

Giant Parathyroid Adenoma Excised through Endoscopic Trans-Axillary Parathyroidectomy; A Case Report with Literature Review

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Abstract

Large parathyroid adenomas comprise 1.5% of all adenomas. While minimally invasive parathyroidectomy is the method of choice with established advantages, surgeons prefer open surgery for large adenomas to reduce surgical risks. Here, we present a 41-year-old male with primary hyperparathyroidism due to a large parathyroid adenoma (3.2 cm) that was removed successfully by endoscopic trans-axillary parathyroidectomy. This presentation can guide surgeons to choose this minimally invasive technique, even for large adenomas.

Keywords: Parathyroid Neoplasms; Parathyroid Neoplasms; Parathyroidectomy; Endoscopic Parathyroidectomy

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Introduction

Primary hyperparathyroidism is the most common cause of hypercalcemia in outpatient settings. Parathyroid adenomas are the underlying pathology in about 85% of cases, while hyperplasia and rare parathyroid carcinoma are other, less frequent pathologies. A normal parathyroid gland weighs approximately 50-70 mg and is about 0.5 cm in size [1]. Parathyroid adenomas (PTAs), on the other hand, are >1 cm but usually <2 cm and weigh <1 g [2]. Giant parathyroid adenomas (GPTAs) are mostly defined as adenomas larger than 2.5-3 cm, weighing >3.5 grams, while up to 110 g GPTA is reported in the literature [3].

Traditionally, parathyroidectomy was performed through bilateral cervical exploration, and efforts were made to inspect and evaluate all parathyroid glands and resect as many of them as necessary. With the advances of pre-operative localization studies, more expertise in sonographic evaluation, Sestamibi (MIBI) scans and sometimes 4-D CT scans, it is now possible to localize the pathologic parathyroid adenoma in many cases more accurately

and perform a minimally invasive parathyroidectomy (MIP), which could be done transcervically through a smaller incision, endoscopically assisted, or totally endoscopic.

Surgical removal is the mainstay of treatment in PTA, preferably performed by minimally invasive surgery (MIS), which has several advantages, including fewer complications and blood loss, shorter hospitalization and rapid recovery, shorter duration of surgery, and better cosmetic outcomes, resulting in higher patient satisfaction [4]. These methods include small incision (endoscopic or with video-assisted techniques) on the neck midline or lateral, or an ectopically placed incision in an extra-cervical region [5], like the endoscopic axillary approach with favorable cosmetic outcomes, hiding the scar under the armpit.

As the axillary approach is more difficult for the surgeon, visualization is poor, and the duration of surgery is longer, it is performed only for specific indications, including adenomatous goiter or follicle nodule (<6 cm), Graves' disease, low-risk papillary microcarcinomas (<15 mm), and neck scar. But small incisions are potentially difficult during endoscopic

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and video-assisted approaches and can result in capsule rupture with the risk of parathyromatosis [6], and the axillary approach has the potential benefit of excising large tumors [5], considered safe for selected patients with large parathyroid tumors [7] and adenomas [8]. This is while clinical observations show that large incisions on the neck are mainly practiced for large PTA in the real world [9-13]. Therefore, we selected endoscopic trans-axillary parathyroidectomy in a patient presenting with a large PTA (3.2 cm); the favorable results suggested the applicability of this surgical method for large and giant PTA.

To the best of our knowledge, there is only one other report of a GPTA resected by endoscopic method, in which a robotic-assisted technique has been used.

Case presentation

The patient was a 41-year-old Caucasian male who was referred to the endocrine surgery clinic with weakness, nausea, vomiting, and polyuria in the past three months. He did not complain of any other symptoms, nor did he mention any previous medical conditions. Physical examination demonstrated a healthy young man; a firm lesion located among the left thyroid lobe was palpable. There were no signs of lymphadenopathy, tachycardia, diaphoresis, or any signs of thyroid function abnormalities. He had

undergone a series of laboratory evaluations. Thyroid function tests were within normal limits. PTH and calcium levels were elevated (Table 1).

According to the biochemical diagnosis of primary hyperparathyroidism, the patient was subjected to additional investigations to localize the lesion. A Tc-99m sestamibi scan revealed a large lower left parathyroid adenoma (Figure 1) consistent with the ultrasound finding of a 25 mm hypoechoic lesion adjacent to the left thyroid lobe without any signs of invasion to the thyroid lobe or other structures (Figure 2).

