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## Minimally invasive videoscopic parathyroidectomy by lateral approach

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**Abstract** *Methods:* A videoscopic parathyroidectomy was performed in 22 patients presenting with primary hyperparathyroidism (PHPT). No patient had undergone previous neck surgery, presented with goiter or had a history of familial PHPT. Ultrasonography and Sestamibi scanning were performed preoperatively. Rapid intact parathormone assay was used during surgery. Through a 15-mm transversal skin incision on the anterior border of the sternocleidomastoid muscle (SCM), the fascia connecting the lateral portion of the strap muscles and the thyroid lobe with the carotid sheath was gently divided, far enough to visualize the prevertebral fascia. Once enough space was created, three trocars were inserted: a 12-mm trocar through the incision and two 2.5-mm trocars on the line of the anterior border of the SCM, above and below the first trocar. Carbon dioxide was insufflated to 8 mmHg. Unilateral video-assisted parathyroid exploration was then carried out using a 10-mm O°

endoscope. Once the adenoma had been identified, the trocars were removed. Then, directly through the skin incision, the thyroid lobe was retracted medially and the adenoma was extracted after clipping its pedicle. *Results:* Among the 23 enlarged glands, 20 (80%) were correctly identified by endoscopic exploration: mean weight 843 mg (100 mg to 5 g). The exploration was unilateral in 17 patients but bilateral in 5. Mean time of unilateral endoscopic exploration was 84 min (40–130 min). Morbidity was represented by two superficial hematomas. All 22 patients were biochemically cured, follow-up ranging from 3 months to 14 months. *Conclusions:* This preliminary study demonstrates that minimally invasive videoscopic parathyroidectomy by lateral approach is a feasible surgical procedure.

**Key words** Hyperparathyroidism · Endoscopic Parathyroidectomy · Surgical technique

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### Introduction

It has recently been demonstrated that endoscopic parathyroidectomy is a feasible surgical procedure [1, 2, 3]. Previously, the access to the parathyroid glands, as described in the initial studies, has been carried out by division of the strap muscles. We propose a new technique using a lateral approach on the line of the anterior border of the sternocleidomastoid muscle (SCM).

### Materials and methods

During a period of 9 months, 22 of 68 consecutive patients presenting with primary hyperparathyroidism (PHPT) were selected for videoscopic parathyroidectomy on the basis of the following criteria: no previous neck surgery, no evidence of nodular goiter, no history of familial PHPT and no suspicion of multi-glandular disease. The option of endoscopic parathyroid exploration was proposed to all the

patients eligible for the procedure and was accepted by most of them. There were 16 females and 6 males with a mean age of 64 years (38–77 years). In all patients, the diagnosis of PHPT was based on hypercalcemia associated with elevated value of intact parathormone (iPTH). Mean calcemia was 2.86 mmol/l, ranging from 2.67 mmol/l to 3.15 mmol/l (normal range 2.15–2.60 mmol/l). The mean value of iPTH was 132 pg/ml, ranging from 64 pg/ml to 270 pg/ml (normal range 10–65 pg/ml). Ultrasonography and Sestamibi scanning were performed preoperatively. The adenoma was localized in 18 patients but there were two false positives. Rapid iPTH assay was used during surgery. Parathyroidectomy was considered successful when a more than 50% decrease in PTH values with respect to the highest pre-excision levels was recorded. We converted to conventional transverse cervicotomy using the same incision when no adenoma was found after 2 h of endoscopic exploration.

Calcemia and phosphoremia were systematically evaluated on day 1, day 2 and day 8 after surgery. Values of iPTH were controlled 4 h after removal of the adenoma, and on days 1 and 8. Calcemia and iPTH were also measured 1 month after surgery. All patients underwent pre- and post-operative investigations of vocal cord movements.

#### Surgical technique

The patients were placed in the supine position but without extension of the neck. Under general anesthesia, a 15-mm transversal skin incision was made on the anterior border of the SCM, 3–4 cm above the sternal notch. Through this incision, the fascia, connecting the posterior portion of the strap muscles and the thyroid lobe to the carotid sheath, was gently divided with scissors, far enough to visualize the prevertebral fascia. Once enough space was created, two 2.5-mm trocars were inserted on the line of the anterior border of the SCM, 3–4 cm above and below the first skin incision. The transparietal path of these trocars was made through the incision, from the inside to the outside using a guide stick. Then the trocar was adapted to the guide stick, to be put into place in the initially dissected space. A 12-mm trocar was inserted through the incision. A purse-string suture was placed around the trocar to prevent both gas leakage and the trocar from slipping out of the wound. Carbon dioxide was insufflated to 8 mmHg. Unilateral video-assisted parathyroid exploration was then carried out using a 10-mm O° endoscopic camera. The dissection was performed using 2-mm instruments (graspers and scissors). The anatomic structures – posterior aspect of the thyroid lobe, esophagus, trunk and branches of the inferior thyroid artery, inferior laryngeal nerve and thyrothymic tract – were checked. During this exploration, we tried to identify both the adenoma and the ipsilateral parathyroid gland. Once the adenoma was dissected, the trocars could be removed. Then, directly through the skin in-

cision, the thyroid lobe was retracted medially and the adenoma was extracted after clipping its pedicle.

#### Results

The endoscopic exploration was unilateral in 17 patients but bilateral in 5: in four patients, no adenoma was identified on the first side explored and, in one patient, a multiglandular disease was suspected when the iPTH concentrations did not significantly decrease after the excision of the first enlarged gland. Conversion to conventional transverse cervicotomy had to be undertaken in five patients: three because adenomas were not found, one because of multiglandular disease and one because we had to check all four glands after removal of a tiny adenoma of 100 mg which indeed proved to be solitary.

