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Original Research Article

Effect of open minimally invasive parathyroidectomy in the management of primary hyperparathyroidism

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ABSTRACT

Background: To compare the patients who underwent open minimally invasive parathyroidectomy (OMIP) and conventional surgical approach for primary hyperparathyroidism.
Methods: 50 patients with documented primary hyperparathyroidism who underwent surgery by single surgeon, 25 patients who underwent more conventional neck exploration for parathyroidectomy were chosen to match the OMIP patients. Patient demographics, preoperative calcium and parathyroid hormone levels, operative time, total time in the operating room, time in the recovery room, complications, hospital charges for the operating room, and total hospital charges were analyzed.
Results: There was no statistical difference in demographics between the groups. By definition, all patients in the OMIP group and control group are of primary hyperparathyroidism. Mild hypercalcemia in both groups, only 16% of patients in the OMIP group and only 12% in the standard group were considered asymptomatic. The three most common presentations in both groups were fatigue (52% in the OMIP group, 60% in the standard group), renal stones (36% OMIP, 40% standard) and decreased bone density (48% OMIP, 52% standard). Operative time, total time in the operating room, and time in the recovery room were all significantly decreased in the OMIP group. No specific complications observed in both groups. Length of hospital stay and hospital charges are very much significant in both groups. OMIP group has less hospital stay and cost effective.
Conclusions: OMIP technique resulted in excellent cure rates for primary hyperparathyroidism while simultaneously decreasing operative time and hospital stays. These resulted in significant cost reductions without compromising patient safety.

Keywords: Hyperparathyroidism, Hypercalcemia

INTRODUCTION

Primary hyperparathyroidism (PHPT) in India, unlike in the Western world, is largely asymptomatic disease. In Indian series, females were commonly affected (1.7: 1, F:M). 71.5% of the cases were less than 40 yrs of age whereas patients from developed nations are diagnosed in the fifth and sixth decades. The mean duration of symptoms was from months which indicate the delay in diagnosis.[1,2] Surgical approach has ranged from bilateral conventional neck exploration and unilateral neck exploration to focused parathyroidectomy. Focused parathyroidectomy was reported in 38% of cases from one of the centers.

Unilateral focused open exploration has been generally performed only in those patients who have concordant USG findings. Recurrent PHPT has ranged from zero to 4.16% and persistent PHPT between zero and 2.7%.[3] The traditional surgical approach, honed during the past 70

years, has involved carefully exploring both sides of the central neck with the intent of identifying all four parathyroid glands. General endotracheal anaesthesia has been the preferred and usually necessary modality. Enlarged parathyroid glands that were identified were considered pathologic and were then removed; however, surgical judgment and experience played a major role in the assessment and management of these presumably abnormal glands. Experienced surgeons have reported 97% to 99% cure rates using this standard approach.

Minimally invasive parathyroidectomy (MIP) has recently replaced the gold standard of bilateral neck exploration (BNE) in the surgical treatment of most patients with sporadic primary hyperparathyroidism (pHPT).[4,5] Minimally invasive parathyroidectomy focuses on resecting an image-indexed solitary parathyroid adenoma through a short skin incision, without a need for intraoperative identification and assessment of the remaining glands; intraoperative intact parathyroid hormone (IOPTH) assay is often used instead to confirm cure of the hyper parathyroid state.

Among fundamental advantages of MIP-besides better cosmetic effects and less pain-is a significant decrease in the percentage of postoperative transient hypoparathyroidism, which drops to approximately 5-10% as compared to some 20-25% following BNE, as well as complete elimination of the risk of permanent hypoparathyroidism. This results from preserving intact the blood supply of the remaining, normal parathyroid glands, which are not exposed during MIP. Many endocrine surgeons recommend that the treatment of choice for solitary parathyroid adenoma should be Udelsmann's open minimally invasive parathyroidectomy (OMIP), due to advantages in operative duration, a shorter learning curve and improved cost-effectiveness.[6,7]

The purpose of this study was to compare patients who underwent Open Minimally-Invasive Parathyroidectomy (OMIP) with conventional surgical approach for primary hyperparathyroidism.

METHODS

Twenty-five patients with primary hyperparathyroidism underwent MIP. These patients were compared with 25 additional patients with primary hyperparathyroidism who underwent more conventional bilateral or unilateral neck exploration.

The 25 patients in the standard group were selected to match the MIP patients closely. All procedures were performed by the same surgeon. The diagnosis of primary hyperparathyroidism was based on hypercalcemia documented on at least two occasions and an elevated intact parathyroid hormone level (iPTH). A confirmatory 24-hour urinary calcium excretion was also obtained in more than 50% of the patients.

