

# Evaluation of Surgical Complications of Mandibulectomy

Miharisoa Malalatiana Rafenomanjato\*, Rantonirina Henri Andriamanantena, Miadana Joshua Rakotondranaivo, Fenosoa Vonimbola d'Assise Rakotoarimanana, John Alberto Bam Razafindrabe

Department of Maxillo-Facial Surgery, University hospital of Befelatanana, Antananarivo, Madagascar

Email: \*mrafenomanjato@gmail.com

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## Abstract

Mandibulectomy is a surgery that leads to heavy aesthetic and functional sequelae. Surgical complications have been noted but have not yet been evaluated. The aim of this study was to evaluate the surgical complications of mandibulectomy. This is a retrospective descriptive and analytical study of patients who underwent mandibulectomy in the Department of Maxillofacial Surgery of the CHU JDR Befelatanana between January 2017 and December 2020. A correlation between the occurrence of complications, parameters related to the patients and those related to the surgery was sought. Patient-related parameters were: age and sex, comorbidities, toxic habits and body mass index. The parameters related to the surgery which were studied were the duration of the intervention, the size and the seat of the bone defect, the interruption or not of the mandibular continuity. Forty-six cases were selected. The average age was 36.98 years and the sex ratio was 0.7. Fifty percent of patients developed surgical complications. The total number of complications was 38. Salivary fistula was the most frequent complication (26.32%). No correlation was found between the occurrence of complications and patient-related parameters. There were 69.57% of complications when the procedure lasted more than 180 minutes ( $p = 0.003$ ). A correlation was found between the occurrence of complications and the size of the resected bone ( $p = 0.009$ ). Among the complications, 56.52% occurred when the size exceeded 130 mm ( $p = 0.03$ ). The complication rate is high. The size of the resected bone and the duration of the operation influence the occurrence of complications.

## Keywords

Surgical Complications, Surgical Duration, Salivary Fistula, Mandibulectomy

## 1. Introduction

Mandibulectomy, a resection of a part or all of the mandible is a surgery indicated for the treatment of mandibular bone tumors or malignant tumors of the oral mucosa [1]. This surgery leads to heavy aesthetic and functional sequelae. There is a risk of glossoptosis in case of resection of the anterior bilateral part of mandible and this case is a real emergency in maxillofacial surgery. In the literature, we can find studies about quality of life or functional complications after mandibulectomy [2]. There are also studies about outcome of head and neck resection surgery with reconstruction with free flap [3] [4]. Mandibulectomy in the literature can also be included in study about survival rate after squamous cell carcinoma of oral cavity [5]. Few studies are focused on surgical complications after mandibulectomy. A surgical complication is defined as any deviation from the normal course after surgery [6]. Surgical complications are important causes of morbidity and mortality. They can result in prolonged care, increased length of hospital stays, repeated surgeries, medications and additional financial expenses. In addition, postoperative complications are an important parameter that influences the patient's quality of life [2]. After mandibulectomy, post-operative complications have been observed. This motivated us to initiate this study whose main goal is to itemise and evaluate the surgical complications of mandibulectomy in this department. The specific goal is to look for correlations with patient-related and surgical-related parameters. The aim is to improve management.

## 2. Methodology

This is a study that was conducted in the University Hospital Joseph Dieudonné Rakotovoao Befelatanana, Antananarivo Madagascar in the Department of Maxillofacial Surgery. It is a retrospective descriptive and analytical study conducted between the period of January 2017 and December 2020, a period of 48 months. Patients records who underwent a mandibulectomy performed at the CHU JDR Befelatanana during the study period were studied, regardless of the surgical indication. Patients with incomplete or lost records were excluded from the study. Information was obtained from patients' medical records.

The variables studied were:

Marital status: age and sex

Complications: hemorrhage, infection/abscess, suture release, delayed healing, salivary fistula, damage of the marginal branch of the facial nerve, if reconstruction by plate: plate exposure (endobuccal or exobuccal), loss or displacement of screws, plate fracture. Their severity was assessed by the Clavien Dindo classification [6]

Patient-related parameters: comorbidities (diabetes, immunodepression), toxic habits (tobacco, alcohol), body mass index (BMI).

