



## Endoscopic bilateral neck exploration versus quick intraoperative parathormone assay (qPTHa) during endoscopic parathyroidectomy: A prospective randomized trial

P. Miccoli, P. Berti, G. Materazzi, C. E. Ambrosini, L. Fregoli, G. Donatini

Department of surgery, University of Pisa, Via Roma 67, 56100, Pisa, Italy

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### Abstract

**Background:** Quick intraoperative parathormone assay (qPTHa) during parathyroidectomy has become a standard procedure for patients with primary hyperparathyroidism (PHPT). This paper aims to compare endoscopic bilateral neck exploration (BE) versus focused parathyroidectomy plus qPTHa during minimally invasive video-assisted parathyroidectomy (QM). The endpoints of the study are the mean operative time and outcome of the surgical procedure (PTH and calcemia normalization at one and six months postoperatively).

**Methods:** Forty patients with PHPT, positive to preoperative localization studies (ultrasonography evaluation and  $^{99}\text{Tc}$ -MIBI scan) for a single parathyroid adenoma, were randomly allotted into two groups. In the first group (QM), 20 patients (17 women, three men, mean age 57.6 years) underwent focused endoscopic parathyroidectomy (MIVAP technique) plus qPTHa. In the second group (BE) 20 patients (17 women, three men, mean age 59.6 years) underwent endoscopic parathyroidectomy plus bilateral exploration in order to check the integrity of the remaining glands.

**Results:** There were no significant differences between groups at baseline. No conversion to cervicotomy was required. No postoperative complications were reported. The mean operative time was 32.0 vs 33.1 min [BE and QM group respectively,  $p$  = not significant ( $ns$ )]. A second macroscopically enlarged gland was removed in four patients in the BE group. Only one out of four glands was reported to be hyperplastic in the final histology. All patients were discharged on the first postoperative day. Calcemia levels were normalized in all patient of both groups, despite persistently high level of serum PTH in one patient in the QM group.

**Conclusions:** BE can be performed endoscopically, avoiding both the time necessary for qPTHa and its

cost, with the same effectiveness, but might in few cases lead to the unjustified removal of parathyroid glands slightly enlarged but not necessarily pathologic.

**Key words:** Parathyroid — Video-assisted — Surgery — Neck surgery

Surgery has proven to be the only effective therapy for patients with primary hyperparathyroidism [1]. Since 1925 [2], when Felix Mandl performed the first operation, the development of new technologies for preoperative parathyroid localization (ultrasound, computerized tomography (CT) scans, and sestamibi scans) and quick parathyroid hormone intra-operative measurement (qPTHa), has led surgeons to search for a less invasive approach to treating the disease [3–8]. Endoscopic access for parathyroid surgery was first proposed by Gagner in 1996 for a patient suffering from PHPT due to diffuse parathyroid hyperplasia [9]. Since then, many authors have proposed different techniques based on the use of the endoscope, mostly facilitated by the use of qPTHa [10–14]. Nonetheless, all those focused operations may lack in effectiveness in patients with a double adenoma, four gland hyperplasia or renal hyperparathyroidism, being in some of these cases qPTHa-inadequate to predict the removal of any hyperplastic parathyroid tissue [15–19].

Based on the experience derived from more than 450 minimally invasive parathyroidectomies (MIVAP) performed between February 1997 and December 2005, this same approach was also proposed in performing a bilateral neck exploration, which supposedly would allow the avoidance of the use of qPTHa.

A comparison of bilateral video-assisted neck exploration after the removal of enlarged glands and focused MIVAP plus qPTHa was conducted in order to evaluate the effectiveness of the two techniques in the treatment of patients with PHPT, their relative out-

**Table 1.** Results of the BE and QM groups

	QM group	BE group
Patient numbers	20 (16 F, 4 M)	20 (17 F, 3 M)
Mean age	57.2	59.9
Preoperative mean serum calcium levels (mg/dl)	11.02	11.34
Preoperative mean PTH levels (pg/dl)	308.1	320.5
qPTHa	+	–
Mean operative time (min)	33.1	32.0
Postoperative complications	None	None
Second gland removed	0	4*

**Fig. 1.** MIVAP Kit.

comes and operative time with an attempt to also examine their relative costs.

## Methods

Between October 2005 and February 2006, 40 patients undergoing surgery in our department for PHPT were selected for this study after a formal informed consent was obtained. Patients were randomly allocated into one of two groups: in the first group (QM), 20 patients underwent parathyroidectomy using the MIVAP technique plus qPTHa, while the 20 patients of the second group (BE) had a MIVAP plus a bilateral endoscopic neck exploration. Both groups consisted of 17 women and three men, homogeneous in age, preoperative PTH and serum calcium levels (Table 1).

