Modified V-shaped concealed incision versus S-shaped incision in the treatment of benign parotid tumors: a case-control study

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Abstract

Objective: To investigate the feasibility and efficacy of a modified V-shaped incision for partial superficial parotidectomy in the treatment of benign parotid tumors, and compare it with a traditional S-shaped incision. Methods: Fifty benign parotid tumor patients who required partial superficial parotidectomy were selected and randomly divided into two groups, treated with the modified V-shaped incision (V-group) and the traditional S-shaped incision (S-group), respectively. Intraoperative, postoperative, and follow-up indicators were compared between these two groups. Results: There were no statistically significant differences (P > 0.05) between these two groups in drainage volume, postoperative extubation time, postoperative hospital stay, periauricular numbness, fistulas, facial palsy, facial depression, incidence of Frey syndrome, scar score after 1-month follow-up, and 18-month postoperative recurrence rate. In terms of appearance satisfaction score 6 months after surgery, the V-group was superior to the S-group. When the tumor was located at the low part or its diameter was >3 cm, the surgical time in the V-group was longer than that in the S-group. Conclusions: In surgery of benign parotid tumors, when the modified V-shaped incision is applied, the surgical time is prolonged only when the tumors are located at the low part of the parotid gland. For tumors at different sites, the V-shaped incision can achieve a better cosmetic effect than the S-shaped incision without inducing surgical complications.

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Keywords: parotid tumors, surgical procedure, surgical incision, V-shaped concealed incision, S-shaped incision, case-control study

Key points
• A modified V-shaped incision for partial superficial parotidectomy was compared with a traditional S-shaped incision.
• The modified V-shaped incision has a few advantages.
• The modified V-shaped incision has better facial cosmetic effect and no increase in postoperative complications.
• The surgical time of the modified V-shaped incision is slightly longer than that of the S-shaped incision.
• This modified V-shaped incision is worthy of clinical promotion.

Introduction

Parotid tumors are common primary tumors of the head and neck. They are mostly located in the superficial lobe of the parotid gland, and 80% are benign tumors (1, 2). Currently, surgery is the treatment of choice for parotid tumors (3). The traditional surgery adopts an S-shaped incision, which induces obvious scar and a series of complications, such as transient facial nerve paralysis, Frey syndrome, parotid fistula, and ear lobe numbness (4, 5). To reduce complications and visible scars, parotid gland surgery has moved to functional operations (5-7). Moreover, endoscopic parotidectomy has become a reliable procedure for benign and low-grade malignant parotid gland tumors by providing several advantages (8-12).

In this study, we used a modified V-shaped incision for partial superficial parotidectomy. During the surgeries, the normal tissue of the parotid gland, the parotid duct, the great auricular nerve and its earlobe branch, and the posterior auricular branch were preserved as much as possible. Then the 18-month clinical follow-up indicators and cosmetic effect of the modified V-shaped incision were compared with those of the traditional S-shaped incision. Results showed that the V-shaped incision can achieve a better cosmetic effect than the S-shaped incision without inducing surgical complications.

Material and methods

Reporting guideline

The RECORD statement (extension of STROBE).

Patients

This study was carried out in China and the ethics approval was granted. All of the study participants provided informed consent.

Fifty benign parotid tumor patients who underwent parotidectomy from January 2019 to June 2021 were selected. The inclusion criteria were as follows: (1) no symptoms of facial paralysis before surgery; (2) no history of neck surgery; (3) no history of radiotherapy and chemotherapy; and (4) no recurrent tumors. These patients were randomly divided into the V-shaped incision group (V-group) and the S-shaped incision group (S-group), with 25 cases per group. There were no statistically significant differences in gender, age, tumor diameter, or pathological type between these two groups ($P > 0.05$, see Table 1).
V-shaped concealed incision

After successful anesthesia, a patient laid on the back with head tilting to the healthy side. The V-shaped incision line was marked with the earlobe as the intersection point. The V-shaped incision started at the zygomatic arch level. The tragus cartilage was cut off. The incision was continued to the notch; went up around the earlobe and along the posterior ear groove to the level of the upper edge of the external auditory meatus. The deep surface flap of parotid masseter fascia was turned over to remove the tumor. The anterior auricular branch and the parotid branch of the great auricular nerve were cut and fixed subcutaneously. Its trunk, posterior auricular branch, auricular lobe branch, and nourishing vascular bed were kept. The cartilage of the external auditory canal was separated to the deep part. The trunk of the facial nerve was located approximately 0.5 cm from the upper edge of the attachment of the posterior belly of the digastric muscle. We dissected the cervical branch and temporal branch from the deep sides to shallow sides, and took 1.0 cm around the tumor as the safety boundary to remove the tumor and a part of the superficial lobe of the parotid gland. We covered the surgical cavity with oral repair membrane or sternocleidomastoid muscle flap, reset the flap, sutured it in layers, and applied suction with negative pressure and pressure bandage. The negative pressure drainage tube was removed 24–48 hours after surgery, and the parotid gland area was bandaged for 14 days after surgery. The suture was removed on the seventh day after surgery. Figure 1 shows the procedure of this V-shaped incision.