Surgery-related parameters: duration of surgery, location according to the HCL classification of Jewer *et al.* (H: lateral bone loss exceeding the midline in-

cluding the condyle, C: central bone loss from canine to canine, L: lateral bone loss that may exceed the midline but not including the condyle, HC: lateral and condyle with both canines, LC: lateral with both canines without condyle, LCL: bilateral bone loss including both canines but without condyles, HCL: lateral, central, contralateral lateral condyle, HCH: whole mandible [7], the size of the resected bone.

A correlation was sought between: the occurrence of complications and patient-related parameters, and between the occurrence of complications and surgery-related parameters.

The information was entered using Microsoft office Excel 2013\*, and then statistically analyzed using Epi info\* software. The Fisher exact test was used to compare the frequency of complications as well as any correlations with patient-related factors and surgery-related factors. A value of  $p < 0.05$  meant that the difference was statistically significant.

### 3. Results

During the study period, 58 charts were reviewed. Twelve patients didn't come back for follow up and were excluded from the study. In total, 46 cases were retained and included. Patients ranged in age from 12 to 81 years. The average age was 36.98 years. The sex ratio was 0.7 (Figure 1). Twenty-three (50%) patients had complications. Of these complications, 94.74% were classified I in the Clavien Dindo classification. Salivary fistula was the main complication (26.32%). Other complications were suture loosening (23.68%), damage to the marginal branch of the facial nerve (21.05%), infection/abscess (13.16%) and delayed healing (10.53%). Five patients received plate reconstruction. Among these patients, 2 (2 of 5 cases) complications were found: one case of plate exposure and one case of screw displacement. There were no cases of postoperative hemorrhage or glossoptosis. The total number of complications recorded was 38, as 7 patients had more than one complication (Table 1).

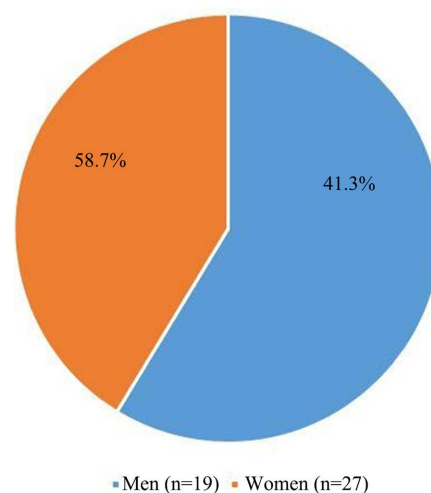


Figure 1. Gender division.

**Table 1.** The surgical complications.

Complications	Total staff N = 38	Proportion 100%
Salivary fistula	10	26.32
Suture loosening	9	23.68
Damage to the marginal branch of the facial nerve	8	21.05
Infection/abscess	5	13.16
Delayed healing	4	10.53
Reconstruction plate exposure	1	2.63
Screw displacement	1	2.63
Hemorrhag	0	0

The seven patients (15.26%) who had more than one complication all developed a salivary fistula. In other words, 70% of salivary fistulas were accompanied by other complications. No correlation was found between the occurrence of complications and patient-related parameters (Table 2). There were 69.57% of complications when the procedure lasted more than 180 minutes ( $p = 0.003$ ) (Table 3). A correlation was found between the occurrence of complications and the size of the resected bone ( $p = 0.009$ ) (Table 4). Among the complications, 56.52% occurred when the size exceeded 130 mm ( $p = 0.03$ ) (Table 5).

