

# Neurological complications and quality of life after submandibular gland resection. A Prospective, non-randomized, single-centre study

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## ABSTRACT:

**Introduction:** There are different complications related to the submandibular gland resection, like damage to the mandibular branch of the facial nerve, lingual or hypoglossal nerve. Moreover, subjective complaints like dry mouth, altered sensation around the scar and taste alterations were described.

**Patients and methods:** A prospective, non-randomized study was performed including 20 patients treated with submandibular gland resection.

**Results:** The most common etiology was sialolithiasis affecting 9 (45%) patients. One (5%) patient presented a lingual nerve paresis, 2 (10%) patients presented a transient marginal mandibular branch paresis and no hypoglossal nerve alteration was observed. Factors like the size of the lithiasis ( $P = 0.293$ ), size of the tumor ( $P = 0.445$ ) or type of pathology ( $P = 0.694$ ) were not related with neurological complications. Altered sensation in the skin around a scar was the most severely weighted problem (55% and 33.3%), and xerostomia was the second one (33% and 27.3%) at one month and at six months after surgery, respectively.

**Conclusion:** The submandibular gland resection remains to be a safe technique with a low rate of surgical and neurological complications. However, patients should be informed about sequelae like xerostomia, altered sensation in the skin or pain around the scar, which may be discomforting. The cosmetic result can be satisfactory, but a surgical scar can be avoided with another approach. Although rare, the risk of MBFN, lingual and hypoglossal nerve damage should always be included in the preoperative information on surgical risks.

## KEYWORDS:

neurological complications, salivary gland, submandibular gland, surgery

## ABBREVIATIONS

**MBFN** – the mandibular branch of the facial nerve

**SGR** – Submandibular Gland Resection

## INTRODUCTION

The submandibular gland is located in the submandibular fossa in close relation to neurovascular structures like the facial artery and vein, the hypoglossal and lingual nerve. The SGR remains the classic approach to treat different pathologies in the submandibular gland, like tumours, lithiasis or chronic sialadenitis. However, due to the development of sialoendoscopy and advent of transoral approaches, SGR is less necessary.

Nowadays, in Head & Neck surgery for benign lesions, damage to neural structures or aesthetic deformity must be minimal; as well as the risk of other surgical complications, like pain or loss of sensation near the scar. According to the indexed literature, there are different complications related to SGR, some of them objective like postoperative hematomas seen in 0–14% [1–3], post-operative

infection between 0 and 14% [1–5], permanent damage to MBFN in 0–8% [1–8], permanent damage to the lingual nerve in 0–12% [1–8] and damage to the hypoglossal nerve (0–1.4%) [1, 3–5, 7, 8]. Subjective complaints like dry mouth oscillate between 2 and 31% [1–3], altered sensation around the scar 3.6–29.1% [1–3, 6] and taste alterations 16.3% [1]. Patient satisfaction with the cosmetic result has been rarely reported on, but when examined, it revealed 4–12% of unsatisfied patients [1, 2].

These are the reasons why, we describe in this manuscript the rate of complications and the quality of life after SGR, emphasizing neurological complications in a group of 20 patients treated between January of 2017 and June of 2018.

## MATERIALS AND METHODS

This study was approved by the ethics committee of our Hospital 2016/CCH016. Twenty patients were included prospectively in the salivary gland database of our department. Clinical and demographic variables were obtained during the first visit to the clinic. The study was performed following the ethical standards laid down

**Tab. I.** Demographic and clinical data.

	NUMBER	%
Sex:		
Male	14	70
Female	6	30
Age	55 ± 16 (Min: 30/Max: 80)	
Diagnosis:		
Lithiasis	9	45
Pleomorphic adenoma	8	40
Sialoadenitis	3	15
Tumor recurrence	1	5%
Lithiasis mean size (cm)	2.66 ± 0.67 (Min: 1.7/Max: 3)	
Tumor mean size (cm)	3.81 ± 0.67 (Min: 1.7/Max: 3)	
Mean Hospital Stay	3 days ± 2 (Min: 2/Max: 7)	
Mean surgical time	56 min ± 15 (Min: 40/Max: 66)	
Complications		
Infection	1	5
Post-operative pain	1	5
Lingual pre-operative normofunction	19	95
Lingual post-operative normofunction	19	95
Lingual post-operative alteration	1	5
Lingual post-operative definitive alteration	0	0
Hypoglossal pre-operative normofunction	20	100
Hypoglossal post-operative normofunction	20	100
Hypoglossal post-operative alteration	0	0
Marginal mandibular pre-operative normofunction	20	100
Marginal mandibular post-operative normofunction	18	90
Marginal mandibular post-operative alteration	2	10
Marginal mandibular post-operative definitive alteration	0	0
Nerve Mean Time recovery	In both cases, the nerve function was normal at 6 months.	
Marginal mandibular nerve		
Lingual nerve	Nerve function was normal 4 months after surgery.	
Follow-up	12 ± 9 (Min: 6/Max: 24)	
Median Vancouver Scar Scale score	1 (Min: 0/Max: 3)	

in the Declaration of Helsinki. Patients with malignant tumours or previous treatment in the submandibular fossa were excluded.

