

Minimally Invasive Parathyroidectomy versus Conventional Open Parathyroid Exploration for Treatment of Primary Hyperparathyroidism

Shaban M. Abdel Mageed

General Surgery Department, Faculty of Medicine, Ain Shams University

ABSTRACT

Introduction: Conventional open parathyroid exploration was the standard of care for treatment of primary hyperparathyroidism until the 1990s, when improvements in imaging techniques made limited (less than 4-gland) exploration feasible (1). Now, many centres worldwide have adopted limited parathyroid exploration as their preferred surgical approach (2-4). The underlying principle behind limited exploration is the fact that approximately 90% of individuals with primary hyperparathyroidism have only one diseased parathyroid gland (5). The challenge is then to find the diseased gland successfully prior to operation. The essential imaging techniques used to localize solitary parathyroid adenomas are parathyroid sestamibi and ultrasound. The sensitivity of each of these techniques approaches 90% in experienced hands (6, 7). Therefore, many people with primary hyperparathyroidism can be treated with Minimally Invasive Parathyroidectomy (MIP). **Aim of the work:** to compare between minimally invasive parathyroidectomy versus conventional open (4-gland) parathyroid exploration for treatment of primary hyperparathyroidism regarding surgical technique, length of operation, duration of hospitalization and recovery. **Patients and methods:** 12 patients with clinically benign parathyroid tumours were included in this study, ages ranged from 38 years to 69 years. These patients were managed over a period of 2 years. They were managed between March 2015 and March 2017 at Ain Shams university hospitals in Egypt. This prospective study included 7 males and 5 females. All patients were assessed by clinical examination and investigated by hormonal assay, computerized tomography (CT) and parathyroid sestamibi scan. 6 patients underwent minimally invasive parathyroidectomy (group A) and 6 patients underwent conventional open (4-gland) parathyroid exploration (group B). **Results:** A total of 12 patients of which 6 patients underwent a Minimally Invasive Parathyroidectomy while 6 patients had a Conventional open (4-gland) parathyroid exploration. The average age was 47.5 years (range = 38–69 years) with the male to female ratio being 7:5. There was a statistically significant increase of intraoperative time in group B (average 85.5 minutes) in comparison to group A (average 65 minutes) but no significant difference as regards intraoperative blood loss. No significant difference was found in relation to hospital stay and there were no postoperative complications in all patients and for 3 months after operation. **Conclusion:** The success of Minimally Invasive Parathyroidectomy (MIP) has been established by several studies displaying cure and complication rates that are at a minimum in comparison to those achieved by conventional 4-gland exploration. In contrast to bilateral exploration, Minimally Invasive Parathyroidectomy has been shown to be associated with significantly reduced complications.

INTRODUCTION

There are four parathyroid glands located near the thyroid gland. Each parathyroid gland is normally about the size of a grain of rice (about 3-5 millimetres in diameter and 30 - 60 milligrams in weight). Parathyroid glands release parathyroid hormone (PTH) which controls the calcium levels in the blood stream. Other areas of the body, especially the bones, kidneys and small intestine, respond to PTH by

increasing calcium levels in the blood. Calcium is very important for our bodies, especially for muscle and nerve function.

Conventional open parathyroid exploration was the standard of care for treatment of primary hyperparathyroidism until the 1990s, when improvements in imaging techniques made limited (less than 4-gland) exploration feasible (1). Now, many centres worldwide have adopted limited parathyroid exploration as their preferred surgical approach (2-4). The underlying principle behind limited exploration is the fact that

approximately 90% of individuals with primary hyperparathyroidism have only one diseased parathyroid gland (5). The challenge is then to find the diseased gland successfully prior to operation. The essential imaging techniques used to localize solitary parathyroid adenomas are parathyroid sestamibi and ultrasound. The sensitivity of each of these techniques approaches 90% in experienced hands (6, 7). Therefore, many people with primary hyperparathyroidism can be treated with Minimally Invasive Parathyroidectomy (MIP).

AIM OF THE WORK

To compare between Minimally Invasive Parathyroidectomy versus Conventional open (4-gland) parathyroid exploration for treatment of primary hyperparathyroidism regarding Surgical Technique, Length of operation, duration of hospitalization and recovery

PATIENT AND METHOD

In this prospective study, 12 patients with clinically benign parotid tumours were included in this study, ages ranged from 38 years to 69 years. These patients were managed over a period of 2 years. They were managed Between March 2015 and March 2017 at Ain Shams university hospitals in Egypt. This prospective study included 7 males and 5 females. All patients were assessed by clinical examination and investigated by serum calcium, serum phosphorus, serum chloride, alkaline phosphatase, parathyroid hormone assay, Computerized tomography (CT), parathyroid sestamibi. 6 patients underwent Minimally Invasive Parathyroidectomy (group A) and 6 patients underwent Conventional open (4-gland) parathyroid exploration (group B). All operations were done under general anaesthesia. Patients with Previous neck irradiation therapy, suspected multiglandular disease, Parathyroid carcinoma, Equivocal localization studies, Family history of MEN and Concomitant thyroid pathology were excluded from our study.

