Minor Parotidectomy Complications: A Systematic Review

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OBJECTIVES: To report descriptive statistics for minor parotidectomy complications.

METHODS: A systematic review was performed, selecting 235 studies for analysis. The incidence of complications was tabulated, and descriptive statistics calculated. Outlier studies, 1 standard deviation above the mean, were reexamined to determine potential causal factors for each complication. All studies were examined for statistically significant differences for any potential causal factor.

RESULTS: The pooled incidence of minor complications reported were: hematoma 2.9% (95% confidence interval [CI]: 2.4–3.5%), wound infection 2.3% (95% CI: 1.8–2.9%), sialocele 4.5% (95% CI: 3.5–5.7%), salivary fistula 3.1% (95% CI: 2.6–3.7%), flap necrosis 1.7% (95% CI: 1.1–2.5%), scar issues 3.6% (95% CI: 2.4–5.4%), numbness 33.9% (95% CI: 25.6–43.4%), and deformity 11.8% (95% CI: 6.9–19.5%). Implants result in more wound complications, such as hematoma, sialocele, or salivary fistula. Sialocele and salivary fistula appear more frequently after less extensive parotid surgery, whereas hematoma, wound infections, flap necrosis, and aesthetic considerations are worse with more extensive resections.

Conclusions: Minor parotidectomy complications are more frequent than generally assumed and related to certain factors that should be investigated.

Key Words: Parotidectomy, complication, hematoma, sialocele, salivary fistula, scar, numbness, deformity, infections, flap necrosis.

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INTRODUCTION

The most devastating complication of parotid surgery is facial paralysis, and therefore the literature on parotidectomy complications is centered on this problem.1,2 Another complication largely addressed in the literature is Frey syndrome,3 although its incidence seems to decline with the increased use of various prevention techniques, such as superficial musculoaponeurotic system (SMAS) flaps.4

The remaining complications after parotidectomy include sialocele; salivary fistula; skin anesthesia; wound complications such as infection, bleeding, hematoma, seroma, and skin flap necrosis; as well as the late occurring adverse scarring and local deformity with skin depression. These minor parotidectomy complications have not been well studied, and their incidence is debatable.

This study aimed to evaluate the incidence and predicting factors of minor parotidectomy complications through a systematic review of the published literature.

Materials and Methods

The review was prepared according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. PubMed and Embase were searched in January 2019 with the following combination of terms: “parotidectomy” and “complications,” “parotidectomy” and “sialocele,” “parotidectomy” and “salivary fistula,” “parotidectomy” and “numbness,” “parotidectomy” and “hematoma,” “parotidectomy” and “infection,” “parotidectomy” and “flap necrosis,” “parotidectomy” and “scar,” and “parotidectomy” and “deformity.” No language restriction was imposed, and unpublished abstracts were not searched for.

The 1,426 references retrieved from PubMed and the 468 references retrieved from Embase were examined for duplicates, which were removed (n = 485), and thereafter some studies were excluded on the abstract content (n = 870) and others after reading the entire article (n = 239). The references of included studies were also checked, providing additional (n = 32) articles (Fig. 1).

To be included, a study needed to provide the incidence of at least one complication of parotidectomy. The pathology (benign, malignant, or infections), the patients’ age group, and the extent of parotidectomy were not exclusion criteria. To avoid case reports, we arbitrarily set at 10 the minimal number of patients required for a study to be included. In each study, all the parotidectomy complications of interest were tabulated. Articles search and selection, as well as data extraction, was performed independently by two authors (S.L., P.D.).

The definition of a given complication is the one given by the individual authors; for example, a skin color change could be considered as a hematoma by some authors, whereas others included only patients requiring clot evacuation. Seroma and sialocele were used as one category. For most complications, namely hematoma, wound infection, sialocele, salivary fistula, flap necrosis, and hypertrophic scars, the occurrence was binary (yes/no). Some complications, such as numbness and depression, were reported as categories; normal or mild or light were tabulated as absent, whereas all other more advanced categories were...
counted as present. Finally, data for all complications were expressed as percent of occurrence in a given publication.

Risk of bias was assessed according to the Risk of Bias Assessment Tool for Nonrandomized Studies (RoBANS) scale by two authors (S.L., P.D.). The six domains (the selection of participants, confounding variables, the measurement of exposure, the blinding of the outcome assessments, incomplete outcome data, and selective outcome reporting) were evaluated separately, without the use of an overall RoBANS score (Supporting Table S1).

Statistical analysis was carried out in IBM SPSS Statistics version 25.0 (IBM, Armonk, NY), and R v.3.6.0 (R Foundation for Statistical Computing, Vienna, Austria) with the meta library. Most statistics are descriptive. We pooled estimates of complication prevalence using a random-effects method, weighting individual study results by the inverse of their variance. Heterogeneity was assessed with $I^2$ statistics, and we considered results heterogeneous at $I^2 > 50%$. Outlier studies, 1 standard deviation above the mean, were reexamined to determine potential causal factors for each complication. All studies were examined for statistically significant differences calculated by their authors for any potential causal factor of minor parotidectomy complications.