Classic SGR was performed in all patients. A horizontal five-centimeter skin incision was made two fingers below the lower edge of the mandible to protect the MBFN. The capsule of the gland was directly approached, and dissection was continued on the capsule. The facial vein was typically ligated. The lingual nerve and the Wharton's duct were identified, and the lingual nerve was freed from the capsule, and the duct was followed as far as possible toward the floor of the mouth to reduce the risk of residual salivary stones. We did not routinely attempt any dissection of the MBFN or hypoglossal

nerve or intraoperative nerve stimulation. Monitorization was not used in any case either. A wound drain (Jost-Redon = 10 French) was left in the surgical site. Pre- or postoperative antibiotics were not used routinely, and skin sutures used were intradermic and absorbable. All the patients were examined and followed by the first author for almost 6 months. The quality of life was assessed using a non-validated questionnaire 1 month and 6 months after surgery. This questionnaire evaluated post-SGR complaints like dry mouth, pain around the scar or in mouth, altered sensation in the skin around the scar, hanging lower lip, reduced sensation in the mouth/tongue, food temperature sensation, tongue sensation, bitten tongue, vocal alteration, taste alteration, cosmetically unsatisfactory result, after one and six months.

In the clinic, the function of the hypoglossal nerve was evaluated by inspection of the tongue and speech assessment. The function of the MBFN was evaluated by inspecting facial symmetry at rest, as well as spontaneous and voluntary facial motion. The lingual nerve function was assessed with the two-point anchored test by discrimination on the tongue and in the mouth mucosa. The sensation on the neck was tested by palpation and light touch. Finally, the Vancouver Scar Scale ranging from 0 to 13, with 0 being a scar that closely resembles the normal skin [9, 10], was used to evaluate the cosmetic result. The salivary function was not assessed.

Statistical analysis was conducted with SPSS for Macintosh Version 21.0 (IBM Corp, Armonk, NY). Categorical data were presented as frequencies and percentages. Continuous data were presented as means and standard deviations. Results were analyzed by Chi-squared statistics or Fisher's exact test where appropriate. A significance level was set at  $P < 0.05$ .

## RESULTS

Patient characteristics and histopathological findings are presented in Tab. I. The most common etiology was sialolithiasis affecting 9 (45%) patients, lithiasis mean size was 2.66 cm ± 0.67 (Min: 1.7/Max: 4). The mean hospital stay was 3 days ± 2 (Min: 2/Max: 7), and the mean surgical time was 56 min ± 15 (Min: 40/Max: 66). One (5%) patient presented a lingual nerve paresis due to compression of big lithiasis (4 cm) in the gland parenchyma and the hilum. Two (10%) patients presented a transient marginal mandibular branch paresis, and both recovered after 6 months. Two (10%) patients suffered a post-operative complication, one of them presented a surgical site infection and the other an intense pain sensation in the surgical site. No hypoglossal nerve alteration was observed. Factors like the size of the lithiasis ( $P = 0.293$ ), size of the tumor ( $P = 0.445$ ) or type of pathology ( $P = 0.694$ ) were not related with neurological complications (Tab. II.). One (5%) patient suffered a pleomorphic adenoma recurrence during the follow-up.

We performed an overview of questionnaire results, considering subjective evaluation of the post-SGR complications (dry mouth, pain around the scar or in the mouth, altered sensation in the skin around the scar, hanging lower lip, reduced sensation in the mouth/tongue, food temperature sensation, tongue sensation, bitten tongue, vocal alteration, taste alteration, cosmetically unsatis-

factory result) after one and six months. Altered sensation in the skin around the scar was the most severely weighted problem (55% and 33.3%), and xerostomia was the second one (33% and 27.3%), at one month after surgery and six months, respectively (Tab. III.).

## RESULTS PER ITEM:

**Altered sensation in the skin around the scar:** One month and 6 months after surgery, 55% and 33.3% of patients respectively considered sensation around the scar as a problem. However, we did not find any relation between the tumour volume or lithiasis size ( $P = 0.851$ ).

**Xerostomia:** Interestingly, xerostomia was the second most weighted problem after SGR in our cohort; 33% of the patients considered xerostomia a problem after one month of follow-up, and 27.5% after 6 months.