The patient was scheduled for minimally invasive endoscopic transaxillary parathyroidectomy, performed with 3 ports (10 mm, 5 mm, 5 mm) by an experienced endocrine surgeon (Figure 3 A, B, and C). First, a small incision was made parallel to the mid-clavicular line 5 cm below the clavicle to accommodate a 10-mm port through which a 0-degree telescope was placed. The subcutaneous space was then insufflated with carbon dioxide gas to a pressure of 8 mmHg, after which the camera was inserted (Figure 3). Under direct visualization, two 5-mm trocars were placed medially and laterally to the first incision. Over the clavicle, through the sternal and clavicular heads of the sternocleidomastoid muscle, beyond the carotid artery, the left thyroid lobe was exposed and elevated, and the recurrent laryngeal nerve was explored. A large lower left parathyroid

Table 1: Patient's laboratory data

Outpatient	WBC count	8.6 ($\times 10^3/\mu\text{l}$)	PTH	900 (pg/mL)
	Hemoglobin	11.8 (gr/dl)	Calcium	13.7 (mg/dL)
	Platelet count	219 ($\times 10^3/\mu\text{l}$)	Phosphorus	1.6 (mg/dL)
			24-hours Urine Calcium	400 (mg/day)

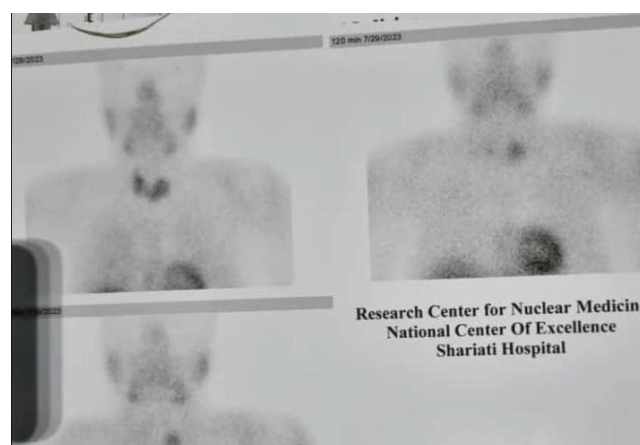


Figure 1: Sestamibi scan showing a "hot spot" compatible with left inferior parathyroid adenoma.



Figure 2: Pre-operative sonography shows a large parathyroid mass.

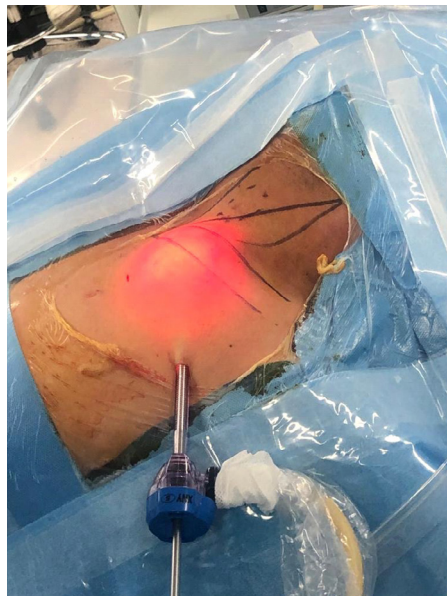


Figure 3: endoscopic approach via an anterior axillary trocar placement

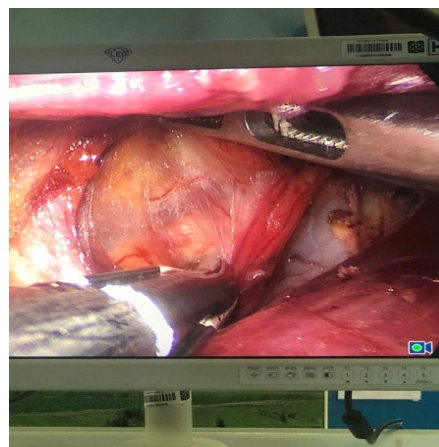


Figure 4: Surgical view of endoscopic parathyroidectomy via an anterior axillary approach (Note the Common Carotid artery (*), Recurrent Laryngeal Nerve (**))



Figure 5: Giant Parathyroid Adenoma

adenoma was observed in close relation with the left thyroid lobe. There were no signs of invasion to other structures. It was gently dissected from the thyroid and removed from the 10-mm trocar site after vascular ligation. No complications were seen intra-operatively. Intra-operative PTH at 0 minutes was 358 pg/ml, and at 10 minutes after excision, it was 39 pg/ml. The excised specimen was a 3.2 cm lesion, which was confirmed by frozen section to be an “abnormally enlarged parathyroid tissue,” weighing 14 grams. No drains were needed as hemostasis seemed to be fine. The duration of surgery was about one hour, and the patient was transferred to the surgery ward after becoming stable in the recovery room. The postoperative day was uneventful, and the patient was discharged from the hospital in good condition with a prescription of 4 mg of calcium carbonate and 0.5 mcg of Rocaltrol daily, which were subsequently tapered. The follow-up of the patient was clear without any subjective problems.