RESULTS

A total of 235 studies are included in this review (Supporting Table S1), reporting on 31,994 patients. Most publications on parotidectomy complications occurred since 2000. Studies were mostly observational and retrospective with no control group; therefore, the risk of bias is expected to be high. However, according to the RoBANS criteria, low bias was estimated for patient selection (low: 95%, unclear: 1%, high: 4%), measurement of exposure (low: 77%, unclear: 3%, high: 20%), blinding of outcome assessments (low: 79%, unclear: 15%, high: 6%), and outcome reporting (low: 64%, unclear: 5%, high: 31%). For confounding variables, which were rarely studied, the bias was classified as high for most studies (low: 10%, unclear: 4%, high: 86%). Incomplete outcome data were found to be intermediate (low: 48%, unclear: 7%, high: 45%), with recent and short span studies being of low bias potential and older or studies spanning several decades seen as high bias.

Hematoma

Hematoma was reported in 125 studies6–130 reporting on 17,545 patients (Table I and Fig. 2A). The pooled incidence of hematoma reported was 2.9% (95% confidence interval [CI]: 2.4-3.5), with a minimum of 0% and a maximum of 41.2%, indicating large heterogeneity among studies ($I^2 = 77.1%$).
An elevated incidence of postparotidectomy hemato-
toma was found in studies using foreign material for pre-
vention of Frey syndrome or deformity: self-forming clot 
from the patient’s own blood, fibrin glue (Tissucaul), 
porcine dermal collagen (Permacol; Covidien, Mansfield, 
MA), and dermis-fat grafts. In other studies, an 
elderly patient population with comorbidities or the 
throughout follow-up of a prospective study might have 
contributed to a reported high incidence of hematoma.

**Wound Infection**

Wound infection was reported in 94 studies, 17, 21–25, 27, 28, 31, 35, 36, 39–44, 49, 55–57, 67–72, 74, 75, 79, 81, 85–90, 92, 93, 95, 96, 98–103, 105–107, 111, 112, 115–122, 124, 125, 128, 131–149 reporting on 15,861 patients (Table I and Fig. 2B). The pooled incidence of wound infection reported was 2.3% (95% CI: 1.8–2.9), with a minimum of 0% and a maximum of 21.2%, indicating large heterogeneity among studies ($I^2 = 78.6\%$).

In studies with an increased incidence of wound infection, possible contributing factors included parotidectomy for sialadenitis, surgery for parotid malignancy and associated neck dissection, retrograde facial nerve dissection, SMAS dissection and lifting incision, with or without a sternocleidomastoid flap. In several studies, no clear explanation could be found.

**Sialocele**

Sialocele was reported in 102 studies, 10, 14, 15, 17, 23–25, 33–36, 38, 39, 41–44, 46, 48, 50, 51, 56–62, 64, 66, 67, 69, 70, 72–77, 79–85, 97–92, 95, 96, 98, 100–103, 106–108, 110–116, 118–121, 125, 128, 135–143, 141, 144, 146, 147, 150–169 reporting on 13,760 patients (Table I and Fig. 2C). The pooled incidence of sialocele reported was 4.5% (95% CI: 3.5–5.7), with a minimum of 0% and a maximum of 44.2%, indicating large heterogeneity among studies ($I^2 = 89.3\%$).

Increased incidence of sialoceles was found with the use of implants (AlloDerm, collagen sponge, polyglycolic acid sheet), and grafts (autologous platelet adhesives with a dermal fat graft). Several studies show a statistical increase of sialoceles with less extensive parotid resections in two studies, no clear explanation could be found for the high incidence of sialoceles. 

**Salivary Fistula**

Salivary fistula was reported in 137 studies, 6, 10, 12, 14–16, 18–24, 27, 28, 30–34, 36–38, 40–43, 45–47, 49, 51, 52, 55, 56, 62–65, 75, 76, 79, 84–87, 89, 91, 93–97, 99, 101, 103–109, 112, 114–119, 124–127, 129, 131–133, 136, 138, 139, 141, 144, 148–150, 153, 154, 156, 164, 166, 170–215 reporting on 18,815 patients (Table I and Fig. 2D). The pooled incidence of salivary fistula reported was 3.1% (95% CI: 2.6–3.7), with a minimum of 0% and a maximum of 21.0%, indicating large heterogeneity among studies ($I^2 = 74.8\%$). Factors associated with an increased incidence of salivary fistula include implants (fibrin glue, Gore-Tex, acellular dermal matrix), parotidectomy for sialadenitis, less extensive parotidectomy, SMAS dissection and lifting incision, with or without a sternocleidomastoid flap. In several studies, no clear explanation could be found.