S-shaped incision

The incision started at the level of the zygomatic arch, in front of the tragus at the upper edge of the external auditory meatus. Next, it went down along the front ear dermatoglyph around the earlobe to reach the posterior ear groove, then bent downward, and continued along the neck dermatoglyph to the lower part of the mandibular angle. The neck S-shaped incision was approximately 1.5 cm away from the mandibular edge. When the flap was turned over, the integrity of the muscle membrane of the masseter muscle of the parotid gland was preserved to protect the great auricular nerve. The general trunk of the facial nerve was dissected in a cis manner to remove the tumor and a part of the superficial lobe of the parotid gland. The remaining methods were the same as the ones in the V-group. Figure 2 shows the procedure of the S-shaped incision.

Outcome measures

The surgery time, drainage volume, extubation time, hospitalization time, parotid fistula, transient facial paralysis, permanent facial paralysis, numbness around the ear, facial depression, and Frey syndrome were recorded.

The evaluation of facial paralysis degree, divided into six grades, was based on the House–Brackmann facial nerve grading system. The surgeon evaluated the patient on the first day and the third month after the surgery, and judged the transient facial paralysis, permanent facial paralysis, periauricular skin numbness according to the sensation of the three parts of the front ear, earlobe, and back ear.

During the third-month follow-up visit, scar was scored according to blood vessel, color, softness and extensibility, thickness, and pain and itch, with the highest score of 18 and the lowest score of 0 (13). A higher total score indicated a more serious scar.

Subjective satisfaction was investigated by a wound cosmetology questionnaire. During the follow-up visit 6 months after the surgery, the patients made subjective evaluations of their incisions, with scores 0 to 10. A higher score indicated a higher satisfaction level.

During the sixth-month follow-up visit, the doctor judged whether there was facial depression from the front view and the side view of the patient, and assessed whether there was Frey syndrome. At the one-year follow-up visit, the tumor recurrence was preliminarily judged by palpation and B-ultrasound in the parotid gland area.
Statistical analysis

SPSS 21.0 was used to process the data. The normally distributed measurement data were described by $\bar{x} \pm s$; the non-normally distributed data were described by $M [P25, P75]$; and the count data were represented by the number of cases and rates. Measurement data were compared by $t$ test and rank-sum test, while count data were compared by chi-square test and Fisher’s exact test. $P < 0.05$ was considered statistically significant.

Results

All surgeries were completed, with wound healing by first intention. No infection or wound dehiscence occurred, and no cases were lost to follow-up. There was no significant difference in drainage volume, hospitalization time, and extubation time between the two groups ($P > 0.05$).

The results are shown in Table 2. One case in the V-group and three cases in the S-group had transient facial paralysis after surgery, but all of them were House–Brackman grade I and recovered in approximately 3 months. One case in the V-group and two cases in the S-group had parotid fistula. Two cases in the V-group and three cases in the S-group developed numbness around the ear after surgery, and all recovered after 18 months. Two cases in the V-group and three cases in the S-group had facial depression. Frey syndrome did not occur in any of the groups. The surgery time of the V-group was longer than that of the S-group; there was no significant difference in wound scar score between the two groups; the appearance satisfaction of the V-group was higher than that of the S-group. None of the patients had tumor recurrence in 18 months.

The surgical time was compared (Table 3). Among the tumors located in the front, upper, and middle of the parotid gland, the surgical time of the two groups was not significantly different. For the tumors located in the lower part of the parotid gland or tumors with a diameter $>3$ cm, the surgical time required by the V-group was significantly longer than that of the S-group ($P < 0.05$).

Discussion

Improvement of surgical incision

The surgical field of the S-shaped incision is well exposed. If the intraoperative frozen section is malignant during the surgery, deep lobectomy of the parotid gland and dissection of cervical lymph nodes can be performed under the original incision (14). However, the surgery leads to obvious S-shaped scars.

To hide the incision as much as possible, a V-shaped incision was proposed: the anterior segment and the posterior sulcus segment are covered by the tragus and auricle (Figure 3) (15). Our investigation showed that the score of postoperative cosmetic effect and patient satisfaction in the V-group were higher than those in the S-group. When suturing the incision, the cartilage should be carefully aligned to prevent it from turning outside and inside the ear canal, resulting in stenosis of the external ear canal. None of the patients in this study had this condition. There was no significant difference in complications, postoperative drainage volume, and hospitalization time between the two groups, and their recurrence rates were not increased.

