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Original research

Parathyroid surgery can be safely performed in a community hospital by experienced parathyroid surgeons: A retrospective cohort study

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HIGHLIGHTS

- There is ongoing debate about the effectiveness and safety of performing parathyroid surgery in community hospitals.
- We measured outcomes of parathyroid surgery performed by experienced parathyroid surgeons in low-volume hospital settings.
- Experienced parathyroid surgeons have comparable outcomes of parathyroid surgery at both community and academic-based centers.
- Expanding endocrine surgery niche will contribute to equalizing access to high-quality surgical care across urban and rural areas.

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ABSTRACT

Background: There is ongoing debate about the effectiveness and safety of performing parathyroid surgery in low-volume community hospitals.
Study design/methods: Cases performed at community hospital by a group of 4 parathyroid surgeons (group 1) were reviewed. Cure and complication rates were analyzed in light of outcomes of an expert endocrine surgeon from high-volume academic center (group 2) as point of reference.
Results: During the respective time periods, 204 patients met inclusion criteria in group1 and 218 patients in group 2. Patient characteristics, biochemical tests, and performed localizing studies (ultrasound and sestamibi scan) were comparable between the two groups. Pathological findings, including adenoma, double adenoma, hyperplasia, and cancer were comparable. Each had comparable cure rates (97% and 99%) ($p < 0.18$) and complication rates (1% and 1%) ($p < 0.93$) for group 1 and 2, respectively.
Conclusion: Our results showed that experienced parathyroid surgeons will achieve comparable excellent outcomes of parathyroid surgery at both community and academic-based centers. As the field of endocrine surgery evolves and matures, producing young fellowship-trained endocrine surgeons, there will be growing need for expanding the niche of endocrine surgery into community-based hospital settings, which eventually will contribute to expanding and equalizing access to high-quality surgical care across urban and rural areas.

1. Introduction

Understanding the association between hospital volume and surgery outcomes in the delivery of health services has been the focus of much research in the last four decades. The magnitude of the hospital volume–outcome association varies depending on the type of procedure. Multiple studies have shown that for certain high-risk procedures, including esophageal, lung, pancreatic, and colon surgery, patients have lower perioperative mortality and morbidity rates at high-volume university-based hospitals compared to low-volume community hospitals [1–6]. On the other hand, common procedures, such as coronary artery bypass grafting, carotid endarterectomy, total hip and knee arthroplasty for which selective referral and regionalization policies have been proposed,

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the magnitude of volume–outcome relationships is much more modest [4,7–10].

There is ongoing debate about the advisability of performing parathyroid surgery in low-volume community hospitals. However, surgeon experience is considered to be the single most important variable that has a direct effect upon cure and complication rates for patients who undergo parathyroid surgery [11–13]. And yet, there are limited data on the outcomes of experienced parathyroid surgeons in specific hospital settings. Therefore, we measured outcomes of parathyroid surgery in a community teaching hospital to test the hypothesis that surgery for primary hyperparathyroidism (PHPT) can be safely performed in a low-volume hospital when performed by experienced surgeons.

2. Materials and methods

2.1. Study design and study cohort

Permission was obtained from the institutional review boards of the Johns Hopkins and Danbury Hospitals, respectively, to conduct a retrospective review of parathyroid surgery database and patient records. We compared the surgical outcomes of cases performed by 4 parathyroid surgeons in a community-based teaching hospital (Danbury Hospital/group 1) with one endocrine surgeon's practice from a high-volume academic center (Johns Hopkins Hospital/group 2) as a point of reference.

Failure to achieve cure of hypercalcemia due to primary hyperparathyroidism has been well studied and the literature shows that the acceptable surgical cure rates should be at or above 95% [11,14,15]. Therefore, we powered the study to determine whether a 6% difference could be detected in cure rate between group 1 and group 2. Specifically having 200 patients in each group would enable us to detect a difference between a 99% cure rate in one type of center vs. a 93% cure rate in the other type of center with 80% power with $p = 0.05$. To obtain adequate and comparable sample sizes, the parathyroid surgery cases performed by group 1 between 2001 and 2012 and group 2 between 2009 and 2011 were reviewed. All pertinent demographic and clinical information was retrieved and analyzed.

