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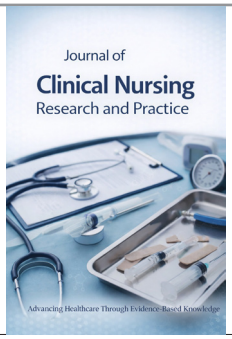

Oncoreconstructive Microsurgeries as Current Treatment for Cancer Patient Nowadays in Indonesia's Largest National Cancer Center: Freshly Graduated Microsurgeon Experience From 2019-2022

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Abstract

Background: *In recent years, the use of free flap repair and microvascular techniques in reconstructive cancer surgery has grown significantly. Patients in high-volume tertiary care facilities often require complex treatments, including free flap transfers.*

Objective: *We examined patient characteristics and their 4-year survival outcomes after receiving oncoreconstructive microsurgeries from a team of surgical oncologists at Indonesia's National Cancer Center, a national referral hospital, between 2019 and 2022.*

Materials and methods: *We conducted 179 microsurgery operations and analyzed patient age, gender, Body Mass Index (BMI), comorbidities, cancer type, tumor location, surgery type, flap sources, recipient and donor sites, and free flap success rates.*

Results: *Between 2019 and 2022, 179 oncoreconstructive microsurgeries were performed, with an average patient age of 46 with normal BMI. The primary tumor location was most commonly in the intraoral area, and squamous cell carcinoma was the most frequent pathology. Wide excision and subsequent reconstruction with an Anterior Lateral Thigh flap were common procedures. The facial artery was the primary recipient artery, and the jugular external vein served as the primary recipient vein. Over four years, the success rate for oncoreconstructive microsurgeries consistently exceeded 90%.*

Conclusion: *As a freshly graduated surgical oncologist at Indonesia's largest national referral hospital, we are able to successfully treat patients with locally advanced malignancies by performing tumor resection and effectively repairing defects using oncoreconstructive microsurgeries, resulting in a success rate of over 90%.*

Introduction

Being the largest national referral cancer center in Indonesia, with over one hundred thousands visits annually, we receive more than 90% of our cases involving solid tumors that span from locally advanced to advanced stages. The number of surgeries done in our hospital reached more than 1000 procedures per year, and with almost 200 surgeries done for each surgical oncologist. Most of the patients presented with complex preexisting conditions from referring hospitals across the country has always been challenging. In the practice of high-volume tertiary care hospitals, the patients are often presented with a mix of complex diseases while the need for free flap transfers become more important [1].

Currently, treating patients with solid tumors demands a comprehensive approach. Surgical excision of malignant tumors frequently leads in significant tissue defects [2]. Free flaps may be used to correct problems depending on their placement [3].

Reconstructive surgery as the treatment of cancer has been improved over the recent decade by the routine use of free flap reconstruction and refining microvascular techniques [3]. Reconstructive surgery allows free transfer of soft tissue and bone from all over the body following aggressive resection. With successful surgical reconstruction, followed by radiotherapy and adjuvant therapies, the quality of life of the patients are maintained and improved [4,5].

A surgical oncologist can also perform microsurgery reconstruction as the latest therapy in the management of solid tumors. This is because cancer management can be done comprehensively, and as a surgical

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oncologist have a deeper expertise in cancer management from diagnosis to reconstruction and rehabilitation.

A comparative study between 98 patients with advanced oral squamous cell who underwent free flap reconstruction and local or regional flap reconstruction revealed that patients with free flap reconstruction showed a trend toward better 5-year survival [6]. In another study, it is shown that free flap transfer is safe and effective even in multimorbid patients [7]. Oncologic reconstructive microsurgery stands out as one of the most intricate and demanding procedures within the field of oncology.

In this paper, we aim to provide an overview of the patient demographics who received oncoreconstructive microsurgery conducted by a team of surgical oncologists at One of Indonesia's National Cancer Center from 2019 to 2022 and their post-procedural survival outcomes.

Methodology

We collected the data of the patients who underwent oncoreconstructive microsurgeries from January 2019 to December 2022. Oncoreconstructive surgery involves excising a tumor mass in patients with solid tumors whose diagnosis has been previously verified through anatomical pathology assessments. It is removed through extensive excision, ensuring tumor-free margins in frozen section analysis. Closure of the defect is then carried out using free flap reconstruction, with the arteries and veins of the free flap donor site anastomosed to those of the recipient site under a microscope.

The inclusion criteria were all patients who are recorded in the medical records as having undergone microvascular surgery by the same microvascular oncology surgical team between 2019 and 2022. The exclusion criteria are patients who were not listed in the medical records and have not yet undergone microvascular surgery by the same oncoreconstructive surgery team.

