

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.

Laryngoscope, 131:571–579, 2021

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.

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Additional supporting information may be found in the online version of this article.

Editor's Note: This Manuscript was accepted for publication on May 26, 2020.

The authors have no funding, financial relationships, or conflicts of interest to disclose.

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DOI: 10.1002/lary.28912

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 = 970) 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 and mild or light were tabulated as absent, whereas all other more advanced categories were

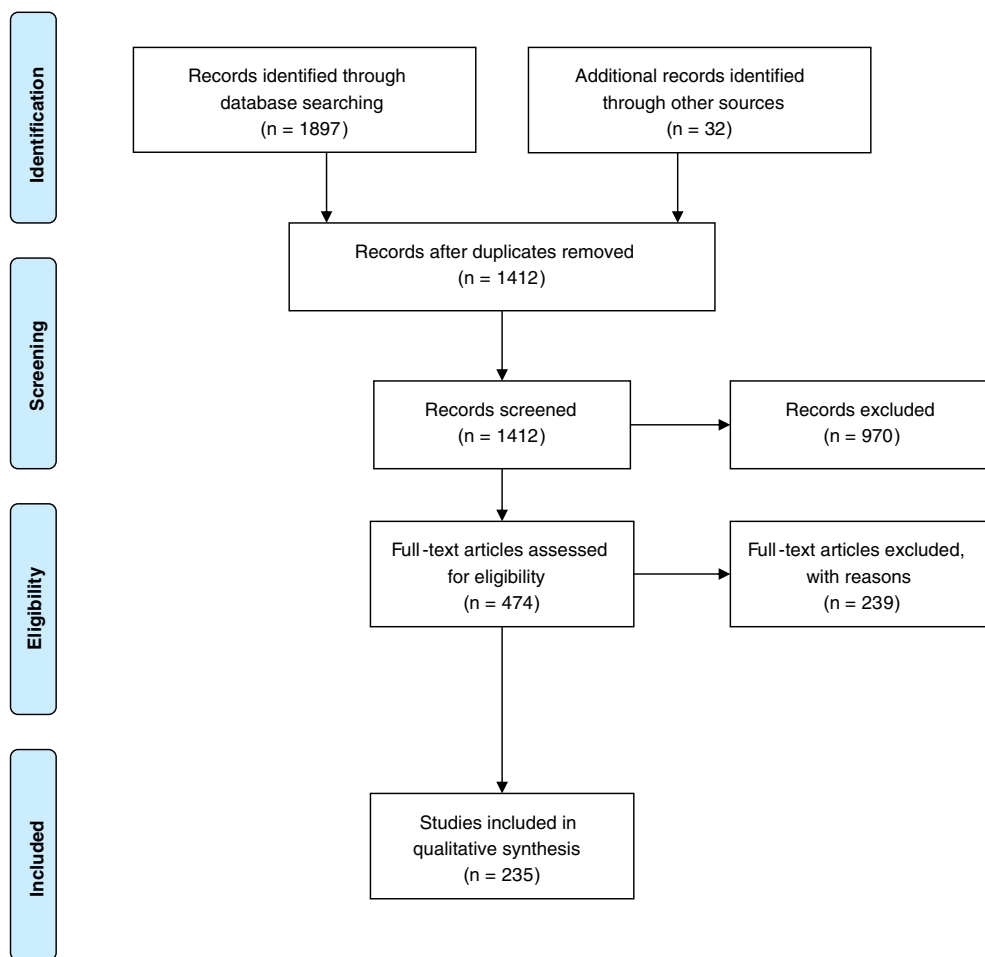


Fig. 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses diagram of the number of studies from literature search to inclusion. [Color figure can be viewed in the online issue, which is available at www.laryngoscope.com.]

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) scale⁵ 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 hematoma was found in studies using foreign material for prevention of Frey syndrome or deformity: self-forming clot from the patient's own blood,²⁹ fibrin glue (Tissucol),³⁰ porcine dermal collagen (Permacol; Covidien, Mansfield, MA),⁸⁴ and dermis-fat grafts.¹⁰³ In other studies, an elderly patient population with comorbidities¹¹⁵ or the thorough follow-up of a prospective study¹¹⁶ might have contributed to a reported high incidence of hematoma.