**Hanging lower lip:** One month and 6 months after surgery 11% and 5.5% of patients respectively considered hanging of the lower lip as a problem. Both patients presented a post-operative MBFN paresis after surgery. One of them recovered the normal function after 4 months and the second one after 10 months.

**Pain around the scar or in the mouth:** Only one patient described pain sensation around the scar after one- and 6-months following surgery. This patient was operated on due to chronic sialoadenitis. After 11 months of follow-up he had consultation in the pain clinic.

No patient considered other items like reduced sensation in the mouth/tongue, food temperature sensation, tongue sensation, bitten tongue, vocal alteration, taste alteration or cosmetically unsatisfactory result as a post-operative problem.

**The appearance of the scar:** In our cohort, the scar was considered a marginal cosmetic issue for the patients during the entire follow-up period. No patient mentioned the appearance of the scar as a problem after one or 6 months. Surgeon's opinion about the surgical scar according to the Vancouver Scar Scale score was 1 (Min: 0/Max: 3).

## DISCUSSION

The SGR through a lateral transcervical approach remains the standard approach to the submandibular gland, although other open or endoscopic approaches for submandibulectomy have been presented [11]. Nowadays, there are more options to remove stones from the submandibular duct; sialoendoscopy techniques or combined transoral approaches have been sufficiently proven and defined during the last decades to be universally accepted as the first-line option in the treatment of submaxillary sialolithiasis [12], leaving SGR as the first choice, exclusively for cases of submaxillary tumour pathology. This is also the current practice in our department.

The submandibular gland weighs around 10 to 15 grams and is divided anatomically into superficial and deep lobe by the posterior

**Tab. II.** Correlation between neurological damage and type of pathology, lithiasis or tumour size.

VARIABLE		P
Lithiasis mean size (cm)	2.66 ± 0.67 (Min: 1.7/Max: 3)	0.293
Tumour mean size (cm)	3.81 ± 0.67 (Min: 1.7/Max: 3)	0.445
Type of pathology		0.694

end of the mylohyoid muscle. The MBFN, hypoglossal and lingual nerves have a close relationship with the gland and damage to these structures can result in increased morbidity after the operation.

The MBFN passes superficially to the fascia of the submandibular gland and deeply to the plane of the platysma muscle. This is the reason why surgical dissection within the fascia poses at least risk of damage to the nerve [13]. In our study, we found a 10% risk of early paresis of the MBFN and 0% after 6 months of follow-up. We hypothesized that in both cases the thermal damage due to the elevation of the skin flap using the Bovie cautery or the compression due to the use of Farabeuf retractor could be related to this, and after some months, the transient neuropraxia can resolve.

The lingual nerve lies in the deep portion of the submandibular gland and the anterior portion of the Wharton's duct in the sublingual space between the tongue and the mandibular ramus. Although this is a strong and very resistant nerve, dissection of the branches of the facial vein lying in close relation to the ganglion should be performed very carefully to lower the risk of damage to this nerve or the submandibular ganglion. In our cohort, one patient presented a lingual nerve paresis before surgery due to compression of the nerve by big lithiasis. Four months after surgery, tongue sensibility was normal again. However, the risk of nerve damage during dissection is well described in previous studies [1–8]. Moreover, according to those previous studies, at least 2.5–3.3% of the patients had subjective or altered sensation in the mouth/tongue or altered taste after surgery, which makes it essential to report this complication during the preoperative visit in the clinic [14].

The hypoglossal nerve runs inferiorly and medially to the lower third of the submandibular gland below the posterior belly of the digastric muscle. In our cohort, no patient suffered damage to the hypoglossal nerve. Nevertheless, in the previous studies, this risk was reported to be very low [1, 2, 4–8]. Inflammation and lithiasis have a higher incidence in the submandibular gland. Defined as acute, subacute or chronic inflammation, sialoadenitis results from a variety of obstructive (calculus duct obstruction) or not obstructive causes (systemic diseases, trauma and specific infective agents). In many cases, the causal factor can be unknown. Sialolithiasis is found in 24% of patients with sialoadenitis [15]. Compared to other salivary glands, the submandibular gland is more prone to calculus formation due to the anatomy of the duct and the type of saliva produced. In those cases, diagnosis can be made by plain radiography, ultrasound and sialography, while CT scan, MRI and biopsy by fine needle aspiration should be reserved for cases of suspected neoplasia [16].

