Original article

Limits and drawbacks of video-assisted parathyroidectomy

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Background: Minimally invasive video-assisted parathyroidectomy (MIVAP) is a novel minimally invasive approach to primary hyperparathyroidism (PHPT). It is a gasless operation characterized by a single central incision and external retraction. This paper describes the drawbacks and limitations of this procedure based on a 5-year experience and 260 operations.

Methods: Of 364 patients with PHTP, 260 were selected for MIVAP. In most patients a unilateral minimally invasive exploration was performed.

Results: MIVAP was carried out successfully in 239 patients with a mean operating time of 40 (range 20–180) min. Conversion to cervicotomy was required in 21 patients (8·1 per cent). Complications included recurrent nerve palsy in two patients (0·8 per cent), haemorrhage that required reoperation 6 h after parathyroidectomy in one patient (0·4 per cent) and transient hypoparathyroidism in six patients (2·5 per cent). In five patients (2·1 per cent) persistent PHPT developed shortly after surgery.

Conclusion: After 5 years of experience, MIVAP appears to be feasible, safe and applicable to the majority of patients with PHPT.

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Introduction

The endoscopic approach to primary hyperparathyroidism (PHPT) was pioneered by Michel Gagner, who first successfully operated on a patient with parathyroid hyperplasia in 1996[1]. Several different approaches have since been proposed including use of either gas insufflation[2–4] or external retraction[5,6]. The authors have developed a gasless operation, minimally invasive video-assisted parathyroidectomy (MIVAP), which is characterized by a single central incision and external retraction[6]. The present study represents an analysis of the drawbacks and limitations of this procedure based on 5 years' experience and 260 operations.

Patients and methods

Between February 1997 and January 2002, 364 patients with a diagnosis of PHPT were referred for surgery. In the early phase of the experience, strict inclusion criteria were applied. Patients were selected for MIVAP only if they had sporadic PHPT (no evidence of possible multiple endocrine neoplasia syndrome or familial disease), absence of large goitre, absence of thyroiditis as judged by ultrasonography and serum autoantibody measurement, no suspicion of malignancy, no previous thyroid surgery, and an adenoma not exceeding 3 cm that had been localized precisely. As more experience was gained, the inclusion criteria were relaxed to include patients in whom the adenoma had not been located precisely, because it was possible to explore both sides of the neck through the central access, and those with larger tumours that could easily be retrieved through the small incision owing to their elliptical shape. MIVAP was also considered in patients who had already undergone thyroid surgery; a lateral access was adopted in patients in whom previous surgery was on the opposite side from the adenoma. Two hundred and sixty patients (71·4 per cent) were considered eligible for MIVAP, 205 women and 55 men, of mean(s.d.) age 56(14) (range 20–87) years.

At least one clearly positive preoperative imaging study was considered mandatory for the selection of patients undergoing MIVAP. In this series 248 patients had undergone echography and 188 scintiscan. Of 188 who had both imaging studies, 150 patients had a concordant result; 96 had only a positive echogram and 31 only a positive scintiscan. Mean size of the adenoma was 1·8 (range

0·7–4·0) cm. As measured only by echography, all patients gave signed informed consent to undergo video-assisted parathyroidectomy.

Operative procedure

Most patients were operated on under general endotracheal anaesthesia. In 16 patients the operation was carried out under bilateral superficial cervical block in association with a laryngeal mask and sedation with sevoflurane. Recently, in five patients the procedure was attempted under locoregional anaesthesia (unilateral superficial cervical block). Two surgeons performed all operations, both of whom had carried out more than 30 parathyroidectomies previously.

The neck was slightly extended. MIVAP was performed essentially as described previously[6], with minor modification. Briefly, the procedure was carried out through a 15-mm incision at the notch level. Neither trocar nor gas insufflation was needed to gain access to the thyroid space on the side of the suspected lesion; this was dissected bluntly after the midline had been incised on a bloodless plane. A 30° 5-mm endoscope and all other instruments were introduced through this central access. Small conventional instruments (2 mm) such as spatulas and forceps were used. The middle thyroid vein was sectioned to allow optimal access into the thyroid space, and was ligated with titanium vascular clips (*Fig. 1*). Access to the thyroid space was maintained by means of two small external retractors, one on the thyroid lobe and the other on the strap muscles and the carotid artery. The recurrent laryngeal nerve and the adenoma were identified, and the latter was gently grabbed with a needlescopic forceps until its pedicle was well exposed. A vascular clip was applied taking care not to injure the nerve. Finally, the adenoma was extracted through the central incision (*Fig. 1*). No drainage was necessary. The midline was closed with interrupted absorbable sutures and the skin by means of sealant.