**Flap Necrosis**

Flap necrosis was reported in 34 studies reporting on 7,017 patients (Table I and Fig. 2E). The pooled incidence of flap necrosis reported was 1.7% (95% CI: 1.1–2.5), with a minimum of 0% and a maximum of 14.0% (heterogeneity $I^2 = 70.7\%$). A factor possibly related to flap necrosis was the extent of surgery, being for recurrences or for deep lobe tumors. In two studies, no clear explanation could be found.

**Scar Problems**

Scarring issues were reported in 46 studies reporting on 5,758 patients (Table I and Fig. 2F). The pooled incidence of keloids or hypertrophic scars reported was 3.6% (95% CI: 2.4–5.4), with a minimum of 0% and a maximum of 61% (heterogeneity $I^2 = 70.7\%$).

Long-term questionnaire evaluation seems to lead to high dissatisfaction with parotidectomy scars. In addition, scars in pediatric populations seem more often unfavorable. In one study, no clear explanation could be found.

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**Table I. Descriptive Statistics for Parotidectomy Complications.**

<table>
<thead>
<tr>
<th>Complication</th>
<th>No. of Studies</th>
<th>No. of Patients</th>
<th>Average ± Standard Deviation</th>
<th>SE Mean</th>
<th>Median</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hematoma</td>
<td>125</td>
<td>17,554</td>
<td>4.05 ± 5.0%</td>
<td>0.44%</td>
<td>2.97%</td>
<td>0.00%</td>
<td>41.2%</td>
</tr>
<tr>
<td>Wound infection</td>
<td>94</td>
<td>15,861</td>
<td>3.22 ± 3.63%</td>
<td>0.37%</td>
<td>2.10%</td>
<td>0.00%</td>
<td>31.2%</td>
</tr>
<tr>
<td>Sialocele</td>
<td>102</td>
<td>13,760</td>
<td>7.27 ± 8.3%</td>
<td>0.86%</td>
<td>4.76%</td>
<td>0.00%</td>
<td>44.2%</td>
</tr>
<tr>
<td>Salivary fistula</td>
<td>137</td>
<td>18,185</td>
<td>4.22 ± 4.0%</td>
<td>0.34%</td>
<td>3.13%</td>
<td>0.00%</td>
<td>21.0%</td>
</tr>
<tr>
<td>Flap necrosis</td>
<td>34</td>
<td>7,017</td>
<td>2.92 ± 3.3%</td>
<td>0.57%</td>
<td>1.24%</td>
<td>0.00%</td>
<td>14.0%</td>
</tr>
<tr>
<td>Scar issues</td>
<td>46</td>
<td>5,758</td>
<td>6.86 ± 10.2%</td>
<td>1.50%</td>
<td>3.74%</td>
<td>0.00%</td>
<td>61.0%</td>
</tr>
<tr>
<td>Numbness</td>
<td>57</td>
<td>6,376</td>
<td>38.74 ± 29.8%</td>
<td>3.41%</td>
<td>33.60%</td>
<td>0.87%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Deformity</td>
<td>25</td>
<td>2,481</td>
<td>15.54 ± 11.76%</td>
<td>2.94%</td>
<td>14.50%</td>
<td>0.00%</td>
<td>45.0%</td>
</tr>
</tbody>
</table>

SE = standard error.
Numbness

Numbness was reported in 57 studies\textsuperscript{17,20,24,25,34,45,50,59,62,64,65,69,72,76,78,80,85,90–92,95,104,110,116,120,125,127,136,138,140,160,164,168,194,200,203,205,206,208,210,214,217,220,222,225–238} reporting on 6,376 patients (Table I). The pooled incidence of numbness reported was 33.9\% (95\% CI: 25.6-43.4), with a minimum of 0.87\% and a maximum of 100\% (heterogeneity $I^2 = 97.6\%$).

The data presented could not be converted to percentages in two studies.\textsuperscript{230,237} Increased incidence of numbness was related to greater auricular nerve sacrifice\textsuperscript{45,138,160,227,234,236} and possibly to the study design (prospective studies\textsuperscript{116,238} and long-term questionnaire evaluation\textsuperscript{91}).

