

Predisposing Factors for Post-Operative Complications of Mandibular Resection and Reconstruction with Plates

Lilies Dwi Sulistyani^{1*}, Hananto Anggoro Wiryawan¹, Andrianto Soeprapto¹,
Vera Julia¹, Eky Nasuri²

1. Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia
2. Division of Oral and Maxillofacial Surgery, Cipto Mangunkusumo Hospital, Jakarta, Indonesia.

Abstract

Reconstruction in post-mandibular resection patients using plate reconstruction is commonly performed in several hospitals in Indonesia. Some complications that can occur after reconstruction of the mandible can be expose plates, plate fractures and infection. The purpose of this study will look for several factors that influence the occurrence of these complications. A retrospective study from 2012-2017 taken from medical records. Data from 69 patients with available information on the prevalence of complications 21.73% (15/69) with an average observation time 15.4 months. There was an effect of smoking history 7.2 % ($p = 0.00$) and age factor 21% ($p = 0.00$) on the occurrence of postoperative complications with hazard ratio of smoking history 9.19 and age factor 10-20 years compared to over 60 years is 153.8. The plate survival rate in patients who do not smoke is above 80% in the first 2 years, the third year is 60% and after that it can decrease by 20-40%. Smoking and age factors influence the incidence of post-reconstruction mandibular complications. If possible, mandible reconstruction using a reconstruction plate is temporary procedure, it is necessary to consider the use of either vascularized or non-vascularized grafts.

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Introduction

The purpose of the mandibular reconstruction procedure is to establish mandibular continuity, form the base of the alveolar bone, correct or repair damage to bone tissue, and also provide adequate durability and strength in the mandible so that the patient can move normally after mandibular resection.¹ Mandibular reconstruction using a vascularized graft is the gold standard for post-mandibular resection treatment. The current management of reconstruction in mandibular post resection patients in the Oral Surgery Division of Cipto Mangunkusumo Hospital is a two-stage mandibular reconstruction. The patient performed a mandibular resection and was only

reconstructed using a reconstruction plate without using a graft, this was because many patients refused to take graft in the donor area.

Clinical experience and literature studies have shown that the reconstruction plate used for reconstruction of the mandibular defect is often the point of excessive chewing pressure, causing several complications.² Many other researchers have demonstrated complications related to reconstruction plate use. Liu et al.³ showed in their journal showed that the total complication rate after mandibular reconstruction of 14.7% with the highest complication was infection (7.4%). While Arden et al⁴ showed plat exposure (29%), loosened screws (29%), fistule (14%), local infections (14%), osteomyelitis (7%), and broken plate (7%). In a study conducted by Isler et al⁵ they found 6 of 23 patient had postoperative complication (one instance of condylar sag, one plate removal, two cases of paraesthesia, one screw-loosening, and one plate exposure). The purpose of this study was to investigate the occurrence of plate complications from several predisposing factor, so that in the future oral surgeons can predict the

*Corresponding author:

Lilies Dwi Sulistyani,
Department of Oral and Maxillofacial Surgery Faculty of
Dentistry, Universitas Indonesia Jalan Salemba Raya 4 Jakarta
Pusat, Jakarta 10430
E-mail: liliesdwi_s@yahoo.co.id

outcome of post-resection mandibular reconstruction.

Materials and methods

Patient data was collected from medical records. Predisposing factors that are predicted as factors that influence the occurrence of complications are recorded and analyzed. These factors include general factor like gender, age, smoking history, postoperative albumin, BMI category (body mass index), duration of surgery and local factor such as tumor location according HLC classification⁶, defect length and type of reconstruction plate. The defect length factor, the extent of the defect and the type of tumor were obtained from the results of histopathological reports. All data in the form of interval data is transformed into nominal data with the mean as the upper and lower limits.

Inclusion criteria: all patient with diagnose mandibular benign tumor, all patient treated with reconstruction patient without graft, and all patient treated in Cipto Mangunkusumo hospital oral and maxillofacial surgery division in 2012 to 2017. Exclusion criteria: All patient who treated by chemotherapy/radiotherapy and no sufficient data on medical record.