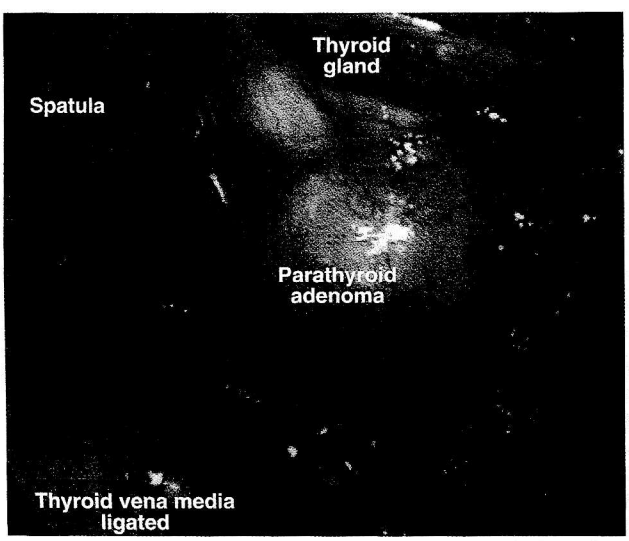

Fig. 1 Endoscopic view of a parathyroid adenoma during minimally invasive video-assisted parathyroidectomy

The intraoperative intact quick parathyroid hormone assay (qPTHa) (Nichols Institute Diagnostics, San Juan Capistrano, California, USA) was used during the procedure. Measurements were taken when the suspected adenoma was first visualized, when it was mobilized, and 5 and 10 min after its removal. The completeness of the surgical resection of all hyperfunctioning parathyroid tissue was confirmed by a decrease in parathyroid hormone (PTH) value of more than 50 per cent with respect to the highest pre-excision level; this level was generally reached after the surgeon started to mobilize the adenoma, although the manipulation occasionally did not lead to an increase in PTH production.

Serum total calcium was measured on the first day after operation, and 1, 6 and 12 months after surgery. All patients underwent laryngoscopy 3 months after surgery under the supervision of the referring endocrinologist. No patient was lost to follow-up.

Results

MIVAP was performed successfully 239 patients with a mean(s.d.) operating time of 40(23) (range 20–180) min overall, which fell to 24 min in the last 100 patients. Video-assisted bilateral exploration with visualization of four glands was performed in three patients. In one patient a double homolateral adenoma was removed. Eleven thyroid lobectomies and four total thyroidectomies were performed through the same incision for small (diameter less than 3 cm) thyroid nodules, Graves disease and small multinodular goitres. A lateral approach was used successfully in three patients who had undergone thyroid surgery previously. In these patients, a 15-mm incision was performed on the lateral aspect of the scar and the operative space was created by retracting the medial border of the sternocleidomastoid muscle and the lateral border of the strap muscles.

Conversion to traditional cervicotomy was required in 21 patients (8·1 per cent). The reasons for conversion were double adenoma in four patients, parathyroid carcinoma in one, malfunction of the qPTHa in one, difficult dissection in three and failure to locate the adenoma by video-assisted exploration in 12 patients. The four patients with double adenoma were operated on at the start of this experience, and the decision to convert was based on the lack of a

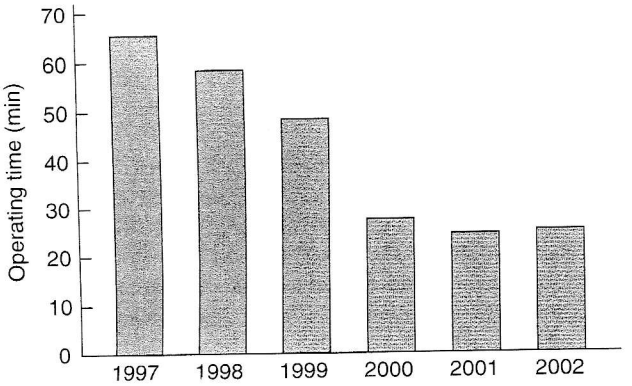

Fig. 2 Learning curve of video-assisted parathyroidectomy in terms of operating time, from 1997 to 2002. Values are median operative time

decrease in PTH level and concern about the duration of the procedure. Of the 12 patients in whom the adenoma could not be located endoscopically, traditional exploration failed to find it in three, even though the patients were not cured by surgery. Open exploration revealed an ectopic location of the adenoma in the remaining nine patients: three in a retro-oesophageal position, three intrathyroid adenomas and three in the upper thymus. The latter were reached easily through an open neck access because they were not really intrathoracic.

Overall, qPTHa measurement revealed a decrease in PTH level of more than 50 per cent in 88·3 per cent of patients at 5 min and in only 10·2 per cent after 10 min. Patients generally had an overnight discharge after careful monitoring for signs, symptoms or a serum value suggestive of hypocalcaemia.

Complications included two cases of laryngeal recurrent nerve palsy (0·8 per cent), haemorrhage that required reoperation 6 h after parathyroidectomy in one patient (0·4 per cent) and transient hypoparathyroidism in six patients (2·5 per cent).