Discussion

Parathyroid adenomas rarely present with a palpable neck mass. A palpable anterior neck lesion in the setting of primary hyperparathyroidism is usually thought to be a thyroid nodule, and if a parathyroid gland has become so large that it could be palpated during physical examination, it may indicate a parathyroid carcinoma, especially with a concurrent serum Ca level of 14 mg/dl or more, and increased PTH levels more than five times the normal upper limit [6]. GPTAs are rare parathyroid tumors described as parathyroid adenomas weighing more than 3.5 g.

Primary hyperparathyroidism is generally discovered when asymptomatic, but it may present with symptoms such as flank pain due to renal stones, bone pain, gastrointestinal symptoms

such as dyspepsia, nausea or vomiting, or psychic abnormalities such as mood instability or anxiety [7].

Our patient was a 41-year-old male presenting to the clinic with nothing other than nausea, vomiting, polyuria, and weakness. His palpable anterior neck mass, compatible with the initial sonographic examination compatible with a left lobe thyroid nodule, had made him a candidate for FNA evaluation; but further serologic assessments revealed hypercalcemia (serum Ca level 13.7 mg/dl), hypophosphatemia (serum P level 1.6 mg/dl), hypercalciuria (24-hour urine phosphorus 400 mg/day), and an elevated PTH level (900 pg/ml). As stated before, high serum Ca and PTH levels, along with a palpable anterior neck mass, could have been suggestive of parathyroid carcinoma.

Further localization studies: MIBI scan confirmed a hot lesion in the lower pole of the left thyroid lobe, concordant with the lesion reported in the initial sonography report. As the diagnosis of primary hyperparathyroidism was confirmed, and a CaPTHUS score of 5, indicating monoglandular disease, an anterior thoracic endoscopic parathyroidectomy was planned. Intraoperatively, no signs of invasion, indicating malignancy, were observed, and parathyroidectomy was performed without any complications. A significant decrease in PTH level, along with the intraoperative pathologic report of an abnormally enlarged parathyroid tissue, confirmed the adequacy of treatment.

This report underlines the efficacy and precision of CaPTHUS score in predicting a mono-glandular disease and possibility of MIP in these scenarios. While a palpable neck mass in setting of hyperthyroidism and high serum Ca and PTH levels may indicate parathyroid carcinoma, benign pathologies such as a GPTA should be kept in mind as well. As more experience is being gained in endoscopic thyroid and parathyroid surgeries, endoscopic parathyroidectomy

seems to be perfectly safe in most cases of GPTAs.

After the introduction of MIS techniques, small incisions on the neck using endoscopic and video-assisted approaches have been widely used; however, large adenomas cannot be excised by a 2-cm incision, and larger incisions increase the risk of complications [6]. Here, we presented successful extraction of a large PTA through the trans-axillary method, which suggested the applicability of this method for large parathyroid lesions.

Previous reports have shown the successful use of trans-axillary (robotic) parathyroidectomy in patients with PTA [14,15] and have concluded the superiority of the improved cosmesis vs. the length of surgery [16], which is in line with the outcome we obtained. Some argue that trans-axillary and other extra-cervical methods are not minimally invasive, as they require extensive dissection of several tissues, compared to the small incision on the neck [6]. However, the few complications reported in the literature suggest this method is a safe and efficient method; the complications can also be minimized

when the surgery is performed by the hands of an experienced surgeon; proficiency is obtainable after fewer than 15 surgeries [17].

The appropriateness of this surgical method (and other MIS techniques) is questioned when it comes to large or giant PTA. A study on 47 patients with giant PTA showed a mean weight of 9 g (3.5–20) for MIS (N = 27) and 23 g (3.6–49) for open parathyroidectomy (N = 20), which shows that surgeons tend to choose MIS only for small PTAs [7]. Based on our literature review, few surgeons have chosen MIS for giant PTA, and only one study practiced robotic-assisted trans-axillary parathyroidectomy for a large adenoma [18]. Small neck incisions, considered as “minimally invasive parathyroidectomy,” were used with a 2-cm neck incision, performed for a 3 × 2-cm PTA [19] and also for a 4-cm left collar neck incision for a 6.5 × 3 × 1.5-cm mediastinal PTA [20]. Therefore, it is required to determine the definition of MIS in parathyroidectomy more accurately. In Table 2, we gathered some of the case reports that reported the course of diagnosis and treatment of giant PTA for a

Table 2: A summary of the medical information of patients with single giant parathyroid adenoma undergoing surgery