The total number of patients gathered is 179 microsurgery procedures have been recorded. From the medical record, we analyzed the demographic features including age, sex, BMI, and comorbidities, including anemia, diabetes mellitus, hypertension, and hypercoagulation, which can pose challenges during the perioperative phase and may impact the outcomes [8]. Additionally, we collected information regarding the cancer type, cancer stage based on AJCC staging guidelines divided into early, locally advanced, and advanced stages, primary tumor location, surgical procedure type, free flap donor site, recipient site, and the flap success rate. The survival of the patients over a four-year period was assessed using the Kaplan-Meier method in SPSS version 26. Ethical clearance was obtained from the ethics commission of the health research at One of Indonesia's National Cancer Center with the number 085/KEPK/III/2023. Informed consent from the patients was obtained to use their medical records.

Cases included in this study were performed by two surgeons. One surgeon was responsible for the tumor resection with the aim of achieving tumor-free margins. The other surgeon was responsible for the defect reconstructions. Flap harvesting and vascular anastomosis were done by one surgeon, and the microvascular anastomosis was performed by both surgeons. Clinical follow-ups were conducted every day right after surgery during the hospital stay, followed by monthly follow-ups after discharge. All patients were followed for at least twelve months or until death. Flap survival was assessed by inspection during each follow-up.

The data is presented in a descriptive method as counts or proportions. All recorded data is confidential. The work has been reported in line with the STROCSS criteria [9].

Results

(Table 1) From 2019 to 2022 the total number of oncoreconstructive microsurgeries procedures done by the team is one hundred and seventy-nine cases with an average of forty-five cases per year. The mean age of the study population was 46.25 ± 16.5 years.

Based on sex, the number of female patients was 61.2% (n=112) which was more dominant compared to male patients 38.8% (n=71). The average BMI of patient was 21.45 ± 4.8. Most of the patients were with underweight to normal BMI.

Based on the primary site of the tumor, it was dominated with intraoral cancer by 37.4% (n=67). Intraoral cancer included lips, tongue, base of the mouth, hard and soft palate, and sinuses. Then followed by lower face (18.4%) and midface (17.3%). Lower face cancer included the sites of mandible and parotid gland. The rest consisted of neck, breast, trunk, and extremities.

Among all patients, the most common type of cancer was squamous cell carcinoma by 44.1% (n=79) then followed by sarcoma (12.8%), breast cancer (9.5%), and basal cell carcinoma (6.1%). Most patients are presented with locally advanced stage (86.5%).

The most common techniques done were wide excision performed to 64 patients in total followed by glossectomy, mandibulectomy, maxillectomy, and mastectomy. Other types of tumor resections were rarely done such as compartment resection, parotidectomy and thyroidectomy.

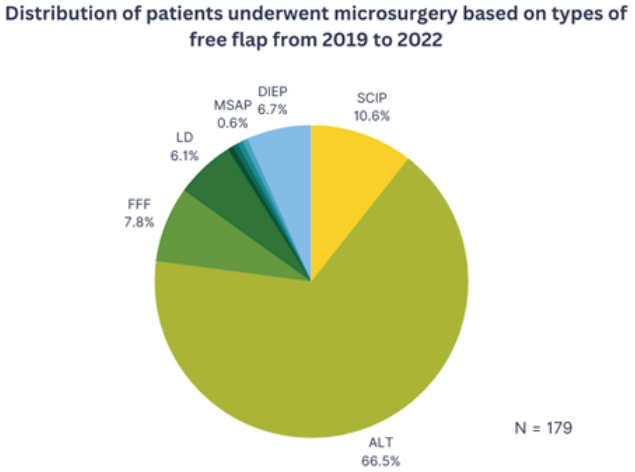

Figure 1. *Distribution of patients underwent microsurgery based on types of free flap from 2019 to 2022.*

More than half of the reconstruction of the defect areas are harvested from anterior thigh flap (ALT) done to 119 (66.1%) patients over the years (Figure 1), especially in patients with squamous cell carcinoma. Facial artery was the most common receipient artery for reconstruction site of head and neck. Most of the receipient vein was external jugulary the followed by facial vein.

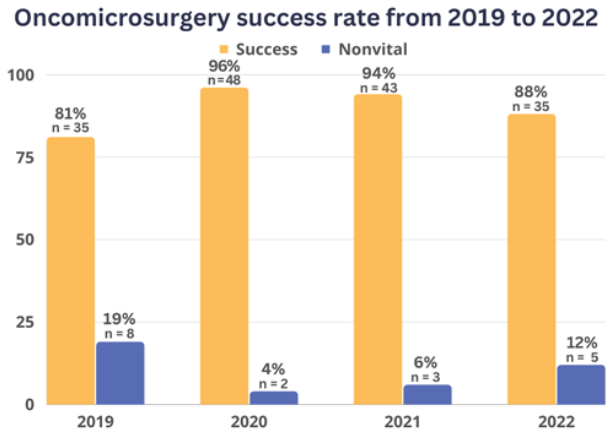

Figure 2. *Oncorecontruction-microsurgery success rate from 2019 to 2022.*

(Figure 2) Over the years, the survival rate of the free flap done was 90% success rate. The most number of microsurgeries procedure done to the patient was in 2020 with 50 patients. The highest success rate was in 2020 with 96% success rate. The least number of patient was in 2022 with 40 patients and the success rate was 87.5%. Representative illustration of the oncoreconstructive cases that have been performed within our institution can be seen in Figure 3 - 4.