Among the 23 enlarged glands, 20 (80%) were correctly identified by endoscopic exploration. The mean weight was 843 mg (100 mg to 5 g) and mean operative time of unilateral endoscopic exploration was 84 min (40–130 min). There was no mortality. Morbidity was represented by two superficial hematomas in the SCM.

In all of the patients, iPTH levels were normal 4 h after excision of the adenoma and on days 1 and 8 after surgery. Mean hospital stay was 48 h. One month after surgery, none of the patients presented with hypercalcemia. One patient had mild hypocalcemia (1.99 mmol/l) with normal iPTH (39 pg/ml) and with no clinical symptoms. Mean calcemia was 2.32 mmol/l (1.99–2.52 mmol/l). All 22 patients were biochemically cured, follow-up ranging from 3 months to 14 months.

#### Discussion

The conventional cervical approach to parathyroid glands is a bilateral exploration of the neck performed under general anesthesia. Minimally invasive parathyroidectomy has been proposed for many years. The first alternative procedure was a unilateral exploration based on finding an enlarged gland and an ipsilateral normal gland [4]. The concept of unilateral exploration was recently reinforced with the development of improved localization studies and the introduction of intra-operative quick parathyroid hormone assay [5, 6]. The operation can also be conducted under local anesthesia [7]. More recently, another technique under local anesthesia facilitated by intraoperative nuclear mapping has been described [8]. This technique has also been proposed in reoperative exploration of the neck for persistent or recurrent PHPT [9].

It was foreseeable that endoscopic surgery would spread to endocrine surgery in the neck. The major technical challenge of an endoscopic approach to parathyroidectomy

consists of creating enough space to work and to obtain adequate exposure. The previously described techniques [2, 3, 10] require: (1) a working area of approximately 5×7 cm created below the platysma by blunt dissection with the tip of the endoscope which is inserted through a skin incision just above the sternal notch in the lower midline of the neck; (2) the dissection of the strap muscles, which are divided vertically in the midline and then retracted laterally; and (3) the exposure of the thyroid lobe. In addition, to maintain the working area, carbon dioxide gas is insufflated into the subplatysmal space, which results in significant subcutaneous neck and face emphysema. To avoid this complication, the same approach has been proposed without prolonged gas insufflation [11]. These techniques are suitable for superficially located parathyroids, i.e., in most cases, the glands located at the lower pole of the thyroid lobe or in the thyrothymic tracts. However, exploration of parathyroid glands located behind the thyroid lobe requires anterior and medial retraction of the lobe, which is not easy with this approach. Obviously, the lateral approach on the anterior border of the SCM is more direct. It does not require previous dissection of the strap muscles and the anterior aspect of the thyroid lobe. The first part of the operation is exactly the same as performed during open surgery for reoperation when a superior gland is being sought. This approach is lateral to the thyroid lobe and the strap muscles. Through the 15-mm skin incision, the contents of the carotid sheath are retracted laterally and the thyroid lobe medially. The fascia connecting the thyroid lobe with the carotid sheath is gently divided. This dissection should be done above and below the level of the inferior thyroid artery, up to the prevertebral fascia. This maneuver is safe because this area is avascular and, thus, a working space is created in a few minutes as in open surgery. During this open approach, the parathyroid adenoma may be immediately visualized. This happened in three cases in our experience. In these cases, it was not necessary to insert the two additional 2.5-mm trocars. The dissection of the adenoma could be done entirely through the 15-mm skin incision with assistance of the 10-mm O camera placed at the level of the incision.

The second part of the operation is the endoscopic exploration. We encountered the same difficulty as with the

other techniques: creating and maintaining enough space to work. We used insufflation in most cases but not systematically. No patient experienced pneumomediastinum or subcutaneous emphysema. The space can be maintained by a simultaneous retraction of the carotid sheath laterally and of the thyroid lobe medially. The purse-string suture placed around the 12-mm trocar is used to maintain the lateral retraction. The thyroid lobe is medially retracted by one grasper. This obliges the operator to perform a one-handed dissection. During this exploration, all anatomical structures can be visualized. Thus, with a minimum of dissection, it is possible to completely explore the area from the superior thyroid artery to the thymus. Ligatures or clip applications, which are normally time consuming to use, are not necessary during this videoscopic exploration. They are made after removal of the trocar, directly through the incision. With experience, this surgical procedure can be performed within an acceptable operative time – in our experience, less than 80 min for the last six patients compared with less than 60 min with conventional transverse cervicotomy.

Endoscopic parathyroidectomy is certainly not indicated for all patients with PHPT. In this series, patients were selected on the basis of the following criteria: no evidence of nodular goiter, no previous neck surgery, no history of familial PHPT and no suspicion of multiglandular disease. We also excluded patients with calcemia over 3.50 mmol/l and/or patients with high values of iPTH (>500 pg/ml). Patients without pre-operative imaging demonstrating the localization of the adenoma are not candidate for this procedure. In addition, because no localization study rules out multiple glandular disease, perioperative, rapid iPTH assay is an additional and mandatory precaution.

## Conclusion

Minimally invasive videoscopic parathyroidectomy is a feasible surgical procedure. The lateral approach on the line of the anterior border of the SCM is safe, direct and effective. As other techniques have proposed, it demonstrates that minimally invasive techniques for parathyroidectomy will inevitably have a role in the surgical management of patients with PHPT.

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