N.	Age	Sex	Adenoma size (cm)	Adenoma weight (g)	Type of surgery	Outcome	Follow-up
1(18)	48	F	3.5×2.5×1.6	NR	Robotic-assisted trans-axillary	Discharged after 1d	Eucalcemic after 12 months, no recurrence
2(19)	42	F	3×2	NR	Small neck incision (2 cm)	Discharged after 1d	No symptoms after 3 months
3(9)	48	M	9×6×4	122	large collar neck incision (12 cm)	Discharged after 3d	Eventless after 12 months,
4(12)	64	M	3.2×2.2×1.5	5.3	right hemithyroidectomy and complete parathyroidectomy	Developed HBS, discharged after 11d	NR
5(10)	53	F	4×2.5×1.5	7.7	Focused neck exploration	Discharged after 2d	No recurrence after 3 years
6(11)	47	F	5.5×3.5×2	30	Collar neck incision	Discharged after 4d	Serum calcium: 8.7mg/dl after one month
7(13)	21	F	80×55×30	59	level VI neck dissection for right thyroid lobectomy and parathyroidectomy,	HBS on day3, discharged on d3	Asymptomatic after 1-year, normal serum level of calcium and PTH
8(23)	40s	M	5.0×3×3 (cystic)	NR	Right partial parathyroidectomy	Normal of calcium and PTH after 4d	NR
9(23)	60s	F	4.3×3.2×6.3 (on ultrasound; cystic)		Surgical resection of left parathyroid adenoma and thyroidectomy	Normal of calcium and PTH after 2d	NR
10(24)	57	M	5×3×2	30.6	Bilateral neck exploration	Developed HBS, discharged after 14d	Uneventful after 1 year
11(24)	60	F	5.5×4×3	35.2	Neck exploration	Developed HBS, discharged after 14d	Normal calcium, phosphorus, and PTH after 9 months
12(24)	33	F	Huge cystic	NR	Bilateral neck exploration	Discharged after 5d	Normal calcium, phosphorus, and PTH after 3 months
13(22)	85	F	8×5×3.5	110	Unilateral neck exploration	NR	NR

Abbreviations: NR; not reported, d: day(s), PTH; parathyroid hormone, HBS; hungry bone syndrome

general overview about the subject, while a complete review has been presented on 61 cases previously [21].

It is notable that only a lower limit is defined for giant PTA, and a quick overview of the table shows that the majority are about 3 to 5 cm [12]; our experience, in addition to that reported by Katz and colleagues [18], shows the applicability of trans-axillary parathyroidectomy for 3-cm PTA. This is while rarely giant PTAs are reported to be larger than 8 cm [9,22], for which open technique may be the only possible option. We suppose that 3 cm is safe for the axillary approach; but more studies are required to establish the maximum size that can be successfully excised by MIS techniques.

The difference in the clinical features that need to be considered in patients with large or giant PTA has been highlighted in reviews and studies on large numbers of patients. In a study comparing 300 patients with giant PTA (>3.5 g) with 285 non-giant PTA, a higher serum level of calcium was observed in the giant group before surgery, with fewer symptoms of hyperparathyroidism, but a higher risk of postoperative hypocalcemia [25]. Unfortunately, the type of surgical approach has not been outlined in this large study; also, some of the case reports have missed mentioning the exact type of surgery performed for resection of the giant PTA and have only mentioned parathyroidectomy [12,23], while mentioning the details of surgery in this rare disease can help researchers and physicians in future clinical anticipations. Similarly, the type of MIS has not been outlined in some case reports, and the type of surgery has been only mentioned as minimally invasive parathyroidectomy [26]. Even the review of 61 cases with giant PTA has not focused on the type of surgery and has only mentioned it in the table, not in the results subtitles or discussion. However, their table also shows very few procedures performed by MIS technique [21]. Apparently, the type of surgery is one of the aspects with scant evidence on, especially when MIS techniques are discussed for giant PTA. The trans-axillary approach is known as a beneficial method for PTAs; however, its applicability for giant PTA has been suggested in one study other than ours. As definite conclusions cannot be drawn from case reports, more studies are required in this regard.

Conclusion

The current study presented the diagnostic and therapeutic features of a patient with giant PTA, for whom the trans-axillary approach has been used. To the best of our knowledge, only one other study has documented the use of this approach, with the difference that we chose the endoscopic method,

and they used a robotic-assisted technique. This is while most of the other case series have used the open technique or a small neck incision for surgical removal of a giant PTA. Also, some of the studies have not documented the type of surgery in their report. Considering the advantages of MIS techniques, it is important that further studies evaluate the most appropriate surgical technique proportional to the PTA size.

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