In the OMIP procedures, the surgical technique relied on the method developed by Irvin and modified by Udelsmann.[6,7]

A 2-3 cm-long skin incision (a short Kocher incision) was made in the majority of patients above the jugular notch. In adenomas of the superior parathyroid or situated outside the oesophagus, the skin incision was made somewhat more superiorly, along the anterior margin of the sternocleidomastoid muscle. Having dissected laterally into layers the short muscles of the platysma, the thyroid lobe was mobilized; the adenoma was identified, resected and sent for histopathology, with the surgeon waiting for the result of IOPTH determination. Routinely, the exposure of the other parathyroid gland situated on the ipsilateral (operated on) side of the neck was avoided. The wound was closed loosely and no wound drainage was employed.

The patient can be discharged once sufficient recovery has occurred. Patients were discharged with one bottle of calcium carbonate (1,250 mg) tablets and asked to take two or three tablets daily. Patients were counseled on signs and symptoms of hypocalcemia. Most patients required only acetaminophen or nonsteroidal anti-inflammatories for pain control.

The standard surgical approach consisted of exploring at least one side of the neck under general endotracheal anaesthesia. If patients had positive preoperative scans, unilateral exploration with excision of the adenoma and visual confirmation of a normal parathyroid gland was considered an option.

Data were obtained by reviewing hospital records and charge sheets. The charge for the operative room, stay and total hospital charge for patients in the OMIP group and control group are noted. Means between groups were compared using nonpaired t tests. Data are reported as means ± standard error of the mean.

RESULTS

The OMIP group consisted of 25 patients with an average age of 56±3 years; 80% were women. No patients had undergone previous thyroid surgery, but four patients had undergone previous unsuccessful parathyroid surgery. No patients had significant radiation exposure.

The control group consisted of 25 patients with an average age of 55±3 years; 70% were women. No patients had undergone previous thyroid surgery, but four patients had undergone previous unsuccessful parathyroid surgery. One patient had significant radiation exposure. There was no statistical difference in demographics between the groups.

There was no statistical difference in demographics between the groups. By definition, all patients in the

OMIP group and control group are of primary hyperparathyroidism.

Table 1: Demographic details.

Variable	Control group	OMIP group	P- value
Age±SD in years	56±3	55±4	>0.05(NS)
Serum calcium in mg/dL	11.3±0.2	10.9±0.2	>0.05(NS)
iPTH level in pg/mL	112±13	108±8	>0.05(NS)
24-hour urinary calcium excretion in mg/day	302±25	306±28	>0.05(NS)

Table 2: Symptoms associated with primary hyperparathyroidism.

Symptoms associated	Control group	Percentage	OMIP group	Percentage
None	3	12	4	16
Renal stones	10	40	9	36
Hypertension	2	8	3	12
Decreased bone density	13	52	12	48
Fatigue	15	60	13	52
Depression	2	8	1	4
Nervousness	3	12	4	16
Ulcer disease	5	20	4	16
Cognitive	2	8	2	8
Aches	2	8	2	8

Despite the relatively mild hypercalcemia in both groups, only 16% of patients in the OMIP group and only 12% in the standard group were considered asymptomatic. The three most common presentations in both groups were fatigue (52% in the OMIP group, 60% in the standard group), renal stones (36% OMIP, 40% standard) and decreased bone density (48% OMIP, 52% standard).

Table 3: Operative data.

Operative data	Control group	OMIP group	P-Value
Operative time (minute)	116±14	71±12	<0.01
Total time in operating room (minute)	165±11	98±10	<0.001
Time in recovery room (minute)	137±10	39±10	<0.001
frozen section obtained	22	12	-

Operative time, total time in the operating room, and time in the recovery room were all significantly decreased in the OMIP group. No specific complications observed in both groups.

Table 4: Length of stay and costs of procedure.

Data	Control group	OMIP group	P-value
Average length of stay	35±7.6 hours	5±1.2 hours	<0.001
Hospital charges of			
operating room in rupees	15000	10000	<0.001
recovery room in rupees	3500	2000	<0.001
total hospital charges in rupees	22000	12000	<0.001

There were no temporary or permanent recurrent laryngeal nerve injuries in either group. In the standard group, one additional patient had two episodes of atrial fibrillation after surgery with no sequelae, and there was one case of cellulitis. Length of hospital stay and hospital charges are very much significant in both groups. OMIP group has less hospital stay and cost effective.

DISCUSSION

The OMIP technique as a curative procedure for primary hyperparathyroidism developed by Irvin and modified by Udelsmann There are two dominant features of the technique that would at first glance appear contrary to traditional surgical teachings. The first is that one makes no attempt to locate and identify all four of the parathyroid glands. The second is that most patients are discharged from the hospital the same day as the surgical procedure.

The purpose of this study was to review the first 25 consecutive OMIP procedures performed at our institution and to compare them with an equal number of patients who underwent more traditional parathyroidectomies. Our primary findings were as follows:

- OMIP can be performed safely, and most patients tolerated conscious sedation extremely well, leading to a significantly reduced hospital length of stay
- The commercially available probe could guide the line of dissection, allowing the procedure to be done expediently and with cure
- OMIP reduced operative and hospital charges by almost 50%.