Wound Infection

Wound infection was reported in 94 studies^{6,9,12,14,15,17,21-25,27,28,31,35,36,39-44,49,55,57-67,69-72,74,75,79,81,85-90,92,93,95,96,98-103,105-107,111,112,115-122,124,125,128,131-149} 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,^{55,132} surgery for parotid malignancy and associated neck dissection,¹⁴⁵ retrograde facial nerve dissection,⁵⁸ elderly patient population with comorbidities,¹¹⁵ and unclear factors.^{40,89,112,139}

Sialocele

Sialocele was reported in 102 studies^{10,14,15,17,23,25,33-36,38,39,41-44,46,48,50,51,56-62,64,66,67,69,70,72-77,79-85,87-90,92,95,96,98,100-103,106-108,110-116,118-121,125,128,135-138,141,144,146,147,150-169} 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,^{39,125,135} Surgicel hemostatic sponges,¹⁵⁹ collagen sponges,¹⁰⁰ polyglycolic acid sheets¹⁶⁷), and grafts (autologous platelet adhesives with a dermal fat graft).¹⁵⁵ Several studies show a statistical increase of sialoceles with less extensive parotid resections.^{100,101,156,166} In two studies, no clear explanation could be found for the high incidence of sialoceles.^{67,80}

Salivary Fistula

Salivary fistula was reported in 137 studies^{6-10,12,14-16,18-24,27,28,30-34,36,38-40,43-45,47,49,51,52,55,56,58,62-65,75,76,79,84-87,89,91,93,97-99,101,103-109,112,114-119,124-127,129,131-133,136,138,139,141,144,148-150,153,154,156,164,166,170-215} 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,³⁰ Gore-Tex,³³ acellular dermal matrix^{164,196}), parotidectomy for sialadenitis,^{63,132,186} less extensive parotidectomy,^{112,198,200,212} SMAS dissection and lifting incision, with or without a sternocleidomastoid flap.^{28,99,104,188,202,205} In several studies, no clear explanation could be found.^{47,105,182,200,209}

Flap Necrosis

Flap necrosis was reported in 34 studies^{16,23,27,30,38,46,48,64,67,68,73,79,82-85,96,98,105-107,111,114,115,118,125,128,130,136,147,149,213,216,217} 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 recurrences⁴⁸ or for deep lobe tumors.²¹⁷ In two studies, no clear explanation^{67,213} could be found.

Scar Problems

Scarring issues were reported in 46 studies^{6,19,20,27,34,36,37,41,55,58,59,62-66,73,83,87,90,91,100,107,110,114,116,125,135,136,140,149,152,160,184,194,195,198,210,218-226} 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.^{91,225} In addition, scars in pediatric populations seem more often unfavorable.^{140,152,220} In one study,²²⁶ no clear explanation could find.

TABLE I.
Descriptive Statistics for Parotidectomy Complications.

| | No. of Studies | No. of Patients | Average ± Standard Deviation | SE Mean | Median | Minimum | Maximum |
|------------------|----------------|-----------------|------------------------------|---------|--------|---------|---------|
| Hematoma | 125 | 17,554 | 4.05 ± 5.0% | 0.44% | 2.97% | 0.00% | 41.2% |
| Wound infection | 94 | 15,861 | 3.22 ± 3.63% | 0.37% | 2.10% | 0.00% | 31.2% |
| Sialocele | 102 | 13,760 | 7.27 ± 8.3% | 0.86% | 4.76% | 0.00% | 44.2% |
| Salivary fistula | 137 | 18,185 | 4.22 ± 4.0% | 0.34% | 3.13% | 0.00% | 21.0% |
| Flap necrosis | 34 | 7,017 | 2.92 ± 3.3% | 0.57% | 1.24% | 0.00% | 14.0% |
| Scar issues | 46 | 5,758 | 6.86 ± 10.2% | 1.50% | 3.74% | 0.00% | 61.0% |
| Numbness | 57 | 6,376 | 38.74 ± 25.8% | 3.41% | 33.60% | 0.87% | 100.0% |
| Deformity | 25 | 2,481 | 15.54 ± 11.76% | 2.94% | 14.50% | 0.00% | 45.0% |

SE = standard error.