Deformity

Postparotidectomy depression or deformity were reported in 25 studies\textsuperscript{29,37,43,83,91,99,103,105,107,116,136,143,157,164,188,194,205,208,213,219,221,223,224,239,240} reporting on 2,481 patients (Table I). The pooled incidence of depressions reported was 11.8 (95\% CI: 6.9-19.5), with a minimum of 0\% and a maximum of 45\% (heterogeneity $I^2 = 90.4\%$). In several studies (n = 11) the conversion of visual analog scales to percentage was not possible.\textsuperscript{37,83,99,105,136,143,205,224,240} The only factor from outliers is the absence of reconstruction.\textsuperscript{116,219} Statistically significant reduction of the depression was found after various reconstruction.
techniques: temporoparietal fascial flap,219 SMAS and sternocleidomastoid muscle flap,157 sternocleidomastoid muscle flap,213,246 or SMAS alone.53,99,143,205,224

**DISCUSSION**

This systematic review allowed the inclusion of a large number of studies, and thus patients, for most parotidectomy minor complications. The large number and the relatively small standard error of the mean for each complication should give confidence that the average values are good estimates of the occurrence of these complications. These data are therefore a good basis to quote in patient information and could serve as a baseline for further studies.

The risk factors for these complications were assessed using two approaches. In the first one, outlier studies with a high (higher than 1 standard deviation above the average) occurrence of a given complication were examined for these risk factors. In the second one, outlier analyses should be straightforward, there is ample room for interpretation. In this context, Ruohoalho et al.112 should be credited for clearly defining major and minor parotidectomy complications. Finally, the association between the various factors discussed and summarized in Table II and a given complication cannot be claimed until further studies confirm statistical differences between study groups for each complication. This review should be seen as a guide for the factors associated with complications that need to be addressed in prospective and randomized trials.

<table>
<thead>
<tr>
<th>TABLE II.</th>
<th>Factors Possibly Associated With Minor Parotidectomy Complications.</th>
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<tbody>
<tr>
<td><strong>Factors From Outliers</strong></td>
<td><strong>Significant Differences in Individual Studies</strong></td>
</tr>
<tr>
<td>Hematoma</td>
<td>Implants and grafts,29,30,84,103 elderly patients with comorbidities115</td>
</tr>
<tr>
<td>Wound infection</td>
<td>Parotidectomy for sialadenitis,55,132 parotidectomy for malignancy,145 retrograde facial nerve dissection,58 elderly patient with comorbidities175</td>
</tr>
<tr>
<td>Sialoce</td>
<td>Implants and grafts,39,100,125,135,155,159,167 less extensive parotid resections100,101,154,166</td>
</tr>
<tr>
<td>Salivary fistula</td>
<td>Implants,50,53,104,198,202,205 parotidectomy for sialadenitis,63,132,186 less extensive parotidectomy,112,198,202,211 lifting incision ± SCM flap,249,250</td>
</tr>
<tr>
<td>Flap necrosis</td>
<td>Extent of surgery,48,217</td>
</tr>
<tr>
<td>Scar issues</td>
<td>Pediatric populations,140,152,220 long-term questionnaire evaluation91,225</td>
</tr>
<tr>
<td>Numbness</td>
<td>Sacrifice of the GAN nerve,45,138,180,227,234,236</td>
</tr>
<tr>
<td>Deformity</td>
<td>Absence of reconstruction116,219</td>
</tr>
<tr>
<td>More extensive parotidectomy,100 not using fibrin glue30</td>
<td></td>
</tr>
<tr>
<td>Parotid duct ligation,63 tumor size,115 total parotidectomy,63 neck dissection,145 drain output &gt;50 mL/24 hr,145 age &gt;60 years,145 female sex145</td>
<td></td>
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<tr>
<td>Implant,53,135,158,159 less extensive parotidectomy,100,101,156 anterior tumors,156 not using fibrin glue137</td>
<td></td>
</tr>
<tr>
<td>Implants13</td>
<td></td>
</tr>
<tr>
<td>Parotidectomy for sialadenitis63 Less extensive parotidectomy100</td>
<td></td>
</tr>
<tr>
<td>Use of LigaSure system,47 lack of SMAS flap151</td>
<td></td>
</tr>
<tr>
<td>More extensive parotidectomy100</td>
<td></td>
</tr>
<tr>
<td>Classic lazy-S vs. facelift incision83,105,141,143,224</td>
<td></td>
</tr>
<tr>
<td>Preservation of the posterior/lobular branch of GAN,95,154,203,205,227–229,231–234,237 parotidectomy for malignancy,209,210,225 total parotidectomy</td>
<td></td>
</tr>
<tr>
<td>Lack of SMAS flap,83,99,143,205,224 lack of reconstruction,224 tumors &gt;3 cm,159 parotidectomy for malignancy,209,210,225 total parotidectomy</td>
<td></td>
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</tbody>
</table>

GAN = great auricular nerve; SCM = sternocleidomastoid; SMAS = superficial musculoaponeurotic system.
CONCLUSION

Minor parotidectomy complications are more frequent than generally assumed and related to certain factors. Implants result in more wound complications, such as hematoma, sialocele, or salivary fistula. Sialocele and salivary fistula appear more frequently after less-extensive parotid surgery, whereas hematoma, wound infection, flap necrosis, and aesthetic considerations are worse with more-extensive resections.

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