The analysis used log rank test and Kaplan-Meier survival curve with significance value of 0.05 (SPSS 18). Observation duration is defined as the period between surgery and the end of the visit / control of the patient to the hospital or until complications occur. The complication incident is a complication related to the reconstruction plate (expose plate, infection, plate fracture). Ethical Clearance is carried out at the Faculty of Dentistry, University Indonesia and the Faculty of Medicine, University of Indonesia - Cipto Hospital Mangunkusumo.

Results

Data from 69 patients with available information were collected. All patient had performed mandibular tumor and reconstruction resection in September 2012 to June 2017 (4 years 9 months). The reason for data collection was up to June 2017 so that all patients studied were at least observed for 1 year after mandibular reconstruction as of June 2018. The average length of observation in this study was 17.8 months.

The most tumor that have been found in this study are mixed ameloblastoma 30/69 (43.4%), ameloblastoma plexiform 16/69 (23.1%), ameloblastoma follicular 12/69 (17.3%), cementoossifying fibroma 4 (5.7%), KCOT 3 (4.3%), CEOT, neurofibroma, Adenomaodontogenic, and mixofibroma respectively 1 (1.4%) The age of patients in this study was between 10-64 years with a mean age of 33.85 years. Operating time ranges from 5-14 hours with a mean of 8.69 hours. The length of the defect ranges from 3-11.5 cm with a mean of 7.23 cm. The area of the defect was 18-294cm³ with a mean of 89.32 cm³. Postoperative albumin values between 1.8-4.1 mg/dl with a mean of 3.02 mg/dl.

The results of the log rank test on the variables of gender $p = 0.166$ (men 5/34 - 14.7% women 10/35-28.5%), defect location $p = 0.308$ (L 4/18 - 22.2%; H 5/23 - 21.7%; LC 1/8-12.5%; LCL 4/15-26.7%; HC 0/3-0%; HLC 1/2-50%), defect length $p = 0.915$ (<7.23 cm 8/36 - 22,2%; >7.23 cm 7/33-21.2%), defect area $p = 0.071$ (< 89,32 cm³ 4/37 - 10.8%; > 89,32 cm³ 11/32 - 34.3%), length of operation $p = 0.062$ (< 8 hour 5/31 - 16.1%; > 8 hour 10/38 - 26.3%), BMI value (Underweight 4/15 - 26.7%; Normalweight 4/25 - 16%; overweight 7/20 - 35%; Obesity 0/9 - 0%), postoperative albumin value $p = 0.571$ (< 3.02 g/dl 7/32 - 21.8%; > 3.02 g/dl 8/37 - 21.6%) and reconstruction plate system $p = 0.602$ (2.4 system 7/48 - 14.5%; 2.7 system 8/21 - 38.1%) showed insignificant results ($p > 0.05$). The smoking history $p = 0.000$ (smoking 5/7 - 71.4%; non smoking 10/62 - 16.1%) and age variables $p = 0.000$ (10-20 yo 2/7 - 28.5%, 20-30 yo 4/16 - 25%, 30-40 yo 4/28 - 14.2%; 40-50 yo 2/10 - 20%; 50-60 yo 2/7 - 28.6%; >60 yo 1/1 - 100%) were significantly ($p < 0.05$). Significant results from the log rank test results on the variable decades of age and smoking history were continued to look at the survival rate using the Kaplan-Meier survival curve (Figures 1 and 2).

The incidence of complications occurred in 15 patients (plate expose $n = 10$, plate fracture $n = 3$, infection $n = 2$). All patients who experience plate expose or plate fracture are performed with a second operation with plate removal or reconstruction with a graft. In patients who have an infection debridement is carried out.