Two hundred and fifty-five patients were normocalcaemic 6 and 12 months after surgery. In five patients (2·1 per cent) persistent PHPT developed shortly after operation. In two patients false-negative values had been obtained by qPTHa and further exploration revealed a second adenoma missed during the first operation. The remaining three patients with persistent PHPT had undergone negative explorations (both endoscopic and open). The patient with parathyroid cancer had normal serum calcium and PTH levels both at discharge from hospital and at follow-up (8 months).

All patients were satisfied with the cosmetic result. After 6 months the scar was barely visible in most patients.

Discussion

In an earlier series the proportion of patients with PHPT who were eligible for endoscopic parathyroidectomy was as low as 25 per cent[7]. The authors' rate has increased from 66 per cent in a previous publication[6] to more than 70 per cent after 5 years' experience with MIVAP. This confirms that experience has a great influence on the recruitment and selection of patients. Increased surgical skill and the development of endoscopic instrumentation[8] have also reduced operating times (*Fig. 2*), from 1 h at the beginning of this experience to the present 24 min. It is reasonable to expect that after 30 procedures the duration of operation can easily rival that of standard surgery.

Even though a bilateral exploration is always possible owing to the central access, preoperative localization studies are essential. In the present series at least one of the two imaging studies had to be clearly positive to fulfil the inclusion criteria. Some 72·3 per cent of patients in this series had already undergone both preoperative imaging studies before referral. Performing both studies allows recruitment of more patients for MIVAP and may lead to a higher success rate[9].

The rate of conversion to traditional cervicotomy remains quite high (8·1 per cent) in spite of the experience acquired. Conversion is rarely needed for surgical complications such as bleeding or difficult dissection, but more often because of failure to locate the adenoma within a reasonable period of time. This occurred in 12 patients in this series, in three of whom the adenoma was still not found at open exploration. In the remaining nine patients the lesion was reached easily through a standard exploration, demonstrating that some ectopic adenomas in the neck are more suited to conventional exploration. This is particularly the case for intrathyroid adenomas because the surgeon's ability to palpate the thyroid gland accurately is dramatically impaired by the endoscopic approach. The three adenomas located in the upper thymus were not really intrathoracic. MIVAP is not suitable for the treatment of true intrathoracic adenomas, which require a thoracoscopic approach.

With increased experience it was also possible to operate on associated thyroid pathologies in 15 patients and contralateral thyroid nodules could be treated successfully. Lateral access, already described by Henry *et al.*[2], was used in several patients and avoided a conventional operation. It was also used in repeat surgery, although this was possible only in patients in whom hemithyroidectomy had not been performed on the same side as the adenoma. The lateral approach requires extensive experience, but MIVAP combined with this approach can offer significant advantages[10].

In Europe, patients are rarely discharged from hospital on the day of surgery for PHPT, although the preliminary results obtained with local anaesthesia indicate that day-case surgery may be feasible, as has been described for radio-guided parathyroidectomy in the USA[11]. In the present study the hospital stay was similar after traditional or video-assisted operations. The simple local anaesthesia seemed more suitable and reliable than use of a laryngeal mask and sevoflurane.

The incidence of complications, in particular recurrent nerve palsy, was low in this series, as in other reports[10,12], and appeared to be comparable to that of conventional surgery[12–14]. The published rate is generally under 1 per cent for both traditional surgery and in the most recent series of minimally invasive surgery[12]. Experience did not seem to influence the risk of nerve lesions as the two cases occurred at the beginning (first 50 cases) and end (year 2001) of the study. The low rate of transient hypoparathyroidism (2·5 per cent) is also similar to that reported previously[10,15] probably owing to the absence of extensive manipulation and biopsies of normal glands. The incidence of persistent hyperparathyroidism (2·1 per cent) concurred with most important published series of surgically treated PHPT[14,16], and confirms the relative safety of minimally invasive parathyroid surgery in this and other series[10,12]. In two of five patients persistent hyperparathyroidism was related to a false-negative qPTHa evaluation. Because only one side had been explored at the first operation it was possible to approach the other side through the same minimally invasive access.

MIVAP has a similar success rate to open surgery for PHPT[12–14], but has the advantages of a better cosmetic result and a less distressful postoperative course[17,18]. It does not incur any additional cost in terms of surgical instrumentation, which is entirely reusable, although preoperative imaging and intraoperative qPTHa represent additional costs that can be avoided by adopting an open procedure. However, since 1997 in the USA, 75 per cent of patients referred for surgery for PHPT have already had at least one preoperative imaging study performed[19]. Finally, any surgeon already experienced in parathyroid surgery will be capable of performing a complete unilateral or even a bilateral exploration through the central access, without a long learning curve. Indeed, an experienced parathyroid surgeon may not need to rely on qPTHa, which at present remains the most relevant additional cost of MIVAP over that of the standard operation.

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