It has generally been believed that in 80% of cases, primary hyperparathyroidism was due to a parathyroid adenoma of one of the four glands. Recently, Denham and Norman performed a meta-analysis based on 50 reports in the literature encompassing 6,331 patients with primary hyperparathyroidism: 87% had a single adenoma, 9% had four-gland hyperplasia, and fewer than 3% had double or triple adenomas. [8]

Since the days of Captain Martell, parathyroid glands have been notorious for being located in aberrant locations.[9,10] Hence, locating these glands can be the most significant challenge of the procedure. Failure to locate the adenoma generally leads to persistent primary hyperparathyroidism. Although no large series have reported a 100% cure rate, initial cure rates of 97% to 99% have been reported by highly experienced surgical teams.[4,5] Despite the general intent to identify all four glands, four glands were identified 44% of the time and three glands were identified in an additional 37% of the patients.[5] Thus, even in bilateral explorations for primary hyperparathyroidism by experienced parathyroid surgeons, all four glands are often not routinely identified.

Length of stay and Costs are significantly greater than for the conventional procedure, and the complication rate is not insignificant. Carty and Norton reported a 95% success rate at reoperation, with a 6.6% rate of recurrent laryngeal nerve injury and an 8.3% rate of postoperative hypocalcemia.[9] Thompson et al recently reported an 88% cure rate at reoperation, with a 13% rate of Hypocalcemia and a 0.8% incidence of nerve injury.[11] In interpreting re-operative results, we must remember that the hypoparathyroidism is most likely secondary to injury or removal of normal parathyroid glands at the initial procedure rather than to injury to normal glands at reoperation.

Recent development that has affected parathyroid surgery is the quick PTH assay, which yields a PTH determination in approximately 15 minutes. Combined with the short half-life of PTH, this allows the drop in PTH to be assessed during surgery after resection of the adenoma.[12] Combining the scan with the assay, Irvin et al and Carty et al performed unilateral explorations based on a positive scan.[13,14] Intraoperative PTH determinations were used to confirm the completeness of the procedure. However, recent data from Garner and Leight and Gordon et al suggest that the intraoperative PTH assay will not eliminate failure, despite this sophisticated approach.[15,16] We use the intraoperative PTH assay in most repeat parathyroidectomies.

The upshot is generally that the cause of the failed initial parathyroidectomy was a failure to find the single enlarged adenoma rather than failing to understand the pathophysiology. Thus, the challenge is to find the adenoma. In our experience, the quick PTH assay primarily serves to confirm that the parathyroid adenoma had been correctly located before surgery and removed. A recent report from the Mayo Clinic analysing the impact of sestamibi scanning and the intraoperative PTH assay on repeat parathyroid surgery found that neither cure rates nor surgical complication rates were significantly altered by the changes in technology.[11] Persistent multigland disease was the major cause of re-operative failure in these patients. Norman and Denham recently reported on the use of OMIP for repeat parathyroid surgery.[8] Although the series was small, the technique was highly successful and reduced the number of preoperative imaging studies obtained.

Thus, two central questions are whether the cure rates of 97% to 99% observed with careful bilateral exploration by highly experienced surgeons can be improved on, and whether such a goal should be the major focus of our efforts.[4,5] Although it is unlikely that either the OMIP or the quick PTH techniques will yield 100% cure rates in multiple large series, it is also true that cure rates of 97% to 99% probably do not reflect parathyroid surgery across the country. Thus, although a successful surgical procedure is paramount, the primary drive for unilateral exploration ultimately may center around patient convenience, perception, and costs. In the current series,

patients underwent successful surgery with only intravenous sedation and local anesthesia, and 65% of the patients could be safely discharged from the hospital within 5+1.2 hours after surgery. The early discharge reflects the relative comfort these patients have as a result of to the smaller incision, the decreased degree of dissection, and the avoidance of general anesthesia. These numbers may improve with experience.

Cost and charge data are often subject to considerable criticism. However, both groups in present study underwent their procedures during a similar time, at a single institution, by a single surgeon. Thus, broad comparisons should be valid. As such, patients undergoing OMIP had operative and total hospital charges that were only 54% of the charges submitted for patients undergoing more standard parathyroidectomy.

CONCLUSION

OMIP appears to be both safe and efficacious. The issue of whether cure rates will be increased will be answered only with multiple large series. However, the convenience of the procedure may convince many primary care physicians and endocrinologists to refer for parathyroidectomy patients with what is perceived to be minimal to moderate disease. In addition, elderly patients with primary hyperparathyroidism and symptoms such as fatigue, depression, or cognitive changes may benefit from parathyroidectomy and may be more willing to undergo such a procedure if general endotracheal anesthesia can be avoided. In any event, during the next few years, more directed approaches for parathyroid disease appear inevitable. The OMIP technique may significantly change the management of primary hyperparathyroidism.

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