Surgical technique: A focused parathyroidectomy, performed through a small incision (2.5-5 cm) central or lateral (over the site of the adenoma overlying the anterior border of

the sternocleidomastoid muscle), guided by preoperative localization (figure 1,2,3).



Figure 1: transverse small incision



Figure 2: dissection of the adenoma



Figure 3: excision of the adenoma

RESULTS

In our study, A total of 12 patients underwent Parathyroidectomy of which 6 patients (50%) underwent a Minimally Invasive Parathyroidectomy (Group A) while 6 patients (50%) had a Conventional open (4-gland) parathyroid exploration (Group B). The average age in our study was 47.5 years (range 38–69 years) with the male to female ratio being 7:5 which was statistically insignificant between both groups. The indication in all patients was adenoma. As regard the intraoperative data, there

was statistically significant increase of intraoperative time in group B (average 85.5 minutes) in comparison to group A (average 65 minutes) but no significant deference as regard the intraoperative blood loss. Also, as expected more number of parathyroid glands were identified in group B versus group A due to better exposure and accessibility. No significant deference was found in relation to hospital stay and there were no postoperative complications in all patients for 3 months follow up after operation. Data was summarized in table 1.

Table 1: Comparison of preoperative, intraoperative and post-operatedata between the two groups.

	Group A	Group B	p value
Number of patients	6(50%)	6(50%)	
Age	47.5(38-66)	49.5(39-69)	0.122(ns)
Male: Female	4:2	3:3	0.980(ns)
Operative time (min.)	65 (50-80)	85.5 (75-100)	0.044(s)
Blood loss(ml)	25(20-30)	30(20-40)	0.065(ns)
No of parathyroid glands identified	1-2	2-3	0.013(s)
Hospital stay	1-2	1-2	1.000(ns)

DISCUSSION

A focused parathyroidectomy was performed through a small incision (2.5-5 cm) central or lateraloverlying the anterior border of the sternocleidomastoid muscle, (over the site of the adenoma).Open Minimally-Invasive Parathyroidectomy (MIP) is the most commonly used minimally-invasive procedures^(8,9), guided by preoperative localization studies .the surgeon performed ultrasonography and intraoperative parathyroid hormone assay (IOPTH)⁽¹⁰⁾, is the most attractive and widely-utilized technique for the surgical treatment of primary hyperparathyroidism. it appears easy to learn and reproduce in different surgical settings, it can be performed under general anaesthesia or loco-regional anaesthesia, with reduced operative time and as a short stay procedure. The main limitation of the different Open Minimally-Invasive Parathyroidectomy techniques resides in the potentially poor visualization of neck structures, due to the small size of the skin incision, or conversely, the need for larger skin incision when compared with video-assisted and/or endoscopic

techniques^(11,12). Since coexistent thyroid nodular disease is relatively common, associated thyroidsurgery can also be performed.

Dr.Yeh has had direct, hands-on experience with almost all the Minimally-Invasive Parathyroidectomy techniques listed above^(7,13,14). Other Research studies suggest that the various techniques all offer a similarly high success rate (>98%) and low complication rate (about 1%) when performed by experienced surgeons^(15,16). the focused lateral mini-incision technique first described by Delbridge and associates in 2002, which involves an incision length of 1.5-2.0 cm (about ¾ in)^(17,18,19). this technique provides the most direct access to the parathyroid glands, minimizes tissue injury, and has superior cosmetic results.

The average operating time is 17 minutes, with 90% of operations being completed in less than 30 minutes. The shortest operation performed lasted 6 minutes, consistent with previously published reports using this technique^(20,21,22). Though we value efficiency, we do not necessarily equate fast surgery with good surgery. Patient safety is our priority. Ultimately, our

operations take as long as necessary to complete in a safe and meticulous manner.

CONCLUSION

The success of Minimally Invasive Parathyroidectomy (MIP). has been established by several studies displaying cure and complication rates that are at a minimum in comparison to those achieved by conventional 4-gland exploration. In contrast to bilateral exploration, Minimally Invasive Parathyroidectomy has been shown to be associated with significantly reduced complications

Disclosure:

This article is not sponsored by any company, so the authors have no competing interests as defined by Nature Publishing Group, or other interests that might be perceived to influence the results and/or discussion reported in this article.