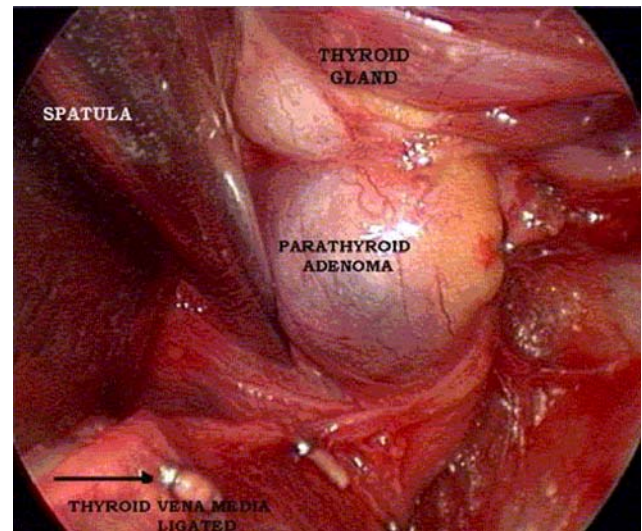
All patients underwent preoperative localization studies with ultrasounds and sestamibi-<sup>99</sup>Tc scans.

All patients were blind to the technique used as well as the pathologist who examined the specimens.

## Surgical technique

The MIVAP technique is accomplished through a unique central neck incision of 15–20 mm, 2 cm above the sternal notch, using a 30° 5 mm endoscope and a specifically designed kit (Figs. 1 and 2). The procedure is entirely carried out without gas insufflation [13]. The quick parathyroid hormone assay (Nichols Institute Diagnostics, San Juan Capistrano, CA) was performed at baseline (before incision of the skin), at five and ten minutes after the removal of the pathological gland. The surgical procedure was ended when a decrease greater than or equal to 50% of the highest preoperative value was reported by qPTHa.

The bilateral neck exploration was performed via the same central neck access for a MIVAP procedure, with the procedure ended after visualization of the four parathyroid glands and removal of the macroscopically enlarged glands.

**Fig. 2.** Minimally invasive parathyroidectomy; visualization of parathyroid adenoma.

## Results

The two groups were homogeneous in age, sex and pathology. All patients of both groups underwent the operation successfully with the chosen procedure, with no conversion to cervicotomy required. The mean operative time was 32.0 minutes in the BE group and 33.1 minutes in the QM group ( $p = ns$ ).

In four patients of the BE Group a second enlarged gland was removed during the procedure. Pathological examination of the second removed glands showed a normal parathyroid gland in three patients and a hyperplastic gland in the fourth.

No postoperative complications (haemorrhage, laryngeal nerve palsy, hypocalcemia) were reported, including the group of the four patients with a second parathyroid gland removed. All patients were discharged on the first postoperative day. PTH and serum calcium levels were normalized at one- and six-month follow-ups in all patients in the BE group and all but one in the QM group.

The one patient in whom calcium levels were not normalized was a 71-year-old woman with a history of mild hyperparathyroidism lasting for years and classical symptoms presentation for 11 months before surgery. Her preoperative PTH level was 984 ng/ml and her calcium level was 10.8 mg/dl. At the one-month follow-up her PTH and serum calcium levels had fallen to 220 ng/ml and 9.5 mg/dl respectively. At six-month follow-up further decreased values of PTH and calcium levels to 110 ng/ml and 9.1 mg/dl were observed. At the six-month follow-up the patient was completely free from symptoms.

## Discussion

The MIVAP technique with qPTHa has proven to be effective in the treatment of PHPT [13, 14]. Nevertheless, this approach may lack in effectiveness in patients with a double gland or multiglandular disease, even when the

PTH levels after the removal of an enlarged gland have decreased to within the therapeutic limits [8, 15–19]. On the basis of our experience in minimally invasive parathyroid surgery, the bilateral neck video-assisted exploration has been evaluated in feasibility and effectiveness for those patients with PHPT. Based on the surgical concept of neck exploration [2, 19, 20] the qPTHa has not been used during all the video-assisted procedures involving the patients of group BE. The mean operative time of the latter group was comparable to the mean operative time of the QM group (32.0 versus 33.1 minutes,  $p = \text{ns}$ ), thus suggesting that bilateral exploration can also be carried out endoscopically with no additional operative time.

The results of our experience prove that bilateral neck exploration is as safe and effective as MIVAP with qPTH assay, without prolonging the surgical procedure: this represent the most interesting points of our results. This approach might then be considered by all institutions where a minimally invasive technique is routinely performed but where it might be necessary to save resources by avoiding the expenses inherent in the use of the qPTHa kit, whose cost has been estimated by Udelsman to be about 150 dollars per patient [8]. Moreover, the qPTHa might turn out to be inadequate in some patients in which a second adenoma or a multiglandular disease underlines the hypercalcemia, but where a bilateral exploration is able to unveil the source of a possible persistent PHPT.

On the other hand, although bilateral exploration has been the standard of treatment for more than 30 years, in the present series the histology reported a normal parathyroid in three out of four patients in whom a second gland was removed. The drawback of such an approach is then represented by the risk of removing glands that, though macroscopically enlarged, do not show any pathological pattern [4, 15].

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