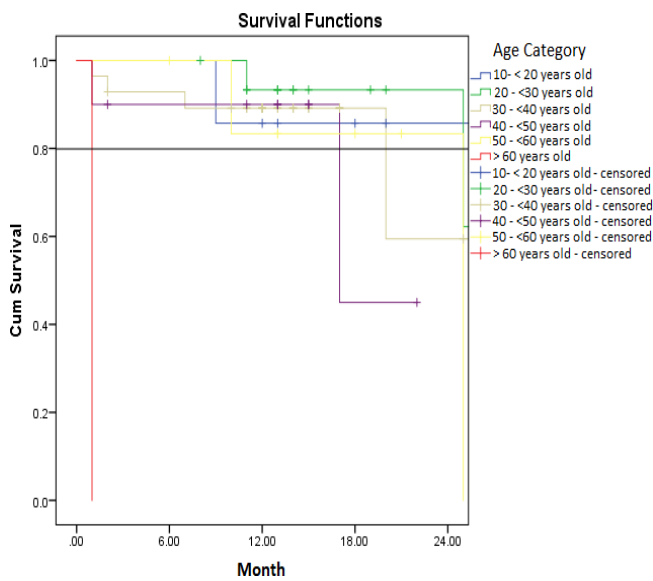


Figure 1. Survival Rates in the 10-60 Year Age Group Show Numbers Above 80% in One Year Postoperatively (blue, green, purple, yellow, yellow).

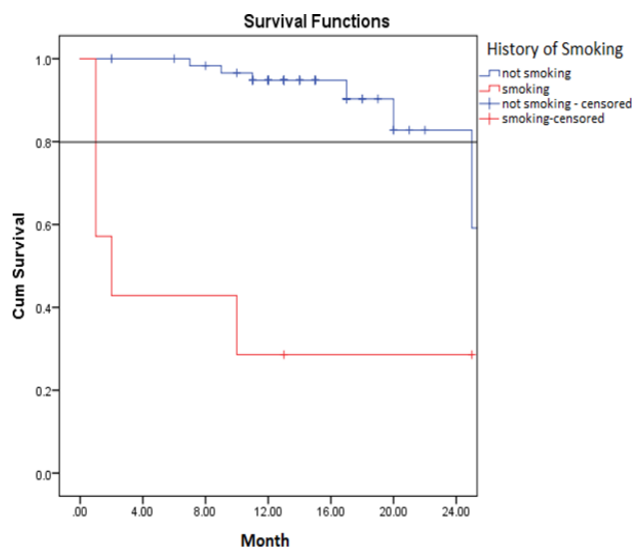


Figure 2. Survival Rates in The Group Not Having a Smoking History Showed Figures Above 80% in the Two Years Postoperatively (blue). In the Smoking Group Obtained a Lower Survival Rate, which is between 20-40% (red).

General Factors		
1	Gender	0.170
	Man	34 (49.3%) 5 (7.2%)
	Women	35 (50.7%) 10 (14.5%)
2	Age	0.000
	10-20 years	7 (10.1%) 2 (2.9%)
	20-30 years	16 (23.2%) 4 (5.8%)
	30-40 years	28 (40.6%) 4 (5.8%)
	40-50 years	10 (14.5%) 2 (2.9%)
	50-60 years	7 (10.1%) 2 (2.9%)
	> 60 years	1 (1.4%) 1 (1.4%)
3	Smoking history	0.000
	Yes	7 (10.1%) 5 (7.2%)
	No	62 (89.9%) 10 (14.5%)
4	Albumin	0.571
	≤ 3,02 g/dl	32 (46.4%) 7 (10.1%)
	> 3,02 g/dl	37 (53%) 8 (11.6%)
5	BMI	0.428
	Underweight	15 (21.7%) 4 (5.8%)
	Normalweight	25 (36.3%) 4 (5.8%)
	Overweight	20 (29%) 7 (10.1%)
	Obesity	9 (13%) 0 (0%)
6	Operation Length	0.602
	≤ 8 hour	31 (44.9%) 5 (7.2%)
	> 8 hour	38 (55.1%) 10 (14.5%)
Local Factors		
1	Location	0.310
	L	18 (26.1%) 4 (5.8%)
	H	23 (33.3%) 5 (7.2%)
	C	0 (0%) 0 (0%)
	LC	8 (11.6%) 1 (1.4%)
	LCL	15 (21,7%) 4 (5.8%)
	HC	3 (4.3%) 0 (0%)
	HLC	2 (2.9%) 1 ((1.4%)

Table 1. Distribution of Each Variable.