REFERENCES

1. Sackett WR, Barraclough B, Reeve TS, and Delbridge LW. Worldwide trends in the surgical treatment of primary hyperparathyroidism in the era of minimally invasive parathyroidectomy. *Arch Surg.* 2002;137(9):1055-9.
2. Lee JA, Inabnet WB, 3rd. The surgeon's armamentarium to the surgical treatment of primary hyperparathyroidism. *J Surg Oncol.* 2005;89(3):130-5.
3. O. Hessman, J. Westerdahl, N. Al-Suliman, P. Christiansen, P. Hellman, and A. Bergenfelz, "Randomized clinical trial comparing open with video-assisted minimally invasive parathyroid surgery for primary hyperparathyroidism," *British Journal of Surgery.* 2010; vol. 97, no. 2, pp. 177-184.
4. Udelsman R. Six hundred fifty-six consecutive explorations for primary hyperparathyroidism. *Ann Surg.* 2002;235(5):665-70; discussion 670-2.
5. Sosa JA and Udelsman R. Minimally invasive parathyroidectomy. *Surg Oncol.* 2003;12(2):125-34.
6. Perrier ND, Ituarte PH and Morita E Parathyroid surgery: separating promise from reality. *J Clin Endocrinol Metab.* 2002;87(3):1024-9.
7. Kelly CW, Eng CY and Quraishi MS. Open mini-incision parathyroidectomy for solitary parathyroid adenoma. *Eur Arch Otorhinolaryngo.* 2014; 271: 555-560.
8. Brunaud L, Zarnegar R, Wada N, Ituarte P, Clark OH and Duh QY. Incision length for standard thyroidectomy and parathyroidectomy: when is it minimally invasive? *Arch Surg.* 2003;138(10):1140-3.
9. Agarwal G, Barraclough BH, Reeve TS and Delbridge LW. Minimally invasive parathyroidectomy using the 'focused' lateral approach. II. Surgical technique. *ANZ J Surg.* 2002;72(2):147-51.
10. Beldi G, Kinsbergen T and Schlumpf R. Evaluation of intraoperative recurrent nerve monitoring in thyroid surgery. *World J Surg.* 2004;28(6):589-91.
11. Inabnet WB, 3rd, Kim CK, Haber RS and Lopchinsky RA. Radioguidance is not necessary during parathyroidectomy. *Arch Surg.* 2002;137(8):967-70.
12. Palazzo FF and Delbridge LW. Minimal-access/minimally invasive parathyroidectomy for primary hyperparathyroidism. *Surg Clin North Am.* 2004;84(3):717-34.
13. Agarwal G, Barraclough BH, Robinson BG, Reeve TS and Delbridge LW. Minimally invasive parathyroidectomy using the 'focused' lateral approach. I. Results of the first 100 consecutive cases. *ANZ J Surg.* 2002;72(2):100-4.
14. Senchenkov A and Staren ED. Ultrasound in head and neck surgery: thyroid, parathyroid, and cervical lymph nodes. *Surg Clin North Am.* 2004;84(4):973-1000, v.
15. Kell MR, Sweeney KJ, Moran CJ, Flanagan F, Kerin MJ and Gorey TF. Minimally invasive parathyroidectomy with operative ultrasound localization of the adenoma. *Surg Endosc.* 2004;18(7):1097-8.
16. Solorzano CC, Lee TM, Ramirez MC, Carneiro DM and Irvin GL. Surgeon-performed ultrasound improves localization of abnormal parathyroid glands. *Am Surg.* 2005;71(7):557-62; discussion 562-3.
17. Van Husen R and Kim LT. Accuracy of surgeon-performed ultrasound in parathyroid localization. *World J Surg.* 2004;28(11):1122-6.
18. Carneiro DM, Solorzano CC, Nader MC, Ramirez M and Irvin GL, 3rd. Comparison of

- intraoperative iPTH assay (QPTH) criteria in guiding parathyroidectomy: which criterion is the most accurate? *Surgery*. 2003;134(6):973-9; discussion 979-81.
19. K. Sugino, K. Ito and M. Nagahama , "Minimally invasive surgery for primary hyperparathyroidism with or without intraoperative parathyroid hormone monitoring," *Endocrine Journal*. 2010; vol. 57, no. 11, pp. 953–958, View at Publisher ·
20. M.M. Krausz, S. Ish-Shalom, and A. Ofer, "Minimally invasive parathyroidectomy for treatment of primary hyperparathyroidism caused by parathyroid adenoma," *Harefuah*. 2010; vol. 149, no. 6, pp. 353–356, 404.
21. A. I. Sevinç, Z. S. Dericı and R. Bekiř, "Success of minimally invasive single-gland exploration using the quick intraoperative parathyroid assay," *ActaChirurgicaBelgica*. 2010; vol. 110, no. 4, pp. 463–466.
-