INTRODUCTION

Urologists sometimes encounter patients who suffer from primary hyperparathyroidism (PHPT) with urolithiasis. Treatment of these patients is traditionally performed by surgery through a cervical collar incision. After the first description of endoscopic parathyroidectomy was made by Gagner in 1996\(^1\), several minimally invasive procedures have been proposed as surgical treatment for PHPT. In 1998, Ishii et al.\(^2\) introduced a method of endoscopic thyroidectomy via a precordial approach which leaves no postoperative scarring in the neck and thus provides satisfactory for an appearance. We treated 4 cases of PHPT with urolithiasis and performed endoscopic parathyroidectomy via a precordial approach. Constructing an adequate working space is necessary and unique in this endoscopic method.

Original Article

Endoscopic Parathyroidectomy for Ectopic Primary Hyperparathyroidism
A Minimally Invasive Procedure for Urolithiasis Patient

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Abstract: Aim: Open parathyroidectomy with a neck incision is a well-established procedure, but the scar in the neck usually causes a mental burden especially for female patients. We introduce a form of endoscopic surgery without neck or anterior incision, resulting in a great cosmetic advantage for primary hyperparathyroidism (PHPT) with urinary calculi.

Methods: We treated 4 PHPT patients with urolithiasis between September 2000 and September 2001. Preoperative imaging studies showed presumed solitary ectopic adenoma. Endoscopic parathyroidectomy was performed via a precordial approach using 3 trocar ports.

Results: The operation time was not different between endoscopic and open surgery. The amount of blood loss during endoscopic surgery was less than 30 ml. We achieved satisfactory results in terms of cosmetic as well as endocrinological viewpoints.

Conclusions: Endoscopic parathyroidectomy is feasible for PHPT with solitary adenoma, especially for female patients.

Key words: urinary calculi, primary hyperparathyroidism, endoscopic surgery, minimally invasive surgery, cosmetic

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METHODS

Patients:

From September 2000 through September 2001, four ectopic PHPT patients were treated using endoscopic parathyroidectomy via a precordial approach (Table 1). We used diagnostic imaging involving ultrasonography (US), computed tomography (CT) and ⁹⁹mTc-SestaMIBI to detect ectopic parathyroid tumors before surgery for patients 1 to 3. Although US, CT and ²⁰¹Tl/ ⁹⁹mTc-pertechnetate subtraction scintigraphy did not show a parathyroid tumor for patient 4, selective venous sampling of intact PTH (iPTH) and MRI suggested an ectopic tumor. All patients suffered from urolithiasis and hoped to undergo endoscopic surgery. Written informed consent was obtained from each patient.

Operative techniques:

Under general anesthesia, each patient was placed in the supine position with their legs open and neck extended. To prevent the expansion of subcutaneous emphysema, preoperative compression by a rubber band and elastic tapes on the lower jaw and bilateral shoulders was desirable. The first skin incision, which was 1.5 cm long, was made along the right side of the sternum at the height of the nipple. Blunt dissection was performed from the precordial region to the anterior cervical region and a subcutaneous tunnel was created. A 12 mm trocar was inserted, carbon dioxide was ventilated at 6 mmHg and an apical flexible endoscope was inserted. Then 5 mm trocars were inserted at the upper edge of the bilateral nipples. To construct a working space, the subcutaneous tissue was dissected to the hyoid bone (Fig. 1). After vertical dissection of the platysma, the sternohyoid and sternothyroid muscles were dissected using an ultrasonic coagulation device, and then the thyroid was exposed. The inferior thyroid vein was exposed and ligated if needed. Pulling on the thyroid, the parathyroid adenoma was exposed and extracted (Fig. 2). The muscles were then closed with 3-0 vicryls, and an absorption-type drain was inserted into the right side of the sternum.

RESULTS

The amount of blood loss was less than 30 ml, and the mean operative time was 213 min with a range of 205–222 min (Table 2). They were not

<table>
<thead>
<tr>
<th>Pt</th>
<th>age</th>
<th>sex</th>
<th>Ca (mg/dl)</th>
<th>IP (mg/dl)</th>
<th>ALP (IU/l)</th>
<th>iPTH (pg/ml)</th>
<th>location of tumor</th>
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<tr>
<td>1</td>
<td>55</td>
<td>female</td>
<td>11.8</td>
<td>2.6</td>
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<td>85</td>
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<td>female</td>
<td>11.5</td>
<td>3.0</td>
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<td>84</td>
<td>below the right thyroid lobe</td>
</tr>
<tr>
<td>3</td>
<td>68</td>
<td>male</td>
<td>12.0</td>
<td>2.1</td>
<td>213</td>
<td>370</td>
<td>below the right thyroid lobe</td>
</tr>
<tr>
<td>4</td>
<td>23</td>
<td>male</td>
<td>12.3</td>
<td>2.6</td>
<td>284</td>
<td>133</td>
<td>below the left thyroid lobe</td>
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</table>