As concerns the quality of life questionnaire applied, an altered sensation in the skin around the scar was the most common

**Tab. III.** Questionnaire-reported complaints at 6 months of follow-up.

Alteration or Symptom	1 MONTH		6 MONTHS	
	N	%	N	%
Dry mouth	Yes: 6	33.3	Yes: 5	27.3
	No: 12	66.7	No: 13	72.2
Pain around the scar or in the mouth	Yes: 1	5.5	Yes: 1	5.5
	No: 17	94.5	No: 17	94.5
Altered sensation in the skin around the scar	Yes: 10	55.5	Yes: 6	33.3
	No: 8	45.5	No: 12	66.7
Hanging lower lip	Yes: 2	11.1	Yes: 1	5.5
	No: 16	88.9	No: 17	94.5
Reduced sensation in the mouth/tongue	Yes: 1	5.5	Yes: 0	0
	No: 17	94.5	No: 18	100
Food temperature sensation	Normal: 18	100	Normal: 18	100
	Abnormal: 0	0	Abnormal: 0	0
Tongue sensation	Normal: 18	100	Normal: 18	100
	Abnormal: 0	0	Abnormal: 0	0
Bitten tongue	Yes: 0	0	Yes: 0	0
	No: 18	100	No: 18	100
Vocal alteration	Yes: 0	0	Yes: 0	0
	No: 18	100	No: 18	100
Taste alteration	Yes: 0	0	Yes: 0	0
	No: 18	100	No: 18	100
Cosmetically unsatisfactory result	Yes: 0	0	Yes: 0	0
	No: 18	100	No: 18	100

complaint. This problem is usually related to damage to the transverse cervical nerve branches and the healing process, affecting at least 33% of our patients after 6 months of follow-up, similar to previous data reported [13]. In our cohort, the second most common complaint was xerostomia. The submandibular gland secretes on average 70% of the daily produced saliva, consisting of a serous and mucous component. Its secretion is crucial for lubricating and swallowing of the bolus, in addition to enzyme digestion, which starts in the upper digestive tract [15]. Normal salivary flow is essential for maintaining good oral hygiene, and the lack of normal flow predisposes to an increased incidence of dental caries and symptomatic xerostomia. According to the previous data, unilateral SGR results in a decreased rate of resting salivary flow and an increase in subjective xerostomia [1–3].

Regarding MBFN paresis, hanging lower lip was a problem present at one month and 6 months after surgery in 11% and 5.5% of patients respectively. One of them recovered normal function after 4 months and the second one after 10 months without any complaints. One patient described pain sensation around the scar after one and 6 months of surgery. That patient was operated on due to a chronic sialoadenitis, and after 11 months of follow-up and consultation in the pain clinic, the patient starts to feel better. However, to improve the symptoms, an opioid-based treatment was necessary. No patient considered other items like reduced sensation in the mouth/tongue, food temperature sensation, tongue sensation,

bitten tongue, vocal alteration, taste alteration or cosmetically unsatisfactory result as a post-operative problem.

In our cohort, the scar was considered a marginal cosmetic issue during the entire follow-up. No patient mentioned the appearance of the scar as a problem after one and 6 months. However, the classic incision needed to perform SGR is in the neck, and some complaints can exist in other countries or cultures. In this way, some authors advocate the use of alternative approaches to the submandibular gland, e.g. transoral, submental or retroauricular [11], in particular to reduce scarring and enhance cosmetic results. Our findings suggest that problems with scarring were minor or not relevant to our population. Furthermore, previous authors described problems with scarring in those patients who suffered a post-operative infection [14].

Surgeon's opinion about the surgical scar was measured according to the Vancouver Scar Scale score during every visit, and it showed a very good result, as in previous studies using the same scale [14]. Quantification of scarring after SGR using the generally accepted Vancouver Scar Scale [10] is a novel approach and was used before by Springborg and Møller [14]. Although the literature on the scale has predominantly focused on burn scars, the scale has been validated to rate postsurgical scars. However, as they mentioned before, the scale does not rate symptoms related to the scar, like local pain or altered sensation, and consequently, this was addressed separately in our questionnaire.

Finally, we need to address some limitations of our study as the limited number of patients and the absence of the median biscuit test time. The first one is related to the introduction of sialoendoscopy and the transoral combined approach to the treatment of submandibular salivary gland lithiasis in our department, leaving the SGR as the second-line option, exclusively for cases of submaxillary tumour pathology (benign or malignant) or significant intraglandular lithiasis. The second one was related to the lack of time in the clinic and personnel available to perform the test.

## CONCLUSION

The submandibular gland resection remains to be a safe technique with a low rate of surgical and neurological complications. However, patients should be informed about sequelae like xerostomia, altered sensation in the skin or pain around the scar, which may be discomforting. The cosmetic result can be satisfactory, but a surgical scar can be avoided with another approach. Although the risk of MBFN, lingual or hypoglossal nerve damage is rare, it should always be included in the preoperative information on surgical risks.

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