Discussion

Reconstructive mandibular postoperative mandibular benign tumors are often performed by oral surgeons. The choice of using alloplastic material is the right choice where autograft cannot be performed because of a long operation time and the patient does not want morbidity in the donor area.^{7,8} Survival studies like this have been carried out by several researchers, looking at survival plates using several different

predisposing / variable factors. The results obtained from some of these studies also show different results even though the analysis technique used is the same, namely survival analysis using Kaplan-Meier. This is due to the population studied, the length of observation and the categorization differences in dividing the variables studied. In this study obtained variable age is a predisposing factor that influences this study. Decades of age over 60 years turned out to have a risk of complications of 153 (CI 5.78 - 4097.07) times higher than that of patients aged 10-20 years. This can be caused by postoperative wound healing in young patients is more effective.⁹ However, this can be biased, because in this study there were only 1 patient who was over 60 years of age who underwent surgery who experienced complications in the form of plate fractures.

In Kaplan-Meier survival curve (figure 1) based on age variables, the survival plate level of the 10-60 year age group is above 80% for the first year, whereas in the 10-30 years age group the survival rate of 80% can last up to 2 postoperative year. Research conducted by van der Rijt et al.¹⁰ found no significant differences between age groups, this could be due to differences in categorization of patients' age, the study used patients under 65 years and over 65 years. Five of the 15 patients who experienced complications had a smoking history, 3 patients had plate expose, 1 patient had a plate fracture and 1 had an infection. The smoking history variable is a variable that influences the incidence of complications, the cox regression analysis found that patients with a history of smoking will increase the risk of complications 9 times compared with patients with no smoking history. This is because smoking habits interfere with the circulation of blood vessels which will affect tissue healing.¹¹ According to Ettl et al.¹² patients with a history of smoking 20 cigarettes per day when diagnosed with a tumor can increase the incidence of post-reconstruction plate complications by 49%. Patients with a smoking habit "1 pack per day" will experience microcirculation disorders, delayed inflammatory response and hypoxia in their peripheral range, so that it will prolong the occurrence of tissue healing.¹³ These results are consistent with previous studies which mention smoking is an

independent variable in the post-reconstruction of the mandibular form in the form of dehiscence or expose plate.¹⁰ In a study conducted by Maurer et al.¹⁴ showed that patients with a history of smoking had an increased risk of 2 times greater.

The Kaplan-Meier survival curve (figure 2) based on smoking variables found that the survival plate level group of patients who did not have a smoking history was above 80% for 2 years postoperatively, while in the group of patients with a history of smoking, the survival plate rate dropped between 20- 40% in 2 years after surgery. This result is in line with several studies that show a number of 50-60%¹⁰, 40-50%⁷, 50%¹⁴ in the smoking history group for the first 2 years.

Other variables in this study were gender, BMI category, postoperative albumin value, duration of surgery, reconstruction plate system used in this study had no effect on the occurrence of complications, this was in line with several previous studies.^{2,4,7,10,15} Handling complications in the form of plate fractures and exposure to plates requires a second operation. Some literature states that if post-reconstruction mandibular complications occur using only alloplastic material, vascularized graft is needed in the second operation.^{2,7,16} In this study only 1 patient performed vascularized graft, 9 patients were reconstructed with alloplastic material, 1 patient removed the plate and 1 patient did not undergo surgery.

In this study there were 2 patients with complications in the form of infection which were debrided and administered with antibiotics. Infections can occur due to postoperative infection.¹⁶ Handling of infection without the presence of an exposure plate is sufficient by giving antibiotics and debridement without the need for removal of a plate or vascularized graft.¹⁰

This retrospective study has several limitations, such as the smoking history variable in this study is limited to smoking history when diagnosed with a tumor. Smoking habits and habits of maintaining postoperative oral hygiene are not recorded in the medical record, so that if the patient is still smoking or unable to maintain

good oral hygiene after surgery, this can be a bias from the results of this study.

Although all patient data in this study were carried out by oral surgery specialists, there were several factors that could influence the outcome of surgery. The systemic diseases maybe have an impact on complications after surgery, but in this research all patient with systemic diseases had been controlled before surgery. Suturing techniques, the extent of raised soft tissue defects, and plate bending techniques with the help of stereolithography technology either with CT-scan or CBCT can affect the results of surgery not recorded in the medical record, so that uncontrolled factors can influence the study. Further research is needed by using a cohort design to be able to see the influence of these factors.

Conclusions

Smoking and age factors influence the incidence of post-reconstruction mandibular complications. If possible, reconstruction of the mandible only with a reconstruction plate is a temporary measure, it is necessary to consider the use of either vascularized or non-vascularized grafts.

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