#### 4. Discussion

Fifty percent of our patients had complications. This rate is high compared to those found in the literature. Fidèle *et al.* reported three cases (7.7%) of post-operative infection in a series of 28 cases of mandibulectomy with reconstruction [8]. Cordeiro *et al.* found 13.4% of surgical complications in a series of mandibulectomy with reconstruction [9]. Chang *et al.* report a complication rate of 36.8% in mandibulectomy with reconstruction. In the latter study, 10.7% of the complications came from the donor site [10]. Our figures are high, but 94.74% of our complications are classified I in the Clavien Dindo classification. It should be remembered that this is a score that consists of classifying surgical complications in a standard, simple manner that can be applied in surgery in general. It avoids subjective assessments of complications such as “major” or “minor”. It is based on the treatment that was undertaken to address the complication [8]. The study by Vallur *et al.* demonstrated that this classification is applicable to surgical complications of head and neck surgery [6]. Thus, despite the high rate of complications found in our case series, the 94.74% remain in the Clavien Dindo class I. Furthermore, the most frequent complication in our case series was salivary fistula. Indeed, this is a frequent complication in the surgical treatment of tumors of the oral cavity (5% - 29%). It is the most frequent complication in oncologic surgery of the head and neck [11]. Many risk factor of salivary fistula are cited in literature but there are also controversies.

**Table 2.** The occurrence of complications and patient-related parameters.

Variables	Number	With complications	Without complications	P
Mean age	33.43 years old	40.52 years old	40.52 years old	0.17
Male (gender)	19	10 (52.63%)	9 (47.37%)	0.5*
Female (gender)	27	13 (48.15%)	14 (51.85%)	
Tobacco	16	8 (50%)	8 (50%)	0.62*
Alcohol	12	4 (33.33%)	8 (66.67)	0.15*
BMI < 18 kg/cm <sup>2</sup>	8	5 (62.50%)	3 (37.50%)	0.35*
Hb < 12 g/dl	14	10 (71.13%)	4 (28.57%)	0.21*

\*Fisher exact.

**Table 3.** The occurrence of complications before and after 180 min of surgery.

Procedure time	Number of patients (%)	Number of patients with complications/Total (%)	P
>180 min	21 (45.66%)	16/21 (76.19%)	0.003
<180 min	25 (54.34%)	7/25 (28%)	

**Table 4.** Extreme size of the tumor and occurrence of complications.

Size (in mm)	With complications	Without complications	p
minimum	34	15	0.009*
average	133	91.52	
Maximum	312	156	

\*p value by Mann-Whitney/Wilcoxon Two Sample Test.

**Table 5.** Occurrence of complication according to tumor size.

Size of bone defect	With complication n = 23 (100%)	Without complication n = 23 (100%)	Total N = 46 (100%)
>130 mm	13 (56.52%)	5 (21.74%)	18 (39.19%)
<130 mm	10 (43.48%)	18 (78.26%)	28 (60.87%)

p = 0.03.

Furthermore, our study did not find any correlation between the occurrence of surgical complications and patient-related parameters. The data in the literature on this subject are very variable. Concerning age, in the study by Peters *et al.*, age was not a predictive factor of surgical complications despite a higher odds ratio in patients over 80 years of age. Age was a predictive factor for medical complications [12]. Concerning smoking, Crippen *et al.* found a significant correlation between smoking and the occurrence of suture loosening [13]. Smoking causes tissue hypoxia, cellular dysfunction and thrombogenesis. It therefore

leads to decrease in the supply of oxygen to the tissues and is detrimental to healing [3]. Awareness of smoking should therefore be systematic. Even a short perioperative period without smoking is associated with a lower risk of postoperative infection [13]. Regarding the body mass index, the lack of nutrients especially amino acids and proteins is fundamental in the delay of healing [14]. This problem is again increased by mandibulectomy because chewing is reduced, and then diet quality and quantity is reduced. The main complications are infection and difficulties in healing, including fistulas and surgical site dehiscence. Therefore, care must be taken to maintain adequate caloric intake during the postoperative period to achieve satisfactory healing. Regarding hemoglobinemia, in our study, 71.13% of patients who had hemoglobinemia < 12 g/dl developed a complication but not statistically significant. Anemia is mostly known to be a risk factor for salivary fistula [15]. Regarding blood glucose, there were only 3 diabetic patients in our study. This did not allow us to see conclusive results. Diabetes is a systemic disease known to create microvasculopathy, immunosuppression, altering healing capacities and favoring infections. Diabetes is a systemic factor in coagulation disorders [14]. Thus, even if our results are not conclusive on diabetes, it is important to maintain a good glycemic figure before, during and after major surgery such as mandibulectomy.

