
Outpatient Minimally Invasive Parathyroidectomy Is Safe for Elderly Patients

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- BACKGROUND:** Elderly patients with primary hyperparathyroidism (PHPT) are often not referred for surgical intervention because of concern of comorbid conditions that may increase perioperative complications. Because PHPT is more common in the elderly, we sought to compare indications and complications of minimally invasive parathyroidectomy in patients 70 years of age and older (elderly) with their younger counterparts.
- STUDY DESIGN:** A review was conducted of a prospectively collected database of all patients undergoing parathyroidectomy on our endocrine surgery service. Data collected included patient demographic, biochemical pathologic, and operative findings. Wilcoxon rank sum and chi-square tests were used for comparisons.
- RESULTS:** Three hundred eighty-eight patients with PHPT recently underwent parathyroidectomy over a 3-year period (elderly, $n = 101$; younger, $n = 287$). The elderly cohort had significantly higher median preoperative creatinine (elderly, 2.0 mg/dL; younger, 1.0 mg/dL; $p = 0.002$) and parathyroid hormone (elderly, 145 pg/mL; younger, 123 pg/mL; $p = 0.026$) levels. The elderly cohort also had more severe osteoporosis, with a significantly worse median bone mineral density T-score (elderly, -2.5 ; younger, -1.8 ; $p < 0.001$). The rate of postoperative complications was similarly low in both groups (elderly, 5.9%; younger, 3.5%; $p = 0.38$).
- CONCLUSIONS:** Minimally invasive parathyroidectomy for PHPT can be performed as safely in elderly patients as in their younger counterparts. Elderly patients with PHPT are more likely to have osteoporosis and higher creatinine levels at the time of surgical referral. Additional study of the role of earlier intervention is warranted. (J Am Coll Surg 2009;208:1071–1076. © 2009 by the American College of Surgeons)
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Primary hyperparathyroidism (PHPT) is a common endocrine disorder with prevalence rates of about 1 to 4 per 1,000 in the general population and up to 1 per 100 in the elderly. The chances of developing PHPT increase with age, and patients are most often diagnosed in the sixth and seventh decades of life.¹ Clinical manifestations of PHPT,

including disabling fractures, are more frequent in the elderly.² In past decades, patients with PHPT typically presented with the classic symptoms of osteitis fibrosa cystica, nephrolithiasis, nephrocalcinosis, or psychiatric and neurocognitive manifestations.^{3–5} But since the introduction of routine calcium screening and multichannel biochemical testing in the early 1970s, the majority of PHPT patients are diagnosed at a much earlier stage, avoiding these overt manifestations.³ Today, < 20% of patients with PHPT will present with nephrolithiasis, and < 3% will demonstrate features of osteitis fibrosa cystica.^{4,5}

PHPT patients are commonly referred to as “asymptomatic” if the diagnosis is rendered in the absence of the classic objective symptoms. Guidelines for managing asymptomatic PHPT have been outlined using objective indications for surgical intervention.⁶ Parathyroidectomy is recommended for all symptomatic patients and for asymptomatic patients with one or more documented objective indications such as osteoporosis or serum calcium > 1 mg/dl above normal, or who are unable to follow up medically.⁶

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Abbreviations and Acronyms

BMD	= bone mineral density
IOPTH	= intraoperative parathyroid hormone
MIP	= minimally invasive parathyroidectomy
PHPT	= primary hyperparathyroidism

Surgical removal of abnormal parathyroid tissue is the only curative treatment for PHPT. Historically, PHPT has been treated by standard cervical (four-gland) exploration. Single adenomas are responsible for PHPT in > 80% of patients and resection of the gland involved is curative.⁷⁻¹¹ In recent years, minimally invasive options have become widely used as imaging and localization studies (that pinpoint where to start the procedure) have improved and rapid intraoperative parathyroid hormone assay (IOPTH) testing (which suggests when to stop the procedure) has become more accessible.^{7-9,12-14} Minimally invasive, or “directed” parathyroidectomy results in a smaller incision, less cervical dissection, and decreased postoperative discomfort. The operation is performed on an outpatient basis, and most patients are discharged within 4 to 6 hours after the procedure.¹⁵⁻¹⁸

