Effect of capsular dissection technique on the parathyroid function and recurrent laryngeal nerve in patients with thyroid tumor

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ABSTRACT
Objective: To explore the effect of capsular dissection technique on the parathyroid function and recurrent laryngeal nerve in patients with thyroid tumor. Methods: A total of 70 patients with differentiated thyroid carcinoma who were admitted in our hospital from May, 2011 to July, 2016 were included in the study and randomized into the observation group and the control group. The patients in the observation group were performed with total thyroidectomy by adoption of capsular dissection technique, while the patients in the control group were performed with the traditional thyroidectomy. The serum PTH, Ca\(^{2+}\) concentration, and adverse reactions before and after treatment in the two groups were compared. Results: The serum PTH and Ca\(^{2+}\) 1 d until 1 month after operation in the observation group were significantly higher than those in the control group (P<0.05). The serum PTH and Ca\(^{2+}\) 6 months after operation in the two groups were recovered to the levels before operation, and the comparison between the two groups was not statistically significant (P>0.05). The occurrence rate of temporary parathyroid damage in the observation group was significantly lower than that in the control group (P<0.05), while the comparison of the occurrence rate of recurrent laryngeal nerve damage and hypocalcemia between the two groups was not statistically significant (P>0.05). Conclusions: Capsular dissection technique in the total thyroidectomy can significantly reduce the parathyroid and recurrent laryngeal nerve damage, with a higher clinical application value.

1. Introduction

The thyroid tumor is common in the clinic, including the benign and malignant tumor, among which the benign tumor with adenoma mainly involved is in the majority[1]. Currently, the thyroid cancer has an increasing global morbidity, and is the fourth in the female malignant tumors in China[2,3]. Operation is mainly involved in the treatment of thyroid cancer, with total thyroidectomy and lymph node dissection in the central area as the common surgical methods in the clinic. However, due to the special and complicated anatomical position of thyroid, the operation can easily cause the parathyroid cut by mistake, blood supply disturbance, temporary and permanent parathyroid hypofunction, limbs twitch, deadlimb, and reduced living quality; therefore, the safety of operation remains open to question[4,5]. Some scholars argue that the capsular dissection technique in replace of cluster ligation has a preferable clinical application value[6]. The study is aimed to explore the effect of capsular dissection technique on the parathyroid function and recurrent laryngeal nerve in patients with thyroid tumor.

2. Materials and methods

2.1. General materials

A total of 70 patients with differentiated thyroid carcinoma who were admitted in our hospital from May, 2011 to July, 2016 were included in the study, among which 22 were male, and 48 were female; aged from 18 to 70 years old; average lesion diameter...
Separation was conducted downward. Cling to the true capsule, the laryngeal nerve was exposed inferior to the cricoid cartilage. Meanwhile, the thyroid glands were flattened. The recurrent artery posterior branches of superior arteries were carefully distinguished. Dissected. The cricothyroid space was separated. The anterior and posterior true and false capsule was performed. The superior thyroid was by adoption of capsular dissection technique. Blunt dissection of lymph fatty tissues in the central area were removed. The patients in the two groups were performed with total thyroidectomy. Two parathyroid glands were remained during operation. The glandular lobes and isthmus were removed with the same methods.

2.2. Methods

The patients were randomized into the observation group and the control group with 35 cases in each group. The comparison of the general materials between the two groups was not statistically significant (P > 0.05), but it was comparable. Before operation, the patients in the two groups were performed with routine B ultrasound and or cervical CT to delineate the tumor location, size, and number, peripheral lymph node enlargement. The serum calcium and thyroid function were routinely detected. The patients in the two groups were performed with inhalation anesthesia. A curved incision with a length of 6.0–8.0 cm was made along with the sternal notch. The skin was cut open until the cervical sphincter. The patients in the control group were performed with the traditional thyroidectomy. Blunt dissection of true and false capsule was performed to fully expose the bilateral glandular lobes. The principle of near and far is abided by [7]. The superior arteries and veins of the thyroid were ligated near the superior thyroid. The inferior arteries and veins of the thyroid were ligated far from the inferior thyroid. The identified parathyroid glands were labeled. The cluster was cut off. The extracapsular tissues were ligated, and the glandular lobes were dissected. The differentiated thyroid carcinoma was confirmed by the rapid pathological examination during operation. The contralateral glandular lobes and isthmus were removed with the same methods. Two parathyroid glands were remained during operation. The lymph fatty tissues in the central area were removed. The patients in the observation group were performed with total thyroidectomy by adoption of capsular dissection technique. Blunt dissection of true and false capsule was performed. The superior thyroid was dissected. The cricothyroid space was separated. The anterior and posterior branches of superior arteries were carefully distinguished. Cling to the true capsule, the terminal branches were cut off, and the superior parathyroid glands and peripheral tissues were stripped. Pay attention to protect the parathyroid glands in order to avoid the damage. Meanwhile, the thyroid glands were flattened. The recurrent laryngeal nerve was exposed inferior to the cricoid cartilage. Separation was conducted downward. Cling to the true capsule, the inferior arterial and venous branches were cut off and ligated. Berry ligament was cut off. The glandular lobes were removed and sent for inspection. The rest procedures were the same as in the control group. A drainage tube was placed after operation. Thyroidin tablets and calcium agents were preventively applied.