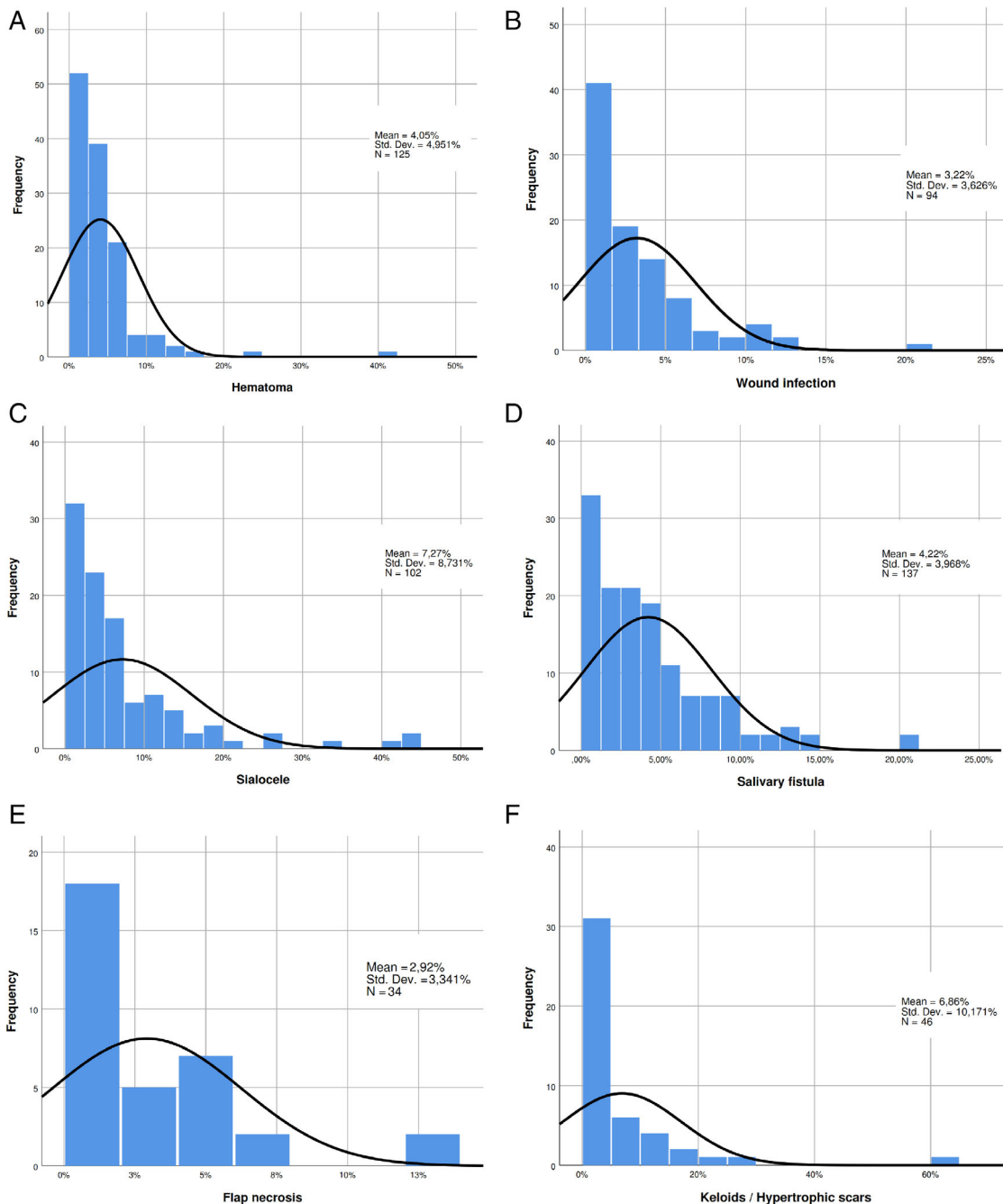


Fig. 2 Histograms of the reported incidence of parotid complications. (A) Hematoma. (B) Wound infection. (C) Sialocele. (D) Salivary fistula. (E) Flap necrosis. (F) Scar problems.

Numbness

Numbness was reported in 57 studies^{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.^{230,237} Increased incidence of numbness was related to greater auricular nerve sacrifice^{45,138,160,227,234,236} and possibly to the study design (prospective studies^{116,238} and long-term questionnaire evaluation⁹¹).