Only patients who underwent initial surgery for primary hyperparathyroidism were included. Patients who presented with classic PHPT symptoms and signs including nephrolithiasis, bone disease, polydipsia, polyuria, and constipation were deemed symptomatic. Patients with secondary hyperparathyroidism and those who had previous neck surgery for thyroid or parathyroid disease were excluded. Intraoperative PTH was measured in both groups in all cases. Cure and complication rates were compared. Cure was defined as eucalcemia at 7–10 days after surgery and in long-term follow-up (≥6 months postoperatively) at which time serum PTH and calcium levels were obtained for confirmation of cure. Complications included hematoma, infection, permanent hypocalcemia and recurrent laryngeal nerve injury. Patients from both groups were not subjected to routine postoperative laryngoscopy unless clinically indicated.

2.2. Statistics

Counts and proportions of categorical variables were analyzed by Chi-square and Fisher exact tests. Given the non-normal distribution of continuous variables, they were analyzed by Kruskal–Wallis test. All data analyses were performed using Stata® 13 (College Station, TX). A p-value less than 0.05 was considered significant.

3. Results

During the respective time periods there were 227 parathyroid operations performed in the community-based teaching hospital and 261 operations performed in the high-volume academic center. Of these, 204 patients in group 1, and 218 patients in group 2 met inclusion criteria. Group 1 included cases performed by 4 surgeons trained in parathyroid and thyroid surgery. All cases in group 2 were performed by a single fellowship-trained expert endocrine surgeon. The surgical team consisted of 2 attending surgeons for each case in group 1, and a surgical attending and an endocrine surgery fellow or surgical resident for each case in group 2.

3.1. Patient characteristics

The demographic profiles of patient in group 1 and group 2 are presented in detail in Table 1. There were 41 (20%) male and 163 (80%) female patients in group 1 and 50 (23%) male and 168 (77%) female patients in group 2, ($p = 0.48$). Mean age was 61 years (53–68) for patients in group 1 and 57 years (50–63) in group 2 ($p < 0.001$). The average body mass index (BMI) was 29 kg/m^2 (24–33) and 28 kg/m^2 (24–32) in group 1 and 2, respectively ($p = 0.22$). There were 129 (63%) asymptomatic and 75 (37%) symptomatic patients in group 1 and 42 (19%) asymptomatic and 176 (81%) symptomatic patients in group 2 ($p < 0.001$).

3.2. Pre-operative biochemical tests and localizing studies

Pre-operative biochemical tests included total and ionized calcium and intact parathyroid hormone (PTH) (Table 1). Mean total calcium was 10.7 mg/dl (10.4–11.1) in group 1 and 11.1 mg/dl (10.8–11.6) in group 2 ($p < 0.001$). Mean pre-operative PTH was 105 pg/ml (80–158) in group 1 and 109 pg/ml (78–148) in group 2 ($p = 0.91$). In group 1, 136 (67%) patients had an ultrasound (US), of which 30 (15%) were positive (localized), 75 (37%) were negative and 31 (15%), indeterminate; in group 2, 202 (93%) patients had an US, of which 122 (56%) were positive, 43 (20%) negative and 36 (16%) indeterminate ($p < 0.001$). In group 1, 196 (96%) patients had a sestamibi scan of which 169 (83%) were positive, 3 (1%) negative and 24 (12%) indeterminate; in group 2, 215 (99%) patients had a sestamibi scan of which 178 (82%) were positive, 29 (13%) negative and 8 (4%) indeterminate ($p = 0.1$). As described previously, the imaging studies were defined as positive, negative or indeterminate according to the wording used in the radiology reports [16].

3.3. Surgical approach, complexity, and pathological findings

Group 1 performed 112 (55%) minimally invasive parathyroidectomies (MIP) and 86 (42%) bilateral parathyroid explorations; the surgical approach was not specified in 6 (3%) cases. Group 2 performed 147 (67%) MIP cases, 66 (30%) bilateral parathyroid explorations, and 5 (3%) unspecified procedures ($p = 0.03$) (Table 2). The reason for more MIP cases performed in group 2 is likely a reflection of the surgeon's detailed review with the nuclear medicine physicians pre-operatively of all sestamibi studies for subtle findings [16].

Patients in group 1 had a single adenoma in 188 (92%) cases, double adenoma in 8 (4%), hyperplasia in 6 (3%), and cancer in 1 (0.5%); normal parathyroid tissue without pathological findings was described in 1 (0.5%) case. Group 2 had a single adenoma in 187 (86%) cases, double adenoma in 12 (5%), and hyperplasia in 19 (9%) ($p = 0.06$). Mean gland weight was 450 mg (200–1040) in group 1 and 463 mg (260–863) in group 2 ($p = 0.55$). Group 2 had a higher number 42 (19%) of complex cases (concomitant thyroidectomy and mediastinal, retrosternal, intrathymic, retroesophageal, and