The number of elderly patients with PHPT will also increase, as the elderly portion of the US population increases. By 2030, nearly 1 in 5 people in the US will be age 65 years or older.¹⁹ A greater portion of patients with PHPT, as a consequence, will be older and have age-associated comorbidities such as hypertension, coronary artery disease, and frailty. These comorbidities often delay the diagnosis of PHPT or make it more difficult to render. In addition, primary care physicians seem to be more hesitant about referring elderly PHPT patients for surgical intervention, and elderly patients themselves often fear parathyroidectomy. Elderly patients as a result, are often not offered the opportunity to experience improvement in quality of life, bone health, and neuromuscular function and the decrease in morbidity and mortality that are associated with cure of PHPT.²⁰⁻²⁴ In 2003, Kebebew and colleagues²⁵ found that 22% of their PHPT patients older than 80 years of age who were referred for parathyroidectomy had a delay of more than a year before referral, with mean delay of 5 years. In this study, all patients were symptomatic by the time of referral.

Advances in the surgical treatment of PHPT, including improved anesthetic techniques, have made it safer, even for patients previously considered poor operative candidates, making them more appealing candidates. Because age older than 50 years is not a formal indication for the seemingly “asymptomatic” patient, many of those patients who potentially have the most to gain are not offered surgical intervention. To evaluate the safety and efficacy of

outpatient minimally invasive parathyroidectomy (MIP) for PHPT in elderly patients, we retrospectively reviewed the procedure in patients 70 years of age and older (elderly) and compared it with the same procedure in their younger counterparts.

METHODS

This study was approved by the Institutional Review Board at The University of Texas, MD Anderson Cancer Center. A prospectively gathered endocrine surgery database was queried to identify patients who had undergone parathyroidectomy from January 2005 to December 2007, and the resulting data were retrospectively reviewed.

All patients underwent parathyroidectomy by a fellowship-trained endocrine/oncologic surgeon at MD Anderson. PHPT was biochemically confirmed before surgery and patients were scheduled for MIP based on symptoms or according to guidelines for surgical intervention in asymptomatic PHPT. Preoperative planning included imaging as described in previous publications from our institution.¹⁴ The standard procedure included general or laryngeal mask anesthesia, a 2-cm incision, gland removal, IOPTH monitoring, and a 4- to 6-hour observation period before discharge. A patient was discharged the same day after tolerating a diet, ambulating, if the patient’s pain was controlled, the dressing was dry, and an adult was present to accompany the patient home safely. An overnight stay was mandatory in cases of reoperation for persistent or recurrent disease or after standard cervical exploration. Additionally, if the procedure ended late in the afternoon and the observation period extended into the evening, patients were kept overnight.

Data collected included patient demographic information, preoperative biochemical values, IOPTH measures, complications, and results of postoperative biochemical studies. Based on current guidelines, osteoporosis was defined as a T-score < -2.5.²⁶ Patients were divided into two cohorts for comparison: patients 70 years of age and older were included in the elderly cohort, and patients 18 to 69 years of age were included in the younger cohort.

The Wilcoxon rank sum test was used to compare preoperative creatinine and parathyroid hormone levels and bone mineral density (BMD) between the two cohorts. The Pearson chi-square test was used to compare the incidence of multigland disease between the two cohorts and Fisher’s exact test was used to compare postoperative complication rates between the two cohorts. All statistical tests were two-sided, and a p value < 0.05 was considered statistically significant. Statistical analysis was performed using SPSS version 12.0 (SPSS Inc).

RESULTS

From January 2005 to December 2007, 388 patients with PHPT underwent parathyroidectomy at MD Anderson. One hundred one patients were 70 years of age or older (mean age at time of operation, 75.9 years), and 287 were 18 to 69 years old (mean age, 53.8 years; $p < 0.0001$). The mean preoperative serum calcium level was 10.7 mg/dL for the elderly cohort and 10.6 mg/dL for the younger cohort ($p = 0.67$). Ten percent (8 of 79) of the elderly cohort and 26% (60 of 227) of the younger cohort had a 24-hour urine calcium of ≥ 400 mg. The elderly cohort had a significantly higher preoperative median creatinine (2.0 mg/dL) compared with the younger group (1.0 mg/dL; $p = 0.002$).