Deformity

Postparotidectomy depression or deformity were reported in 25 studies,^{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 1). 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.^{37,83,99,105,136,143,157,164,205,224,240} The only factor from outliers is the absence of reconstruction.^{116,219} Statistically significant reduction of the depression was found after various reconstruction

TABLE II.
Factors Possibly Associated With Minor Parotidectomy Complications.

| | Factors From Outliers | Significant Differences in Individual Studies |
|------------------|--|--|
| Hematoma | Implants and grafts, ^{29,30,84,103} elderly patients with comorbidities ¹¹⁵ | More extensive parotidectomy, ¹⁰⁰ not using fibrin glue ³⁰ |
| Wound infection | Parotidectomy for sialadenitis, ^{55,132} parotidectomy for malignancy, ¹⁴⁵ retrograde facial nerve dissection, ⁵⁸ elderly patient with comorbidities ¹¹⁵ | Parotid duct ligation, ⁶³ tumor size, ¹¹⁵ total parotidectomy, ⁶³ neck dissection, ¹⁴⁵ drain output >50 mL/24 hr, ¹⁴⁵ age >60 years, ⁶³ female sex ¹⁴⁵ |
| Sialoceles | Implants and grafts, ^{39,100,125,135,155,159,167} less extensive parotid resections ^{100,101,156,166} | Implant, ^{33,135,158,159} less extensive parotidectomy, ^{100,101,156} anterior tumors, ¹⁶² not using fibrin glue ¹³⁷ |
| Salivary fistula | Implants, ^{30,33,164,196} parotidectomy for sialadenitis, ^{63,132,186} less extensive parotidectomy, ^{112,198,200,212} lifting incision ± SCM flap ^{28,99,104,188,202,205} | Implants ³³ Parotidectomy for sialadenitis ⁶³ Less extensive parotidectomy ^{101,200} Use of LigaSure system, ⁴⁷ lack of SMAS flap ¹⁵¹ More extensive parotidectomy ¹⁰⁰ |
| Flap necrosis | Extent of surgery ^{48,217} | More extensive parotidectomy ¹⁰⁰ |
| Scar issues | Pediatric populations, ^{140,152,220} long-term questionnaire evaluation ^{91,225} | Classic lazy-S vs. facelift incision ^{83,105,141,143,224} |
| Numbness | Sacrifice of the GAN nerve ^{45,138,160,227,234,236} | Preservation of the posterior/lobular branch of GAN, ^{45,154,203,205,227-229,231-234,237} parotidectomy for malignancy, ²²⁵ total parotidectomy ^{200,210,225} |
| Deformity | Absence of reconstruction ^{116,219} | Lack of SMAS flap, ^{83,99,104,143,205,224} lack of reconstruction, ²³⁶ tumors >3 cm, ²⁴⁰ parotidectomy for malignancy, ²²⁵ total parotidectomy ²²⁵ |

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

techniques: temporoparietal fascial flap,²¹⁹ SMAS and sternocleidomastoid muscle flap,¹⁵⁷ sternocleidomastoid muscle flap,^{213,240} or SMAS alone.^{83,99,143,205,224}

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, all studies that reported a statistically significant difference for any given risk factor were tabulated (Table II).

Several links between factors and complications can be drawn. The usage of nonautologous implant material seems to result in more wound complications being hematoma, sialoceles, or salivary fistula. Parotidectomy for sialadenitis probably results in increased rates of wound infections and salivary fistula. Correlations between the extent of parotidectomy and complications have been examined in several cohorts,^{43,85,100,101,109,119,200,205,225} sometimes with,^{85,100,101,225} and more often without,^{109,117,119,200,205} statistical significance. In general, sialoceles and salivary fistula appear more frequently after less extensive surgery, whereas hematoma, wound infection, flap necrosis, and aesthetic considerations such as scarring and depression are

worse with more extensive resections. The factors associated with scar issues, numbness, and postparotidectomy depression are more straightforward; better scars are obtained with a facelift incision, numbness is related to the sacrifice of the greater auricular nerve, and less depression is achieved by using some form of reconstruction.

Because it is probably impossible to eliminate all complications, a small incidence of parotidectomy complications seems unavoidable. Patient comorbidities are probably unavoidable risk factors and have been poorly assessed in the cited studies. In addition, even if the underlying pathology seems related to some complications (Table II), it is difficult to change the patient's management.

Shortcomings of our study are mainly related to the quality of the included studies, mostly retrospective and mostly dealing with facial nerve outcome, Frey syndrome, or recurrence. Because the level of evidence of most included studies is low, and because the data for all complications are highly heterogeneous, the present study is more of a review of the literature with descriptive statistics and not a meta-analysis allowing robust conclusions to be drawn. Another problem is the lack of standardized definitions of the surgical complications. Although the definitions should be straightforward, there is ample room for interpretation. In this context, Ruohoaho 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 guide for the factors associated with complications that need to be addressed in prospective and randomized trials.

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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