For tumors located in the lower part of the parotid gland and with a diameter $>3$ cm, the surgical time required in the V-group was longer than that in the S-group. The reason is that if the tumor was located at the lower edge of the parotid gland or its diameter exceeded 3 cm, it blocked the surgical field and affected the exposure of the facial nerve. There are three ways to solve this problem: (1) Fully turning the fascia flap will be beneficial to the surgical exposure and will shorten the surgical time. (2) Ultrasonic scalpels, bipolar electrocoagulation forceps, or needle electrodes are needed to assist hemostasis. (3) Antegrade dissection of the facial nerve can shorten the surgical time.
Improvement of surgical method

To reduce complications such as facial paralysis, parotid fistula, Frey syndrome, and asymmetric depression, we improved the surgical methods in both groups.

We adopted anterograde facial nerve dissection to reduce transient facial paralysis. To reduce transient facial paralysis, facial nerve protection is the key to parotidectomy (16). In previous surgeries, most of the facial nerve was dissected retrogradely (17). Peripheral branches of the facial nerve are small and variable. This method inevitably pulls the facial nerve ending, thereby causing transient facial paralysis. However, the anterograde dissection of the facial nerve does not need to reveal all branches, which avoids the pulling and damage of the peripheral branches (18) and reduces the probability of transient facial paralysis. Moreover, the main branch of the facial nerve is thick and its anatomical position is constant; there are many location markers (19); and the surgical difficulty is low, which can shorten the time of dissecting the facial nerve. No permanent facial paralysis occurred in the two groups in this study.

The contact between the parotid gland and the skin were preserved to reduce Frey syndrome. It is generally recognized that the sympathetic and parasympathetic nerves are cut off during the surgery, and the broken ends may heal wrongly. When the patient eats, the parasympathetic nerves are excited, causing pathological secretion of sweat glands and expansion of skin vessels, and facial flushing (20), with an incidence of 23.5%–60% (21). During the surgery, spacer materials are used to isolate the residual parotid gland and subcutaneous tissue wound (22). At the same time, when the flap is turned over, the fascia layer of the maseter muscle of the parotid gland is turned over from the surface of the parotid gland as completely as possible to reduce the probability of cutting the subcutaneous sympathetic nerve. It can also serve as a barrier to prevent the wrong healing of the sympathetic nerve and parasympathetic nerve fibers (23), and reduce the occurrence of Frey syndrome. Frey syndrome did not occur for all 40 patients in this study.

Partial parotidectomy was performed. The traditional superficial lobectomy of the parotid gland causes obvious facial asymmetric depression, which affects the secretion function of the parotid gland. Organ function should be preserved as much as possible. If the tumor is close to the duct and nerve, the tumor can be excised close to the tumor envelope without increasing the recurrence rate (22). If adenolymphoma is accompanied by lymphadenopathy or multiple tumors, in addition to preserving the 1.0 cm safe range, it is also necessary to clean the lymph nodes around the posterior mandibular vein (24).

The great auricular nerve was protected. Because the great auricular nerve provides sensory innervation of the earlobe and the surrounding skin, numbness or hypersensitivity in the parotid region and the area around the ear may occur after the surgery (25). Generally, the posterior ear and the earlobe branches are retained. After cutting, the corresponding subcutaneous suture is performed. Eight patients experienced temporary numbness in the surgical area, and all recovered after 18 months of follow-up. Even if the anterior ear branch and parotid branch are cut off, the numbness of the skin can be gradually improved if the trunk, earlobe, and posterior ear branch are preserved.

Conclusions

The V-shaped incision has the advantages of better facial cosmetic effect and no increase in postoperative complications, and is worth popularizing in the clinic. The surgical time is slightly longer than that of the S-shaped incision because the exposure of the surgical field is more difficult. Currently, if patients with parotid gland tumor are highly suspected of malignant tumor and need neck lymph node dissection, an S-shaped incision is usually used to fully expose the surgical cavity, and a V-shaped incision is used for the remaining cases. When the patient needs neck lymph node dissection, the V-shaped incision can be extended to the neck. The ideal goal of surgery is to completely remove the tumor, minimize the damage, and give consideration to facial esthetics. In this study, when the tumor was located at the front edge of the parotid gland and the diameter was more than 3 cm, endoscopy-assisted surgery was used to better expose the surgical field and achieve accurate surgery. It should be noted that, due to the variety of tumor locations, shapes (especially pleomorphic adenomas), and the risk of the facial nerve branches running in close proximity to the tumor capsule, the modified V-shape incision can be used only in some selected cases.
References