In the elderly cohort, 58% (51 of 88) had a documented BMD T-score of < -2.5 at one or more sites, and 22% (19 of 88) had a BMD T-score < -2.5 at more than one site. Only 23% (53 of 231) of the younger cohort had a BMD T-score of < -2.5 documented at one or more sites, and only 4% (9 of 231) had a documented BMD T-score of < -2.5 at more than one site. The elderly also had a worse median BMD T-score of -2.5 versus -1.8 in the younger cohort ($p < 0.001$). The most common site of osteoporosis overall and in each cohort was in the lumbar spine (Table 1).

Among the 101 elderly patients who had parathyroidectomy, 10 had concomitant thyroid surgery, so MIP was planned for 91 patients with PHPT. The majority (79.2%) of elderly patients had a solitary gland removed through a minimally invasive approach.

Multiple glands were resected in cases of discordant imaging and in patients with multiple gland disease; rates of multiple gland removal were similar between the elderly (31.4%) and younger (23.5%) cohorts ($p = 0.145$). The mean overall IOPTH drop was 80.6%. Reoperation for persistent and recurrent accounted for 15% ($n = 15.3$) and 17% ($n = 16.8$) of patients for the younger and older cohorts, respectively ($p = 0.415$). The majority (83.2%) of elderly patients had longterm followup (≥ 6 months). The cure rates, with a normal serum calcium (≤ 10.2 mg/dL) at longterm followup, were 96.4% (80 of 83) and 98.2% (228 of 232) in the elderly and younger cohorts, respectively ($p = 0.385$).

The rate of postoperative complications was low overall for both the elderly (5.9%) and younger cohorts (3.5%; $p = 0.38$). Overall, 31.2% (5 of 16) of complications were in patients undergoing reoperative parathyroidectomy; 60% (3 of 5) of these patients also had a history of earlier cervical irradiation.

Sixty-one of the 78 (78.2%) elderly patients who underwent MIP alone were discharged the same day as their operation. The average length of stay was 0.63 and 0.70 days for the elderly and younger cohorts, respectively ($p = 0.71$).

DISCUSSION

The number of elderly patients with multiple comorbidities causing greater operative risks will increase as the life expectancy of the general population increases. In the past, surgeons have been less inclined to operate on many elderly PHPT patients because of the risks associated with standard cervical exploration, general anesthesia, endotracheal intubation, an inpatient hospital stay of 1 to 3 days, and uncertainty about the improvement in quality of life that could be anticipated. Older patients with PHPT, as a consequence of such precautions, are often not even referred for surgical evaluation by their primary care physicians because of the assumption that operative intervention would not be an option. But we found MIP by a directed approach to be safe and curative.

The psychiatric and neurocognitive manifestations of PHPT are additional factors that must be taken into account in the surgical evaluation of elderly PHPT patients. These signs and symptoms may be masked by, or attributed to, another cause, including dementia. But many of these symptoms may improve or even resolve after surgical extirpation of the disease.²⁷⁻²⁹ Elderly patients with PHPT are also at an increased risk for fractures,³⁰ which can cause substantial morbidity and even death, especially in those who are frail.³¹ Additionally, because the progression of PHPT is not predictable, nonoperative management of PHPT requires life-long monitoring to screen for disease progression, which can present as a hypercalcemic crisis.³²

Many patients with osteoporosis and osteopenia decrease their risk of fracture and experience improved bone

Table 1. Clinical and Demographic Data for this Series of Patients with Primary Hyperparathyroidism

Variable	Elderly (n = 101)	Young (n = 287)	p Value
Age, y	75.9	53.8	< 0.0001
Preoperative calcium, mg/dL	10.7	10.6	0.67
Median creatinine, mg/dL	2.0	1.0	0.002
Median T-score	-2.5	-1.8	< 0.001
Complications, %	5.9	3.7	0.40

Groups divided by age 70 years and older (elderly); 69 years and younger (young).

health after parathyroidectomy.² Although medical therapy exists for the decreased BMD caused by PHPT, surgical therapy is definitive and can often offer better results.³³ Given the association between poor physical function, falls, fractures, and frailty, more research should be directed at determining whether surgical treatment of PHPT can improve frailty.