2.3. Observation indicators

PTH and serum Ca$^{2+}$ levels before operation, 1, 2, and 7 d, 1 and 2 months after operation in the two groups were compared. The occurrence rate of parathyroid gland cut by mistake, damage, hypocalcemia, and recurrent laryngeal nerve damage was calculated. Hoarseness and vocal cord activity disturbance were regarded as recurrent laryngeal nerve damage. Hypocalcemia refers to that the serum Ca$^{2+}$ was less than 2.1–2.9 mmol/L, with limbs twitch, and perioral and limbs numbness. The parathyroid damage refers to that the serum PTH was less than 15–65 mg/mL. The temporary damage: the symptoms were disappeared after 6-month treatment; the permanent damage: the symptoms still existed after 6-month treatment, and continuous treatment was required [8]. After 6-month follow-up visit, the local tumor recurrence, distant metastasis, and lymphatic metastasis were recorded, and the occurrence rate was calculated.

2.4. Statistical analysis

SPSS 18.0 software was used for the statistical analysis. The measurement data were expressed as mean±SD. The paired t test was used for the intra-group comparison, and the independent t test was used for the comparison between the two groups. The enumeration data were expressed as percentage, and chi-square test was used. P < 0.05 was regarded as statistically significant.

3. Results

3.1. Comparison of the serum PTH and Ca$^{2+}$ before and after operation between the two groups

The serum PTH and Ca$^{2+}$ 1 d until 1 month after operation in the two groups were reduced first and elevated later; moreover, those in the observation group were significantly higher than those in the control group (P < 0.05). The serum PTH and Ca$^{2+}$ 6 months after operation in the two groups were recovered to the levels before operation, and the comparison between the two groups was not statistically significant (P > 0.05) (Table 1).
3.2. Comparison of the occurrence rate of postoperative adverse reactions between the two groups

The occurrence rate of temporary parathyroid damage in the observation group was significantly lower than that in the control group \((P<0.05)\), while the comparison of the occurrence rate of recurrent laryngeal nerve damage and hypocalcemia between the two groups was not statistically significant \((P>0.05)\) (Table 2).

3.3. Comparison of the follow-up visit results

In the observation group, 1 had local recurrence, 1 had distant metastasis, and the recurrence rate was 5.71%. In the control group, 1 had local recurrence, 1 had distant metastasis, 1 had lymphatic metastasis, and the recurrence rate was 8.57%. The comparison of the recurrence rate between the two groups was not statistically significant \((P>0.05)\).

4. Discussion

The surgical resection is mainly involved in the treatment of benign and malignant thyroid tumor in the clinic. For patients with differentiated thyroid carcinoma, the total thyroidectomy can contribute to reduce the postoperative recurrence rate, and extend the survival time[9]. However, during the long-term clinical practice, it is found that the total thyroidectomy can easily reduce the parathyroid function, and damage the recurrent laryngeal nerve, which can affect the prognosis, reduce the living quality, and is also a main factor for causing the conflict between the doctors and patients; therefore, during the treatment process, it should pay attention to reduce the postoperative complications, and enhance the treatment safety[10].

Parathyroid is a kind of small endocrine gland, with an average diameter of 0.35 cm, and can regulate \(Ca^{2+}\) metabolism and maintain the balance of Ca and P through secreting PTH. Due to parathyroid locating inside the fibrous capsule of the back of parathyroid glandular lobe, 80% of its blood supply is from the superior and inferior arterial branches of thyroid; therefore, during operation, usually due to cut by mistake and intraoperative blood vessel ligation, its blood supply is blocked[11]. During operation, due to attach importance to the recurrent laryngeal nerve and superior laryngeal nerve, the principle of near and far is abided by.