Concerning the parameters related to surgery, our results found that there was a link between the duration of the operation and the occurrence of complications. The longer the operation lasted, the more complications occurred ( $p = 0.003$ ). These results are consistent with the study by Peters *et al.* which showed a correlation between the duration of the operation and the occurrence of surgical and medical complications [12]. Crawley *et al.* also found this correlation [4]. Indeed, surgical complications can be expected in the presence of an advanced tumor and a complex surgery of long duration is indicated [12]. A long duration of surgery is a factor in coagulation and healing disorders [1] [14]. The duration of the operation is also related to infection of the surgical site and fistula formation [12]. Apart from the long duration of the operation, the excessive use of electrocoagulation is also a factor in the occurrence of healing disorders [1]. Indeed, the tissue charred by excessive electrocoagulation is considered as a foreign body. Thus, bipolar and monopolar forceps must be used judiciously.

Another surgical parameter analyzed in this study was the site of the bone defect. The site with the most complications was the H site, but not significantly. According to Gassner, the preferred site for healing disorders is the transition zone between the bone resection site and the dentate portion of the remaining mandible. Thus, at this site, two suture planes and the use of a cushioned suture can prevent complications. Sutures can also be attached to adjacent teeth [1]. Thus, the surgeon must always remain vigilant until the end of the procedure. The suture must be reinforced.

In addition, the size of the bone defect is also a surgical parameter that was analyzed in this study. The results show that there is a statistically significant

correlation between the size of the bone defect and the occurrence of complications ( $p = 0.03$ ). A defect larger than 130 mm is more likely to present complications. These results are consistent with the literature. The study by Peters *et al.* showed the correlation between the advanced stage of the tumor and the occurrence of surgical complications [12]. The study of Bede *et al.* on the complications of mandibulectomies with reconstruction plates showed that only the size of the defect was a significant factor in the occurrence of complications [16]. The study by Shasti *et al.* showed that there is a correlation between the size of the soft tissue defect and the occurrence of any complication which is, total or partial failure and early or delayed unplanned return to the operating room ( $n = 80$ ,  $p = 0.002$ ) [17]. Indeed, a wide resection leads to an under-tension suture and a reduction of blood circulation and thus alters the healing process. All of this increases the risk of complications [15]. Thus, the operative indication and the size of the bone to be resected must be well studied. Adequate imaging studies would be an asset in order to clearly see the tumor boundaries and the anatomical relationships. Adequate imaging would also save operative time compared to surgical exploration without imaging.

This study was therefore able to highlight these correlations between the occurrence of complications and surgical parameters. However, the monocentric nature and the small size of the sample do not allow establishing any risk factors. We therefore suggest starting a long-term prospective study in order to have the necessary sample for a case-control study or a cohort study.

## 5. Conclusion

So, despite our small sample size, this study found that the surgical complication rate after mandibulectomy is high at 50%. Therefore, surgeons must take steps to decrease this complication rate. Our results showed that the larger the resection, the higher the complication rate. This extent may also have an impact on the duration of surgery. While the duration of surgery was also correlated with the occurrence of surgical complications in our study. The duration of surgery is also related to superinfection and the occurrence of salivary fistula. Thus, the surgical indications on the size of the bone to be resected must be well studied. Furthermore, our bibliographic research has also shown that the zone of predilection for complications is the transition zone between the resection and the remaining dentate portion. The suture must therefore be reinforced at this level. We suggest starting the closure at this transition zone. Thus, the surgeon must remain vigilant until the end of the procedure and not let his guard down during closure. This leads us to a question: is it knowledgeable to leave closure to young training surgeon?

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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