Previous studies have shown that parathyroidectomy today can be performed as safely in elderly patients as in their younger counterparts.³⁴ Chen and colleagues³⁴ demonstrated 10 years ago that parathyroidectomy by standard cervical exploration in their elderly (70 years of age or older) population was associated with cure and morbidity rates statistically no different from those of their younger counterparts. They also reported only a 5.6% complication rate in elderly patients (one case of transient hypocalcemia and one case of deep venous thrombosis). Subsequently, Irvin and Carneiro³⁵ published their report of a series of 34 elderly patients (75 years of age or older) who underwent "limited" parathyroidectomy. The majority of their patients were discharged home after an overnight stay. More recently, Egan and associates³⁶ described their experience with parathyroidectomy in elderly patients (80 years of age or older). Despite the presence of multiple comorbidities, their patients underwent parathyroidectomy with minimal morbidity (4%) and 0% mortality, and 50% were discharged the same day.

In this study, we present our cohort of elderly patients who underwent outpatient MIP. A majority of patients were discharged on the same day as their operation, decreasing their exposure to hospital conditions associated with an increased risk of complications.³⁷⁻⁴¹ There is potential benefit in quickly returning elderly patients to the familiar milieu of their home. This minimizes the risk of confusion and delirium from lack of sleep, which frequently happens in the hospital setting. By systematically adhering to strict guidelines for same-day discharge, we have proved that MIP can be performed safely with few complications.

The complications in this series were recognized and treated without compromise and only one had longterm sequelae. These pneumothoraces all occurred in patients whose procedures were performed under moderate sedation with local anesthesia. In these patients, the pneumothoraces were attributed to increased intrathoracic pressure against a closed glottis after cough. The pneumothoraces all occurred in the first 2 years of the study; after noting this trend, this method of anesthesia was discontinued in our group. No pneumothoraces oc-

curred in the subsequent (third) year of our study. The disappearance of this complication after this change supports our hypothesis that the pneumothoraces were from barotrauma during the procedure.⁴² Our tertiary care practice includes a relatively high volume of reoperative parathyroid surgery. In this respect our practice is somewhat unusual. The challenges associated with reoperative parathyroidectomy (especially postoperative scarring) likely contributed to the observation that six of the complications in our series occurred in patients who had previously undergone parathyroid surgery, earlier neck irradiation, or both.

Despite continued evidence of the safety of MIP, elderly patients with PHPT had more advanced bone and renal disease at the time of surgical referral than younger patients in our study, as in previous studies. This impairment is not merely a function of natural aging because previous studies have demonstrated that bone density and renal function can return to normal after surgical treatment of PHPT. In addition, patients can experience an improvement in quality of life and psychiatric symptoms.^{20,21,23,27,28,43} So it is likely that the elderly patients in our series were referred later (after their disease had progressed) because of age alone.

Evidence from our large series of elderly patients with PHPT who underwent MIP supports early referral for surgical intervention, and provides evidence against denying elderly patients surgical treatment for PHPT. This is particularly relevant with the current trend in the US toward an increasingly elderly population and an increasing population of elderly patients with PHPT. Minimally invasive parathyroidectomy in this patient population, along with standardized criteria for same-day discharge, was a safe procedure with few associated risks because of the combination of modern preoperative imaging, advances in surgical technique, and advances in anesthesia care. We recommend expedited surgical referral for PHPT in all patients regardless of age.

Author Contributions

Study conception and design: Perrier

Acquisition of data: Shin, Kee

Analysis and interpretation of data: Holmes, Bao, Potylchansky, Evans

Drafting of manuscript: Shin, Holmes, Jimenez, Perrier

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