Fig. 1. The working space is outlined by the dotted line. The locations of the trocar are shown.
inferior to open parathyroidectomy in our department. In Cases 2 and 4, we had to supplement calcium gluconate for hypocalcemia after surgery for several days. Otherwise, the postoperative progress of all patients was good. We did not observe severe hypercarbia, subcutaneous emphysema on the face and upper limbs or recurrent laryngeal nerve paralysis. One of four parathyroid tumors was diagnosed as a carcinoma by pathologic examination (patient 3), and the others were adenomas. The patients complained of prickly sensations on their precordium for a few weeks, but they were satisfied by the good appearance after a month without any pain (Fig. 3). The follow up data of iPTH, Ca and IP indicated successful resection of the solitary parathyroid tumor in all cases. We did not find recurrence of carcinoma in patient 3 after four years.

**DISCUSSION**

Gagner\(^1,3\) introduced endoscopic parathyroidectomy after successful animal experimentation and exploration of multiple techniques involving endoscopic thyroidectomy and parathyroidectomy. Miccoli \(et\ al.\)^4 also reported on lessons learned from more than a hundred cases of video-assisted parathyroidectomy, and disseminated much useful knowledge on performing minimally invasive parathyroidectomy. Following Ishii \(et\ al.\)^2 and Yamamoto \(et\ al.\)^5, we tried a unique approach and constructed a working space so as not to leave even a tiny scar.

<table>
<thead>
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<th>pt</th>
<th>operation time (min)</th>
<th>blood loss (ml)</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>210</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>215</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>222</td>
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<tr>
<td>4</td>
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<tr>
<td>F</td>
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<td>50</td>
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Fig. 2. The arrow in the left picture indicates the inferior thyroid vein. The long arrow indicates the parathyroid tumor and the shorter one the thyroid gland in the right picture.

Fig. 3. There is no neck scar. The scar on the sternum is completely covered by under wear.
on the neck for parathyroid tumors. Fortunately, we tried this method on four cases of ectopic parathyroid tumors located in the lower area, which seemed easier to be approached and removed. Developmentally, ectopic parathyroid tumors often exist in areas lower than the thyroid gland, so this approach may be more desirable for this type of tumor. In addition, the magnification of the videoscope allowed for easy visualization of ectopic parathyroid glands.

Reeve et al.\textsuperscript{6)} propose that the indication of minimally invasive surgery for PHPT is presumed solitary adenoma and is not multiple gland disease like hyperplasia in their systematic review. The means of identification are by \textsuperscript{99m}Tc-SestaMIBI and US with high sensitivity and specificity of correct localization. CT and MRI may help in further localizing the tumor. Since intraoperative frozen-section histology cannot be used to distinguish adenoma from hyperplasia in most cases, Miccoli et al.\textsuperscript{4)} and Hallfeldt et al.\textsuperscript{7)} strongly recommend using quick, intraoperative parathyroid hormone assay to evaluate the successful removal of the diseased gland. Hallfeldt et al.\textsuperscript{7)} consider surgery to be successful when a \textgreater{} 50\% decrease in the preexcision iPTH level is observed after 5 min. Although we did not use an intraoperative assay, we think it should be adopted in our institution.

As for the cure of PHPT, this endoscopic surgery seems equal to open one. Post-operative hormonal data suggested complete resection of the adenomas. Although endoscopic surgery requires practice and manipulating devices in the working space is restricted, a highly magnified operative field under endoscopy allows for accurate dissection of adenomas. We also need to carry out long-term follow up of these cases.

By our method, we used a large volume of carbon dioxide. Problems resulting from this might be complications like hypercarbia and subcutaneous emphysema as well as the cost of surgery. However, we did not experience any problems at 6 mmHg inflation in relation to hypercarbia, and were able to prevent the expansion of subcutaneous emphysema to the face and upper limbs using a rubber band and elastic tapes pressed along the mandible and both shoulders. The cost should decrease if we can shorten the operation time after the early phase of the learning curve.

Due to the demand for cosmetic surgery, minimally invasive parathyroidectomy for PHPT may become more popular, but limitations still remain. These include the size of the adenoma, pathological features, the presence of a thyroid nodule, anatomical abnormalities around the neck, chronic obstructive pulmonary disease or severe coronary disease and so on.\textsuperscript{3,4,6)}

If we select an adequate case, we believe this method is very feasible especially for female patients in terms of cosmetic viewpoint.

**References**