**Table 1.** General information and tumor characteristics of patients in the two groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of cases</th>
<th>Age</th>
<th>Gender (male/female)</th>
<th>Tumor diameter (cm) &lt;3 cm/&gt;3 cm</th>
<th>Pleomorphic adenoma/adenolymphoma/basal cell tumor (cases)</th>
<th>Tumor location</th>
<th>Front/top/middle</th>
<th>Front/top/middle</th>
</tr>
</thead>
<tbody>
<tr>
<td>V-group</td>
<td>25</td>
<td>45.15±8.12</td>
<td>9/16</td>
<td>2.1 (16, 9)</td>
<td>19/5/1</td>
<td></td>
<td>8/3/9/5</td>
<td></td>
</tr>
<tr>
<td>S-group</td>
<td>25</td>
<td>43.63±7.21</td>
<td>10/15</td>
<td>2.3 (14, 11)</td>
<td>18/6/1</td>
<td></td>
<td>6/2/10/7</td>
<td></td>
</tr>
<tr>
<td>t/χ²</td>
<td>-</td>
<td>0.329</td>
<td>0.193</td>
<td>2.192</td>
<td>-</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>P</td>
<td>-</td>
<td>0.394</td>
<td>0.769</td>
<td>0.561</td>
<td>0.728*</td>
<td></td>
<td>0.552</td>
<td></td>
</tr>
</tbody>
</table>

* Fisher’s exact test.

**Table 2.** Comparison of relevant observation indexes between the two groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>Surgical time (min)</th>
<th>Drainage volume (mL)</th>
<th>Postoperative extubation time (d)</th>
<th>Postoperative hospital stay (d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>V-group</td>
<td>75.7±23.16</td>
<td>34.8±9.42</td>
<td>3 (3, 6)</td>
<td>4 (3, 7)</td>
</tr>
<tr>
<td>S-group</td>
<td>65.3±19.80</td>
<td>39.5±10.45</td>
<td>3 (3, 6)</td>
<td>4 (3, 7)</td>
</tr>
<tr>
<td>τ/χ²</td>
<td>12.232</td>
<td>0.265</td>
<td>0.712</td>
<td>0.715</td>
</tr>
<tr>
<td>P</td>
<td>0.042</td>
<td>0.875</td>
<td>0.843</td>
<td>0.765</td>
</tr>
</tbody>
</table>

**Table 3.** Comparison of surgical time of parotid tumors in different parts between the two groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>Front Surgical time</th>
<th>Front Surgical time</th>
<th>Top Surgical time</th>
<th>Top Surgical time</th>
<th>Middle Surgical time</th>
<th>Middle Surgical time</th>
<th>Bottom Surgical time</th>
<th>Bottom Surgical time</th>
<th>Diameter &gt; 3 cm/ &lt;3 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>V-group</td>
<td>70.0±20.11</td>
<td>68.0±17.76</td>
<td>65.0±16.75</td>
<td>60.0±15.35</td>
<td>65.0±19.16</td>
<td>65.0±19.16</td>
<td>13.232</td>
<td>13.232</td>
<td>15.253</td>
</tr>
<tr>
<td>S-group</td>
<td>64.0±16.16</td>
<td>62.0±19.28</td>
<td>60.0±15.35</td>
<td>60.0±15.35</td>
<td>65.0±19.16</td>
<td>65.0±19.16</td>
<td>13.232</td>
<td>13.232</td>
<td>15.253</td>
</tr>
</tbody>
</table>

7
<table>
<thead>
<tr>
<th>Group</th>
<th>Front</th>
<th>Front</th>
<th>Top</th>
<th>Top</th>
<th>Middle</th>
<th>Middle</th>
<th>Bottom</th>
<th>Bottom</th>
<th>Diameter</th>
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</thead>
<tbody>
<tr>
<td>P</td>
<td>0.065</td>
<td>0.065</td>
<td>0.074</td>
<td>0.074</td>
<td>0.068</td>
<td>0.068</td>
<td>0.032</td>
<td>0.032</td>
<td>0.028</td>
</tr>
</tbody>
</table>

**Figures:**

**Figure 1.** Parotidectomy through a V-shaped concealed incision. (A) Preoperative CT examination. (B) Preoperative marking of the incision. (C) Cutting the skin. (D) Intraoperative exposure range. (E) Postoperative suture of oral repair membrane. (F) Incision situation one week after surgery. (G) Incision situation one month after surgery.
Figure 2. Parotidectomy through an S-shaped incision. (A) Preoperative CT examination. (B) Preoperative marking of the incision. (C) Cutting the skin. (D) Intraoperative exposure range. (E) Postoperative suture of oral repair membrane. (F) Incision situation one week after surgery. (G) Incision situation one month after surgery.

Figure 3. Surgical incisions for parotidectomy. (A) S-shaped incision; (B) N-shaped incision; (C) inverted V-shaped incision; and (D) V-shaped incision.