($p < 0.01$; Cohen's d = -0.82). This reflects an 11.1 minute or 33.3% reduction in processing time (**Figure 1**). The mean time of surgery was 91.2 ± 36 min in Group A and 97.7 ± 51 min in Group B. This difference did not show statistical significance. The proportion of operative time spent awaiting ioPTH results was reduced from 34.1% [CI: 28.2, 40.1] to 24.4% [CI: 21.1, 27.9] with checklist implementation ($p < 0.01$; Cohen's d = -0.69), as illustrated in **Figure 2**.

The distance from the operating room to the laboratory and sample transport pathways was analyzed qualitatively and was not found to vary significantly between groups.

Discussion

In this single-institution study, implementation of a standardized intraoperative checklist led to a 33% (11 minute) reduction in ioPTH assay TAT and a 10% reduction in the proportion of operative time spent awaiting results. These findings highlight how a low-resource, workflow-focused intervention can meaningfully improve surgical efficiency to guide intraoperative decision-making. Communication lapses and process variability have been cited as key drivers of assay delay in the literature [4]. Our checklist helps mitigate these issues by standardizing critical steps, such as preemptively notifying the collecting laboratory before sample collection.

Use of the checklist reduced TAT variability as well, suggesting improved reliability in the ioPTH workflow. Prior studies have shown that delays in PTH processing are commonly linked to mislabeling, incorrect order entry, and sample routing errors[2]. Our findings support the value of systematizing roles and expectations among team members, especially in complex or multiglandular disease where multiple samples may be drawn and ioPTH results directly influence intraoperative decision-making.

While overall operative time was reduced by 7 minutes, this was not statistically significant. This may be explained by our relatively small sample size and case heterogeneity. Limitations include single-site design, potential unmeasured confounders (e.g., time-of-day staffing), and absence of cost or patient-centered outcomes.

Nonetheless, the observed gains in efficiency support broader adoption of checklist-based approaches to optimize ioPTH protocols and reduce intraoperative delays.

Conclusion

A brief, multidisciplinary checklist reduces intraoperative parathyroid hormone assay turnaround time and improves surgical workflow. Perioperative teams can consider adopting similar structured communication tools to standardize specimen handling and laboratory coordination. Institutions should adapt checklist content to local systems and staffing models to maximize effectiveness. Implementation of such low-cost interventions may support higher-value parathyroid surgery.

References

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