Emphasis on cutting off the main branch, ligating the superior and inferior vessels of thyroid, and blunt dissection during operation can block the parathyroid blood supply, which can cause the ischemic and hypoxic necrosis, resulting in deadlimb, hypocalcemia, and convulsion[12]. The main points of capsular dissection technique are listed in the following: (1) the parathyroid gland was dissected cling to the true capsule; (2) the small blood vessels in and out the gland were ligated; (3) the operation was performed not penetrating into the gland; (4) the parathyroid was retained in situ; (5) the parathyroid blood perfusion was guaranteed; (6) the recurrent and superior laryngeal nerves were protected to reduce the postoperative complications[13]. Some researches demonstrate that[14] application of capsular dissection technique can expose the recurrent laryngeal nerve, maximumly protect the recurrent laryngeal nerve, and will not increase the operation difficulty and time. The results in the study showed that the serum PTH and \(Ca^{2+}\) 1 d until 1 month after operation in the observation group were significantly higher than those in the control group \((P<0.05)\); the serum PTH and \(Ca^{2+}\) 6 months after operation in

### Table 1
Comparison of the serum PTH and \(Ca^{2+}\) before and after operation between the two groups \((\bar{x}\pm s, n=35)\).

<table>
<thead>
<tr>
<th>Groups</th>
<th>Indicators</th>
<th>Before operation</th>
<th>1 d after operation</th>
<th>2 d after operation</th>
<th>7 d after operation</th>
<th>1 month after operation</th>
<th>6 months after operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation group</td>
<td>PTH</td>
<td>46.33±17.93</td>
<td>22.42±10.18</td>
<td>21.27±9.05</td>
<td>26.52±11.42</td>
<td>32.86±16.24</td>
<td>46.25±15.32</td>
</tr>
<tr>
<td>Control group</td>
<td>PTH</td>
<td>47.91±18.52</td>
<td>13.78±7.12</td>
<td>12.43±7.03</td>
<td>16.87±8.26</td>
<td>25.04±14.27</td>
<td>45.75±15.35</td>
</tr>
<tr>
<td>t</td>
<td></td>
<td>0.363</td>
<td>4.115</td>
<td>4.564</td>
<td>4.051</td>
<td>2.140</td>
<td>0.136</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>0.718</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.036</td>
<td>0.892</td>
</tr>
<tr>
<td>Observation group</td>
<td>(Ca^{2+})</td>
<td>2.12±0.11</td>
<td>2.11±0.13</td>
<td>2.03±0.11</td>
<td>2.14±0.13</td>
<td>2.16±0.13</td>
<td>2.21±0.12</td>
</tr>
<tr>
<td>Control group</td>
<td>(Ca^{2+})</td>
<td>2.13±0.12</td>
<td>1.84±0.11</td>
<td>1.75±0.11</td>
<td>1.89±0.12</td>
<td>2.02±0.13</td>
<td>2.19±0.14</td>
</tr>
<tr>
<td>t</td>
<td></td>
<td>0.363</td>
<td>9.380</td>
<td>10.648</td>
<td>8.360</td>
<td>4.505</td>
<td>0.642</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>0.717</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.523</td>
</tr>
</tbody>
</table>

### Table 2
Comparison of the occurrence rate of postoperative adverse reactions between the two groups \([n(\%), n=35]\).

<table>
<thead>
<tr>
<th>Groups</th>
<th>Recurrent laryngeal nerve damage</th>
<th>Hypocalcemia</th>
<th>Parathyroid damage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Temporary</td>
<td>Permanent</td>
<td>Temporary</td>
</tr>
<tr>
<td>Observation group</td>
<td>2(5.71)</td>
<td>0(0.00)</td>
<td>1(2.86)</td>
</tr>
<tr>
<td>Control group</td>
<td>4(11.43)</td>
<td>1(2.86)</td>
<td>3(8.57)</td>
</tr>
<tr>
<td>(\chi^2)</td>
<td>0.729</td>
<td>1.015</td>
<td>1.061</td>
</tr>
<tr>
<td>(P)</td>
<td>0.393</td>
<td>0.314</td>
<td>0.010</td>
</tr>
</tbody>
</table>


the two groups were recovered to the levels before operation, and the comparison between the two groups was not statistically significant ($P$>0.05); the occurrence rate of temporary parathyroid damage in the observation group was significantly lower than that in the control group ($P$>0.05), indicating that the capsular dissection technique has a same therapeutic effect with the routine surgical methods, and can better protect the parathyroid function and recurrent laryngeal nerve. Some other researches demonstrate that\[15,16\] the capsular dissection technique can reduce the asphyxia caused by a large amount of exudation pressing the trachea, and contribute to the recovery of body function; moreover, small incision and intradermal continuous suture are adopted, only one line scar is retained, and the appearance is beautiful; therefore, it is easy to be accepted by the female patients.

In conclusion, capsular dissection technique in the total thyroidectomy has an ideal therapeutic effect, and can significantly reduce the parathyroid and recurrent laryngeal nerve damage, with a higher clinical application value, with a significant treatment advantage.

References