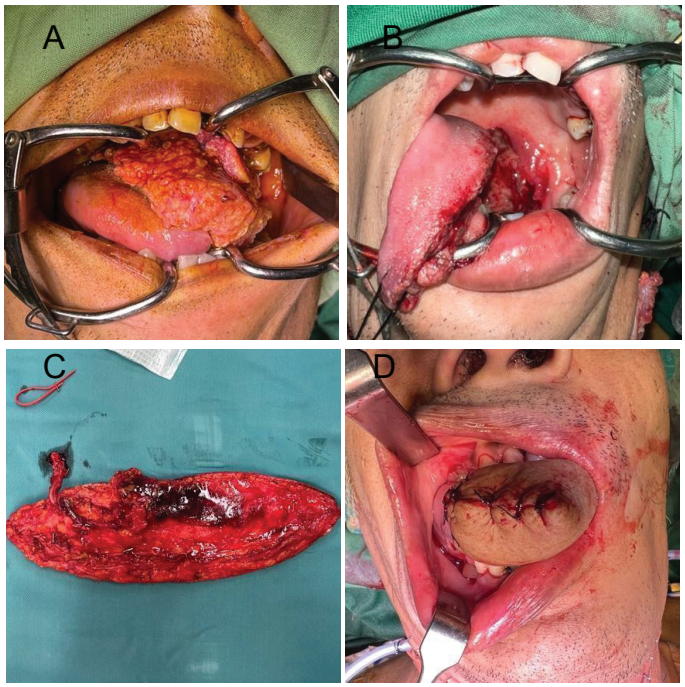

Figure 3*. A) A 42-years-old male presented with Squamous Cell Carcinoma of tongue T4N0M0 with 5 cm x 6cm in size B) Subtotal glossectomy was done with 10 mm margin was done C) ALT free flap harvested from right thigh. D) the outcome after surgery.*

Table 1*. Distribution of characteristic's of patients who underwent oncoreconstructive microsurgeries*

Characteristic	N	%
Age (years), mean ± SD	46.25 ± 16.5	
Sex		
Male	71	61.2
Female	112	38.8
BMI, mean ± SD		
Underweight	45	25.1
Normal	99	55.3
Overweight	27	15.1
Obese	8	4.5
Comorbid		
No comorbid	102	57
Anemia	45	25.1
Diabetes Mellitus	6	3.4
Hypertension	17	9.4
Hypercoagulation	9	5
Primary tumor site		
Intraoral	67	37.4
Scalp	11	6.1
Head and neck	66	36.9
Breast	14	7.8
Trunk	5	2.8
Upper/lower extremities	16	8.9
Cancer stage		
Locally advanced	155	86.5
Metastases	8	4.4
Early stage	5	2.7
Types of cancer		
Squamous cell carcinoma	79	44.1
Basal cell carcinoma	11	6.2
Sarcoma	34	18.9
Ameloblastic carcinoma	14	6.7
Adenoid cystic carcinoma	8	4.5
Melanoma	4	2.2
Mucoepidermoid carcinoma	4	2.3
Breast cancer	17	9.5
Clear cell carcinoma	1	0.5
Thyroid carcinoma	1	0.5
Salivary duct cancer	2	1.1
Other non-malignancies	5	2.8
Types of tumor resection		
Wide excision	64	35.8
Glossectomy	36	20.1
Mandibulectomy	28	15.6
Maxillectomy	22	12.3
Mastectomy	12	6.7
Compartment resection	5	2.8
Parotidectomy	3	1.7
Thyroidectomy	1	0.6
Salvage	7	3.9
Nerve graft	1	0.6
Types of free flap		
SCIP	19	10.6
ALT	119	66.5
FFF	14	7.8
LD	11	6.2
IMAP	1	0.6
Vastus lateral	1	0.6
Nerve Graft	1	0.6
MSAP	1	0.6
DIEP	12	6.7
Status of viability		
Viable	161	90
Non viable	18	10

Note:
SCIP : Superficial Circumflex Iliac Artery Perforator free flap
ALT : Anterior Lateral Thigh free flap
FFF : Free Fibular Flap
LD : Latissimus Dorsi
IMAP : Internal Mammary Artery Perforator
MSAP : Medial Sural Arteri Perforator
DIEP : Deep Inferior Epigastric Artery Perforator

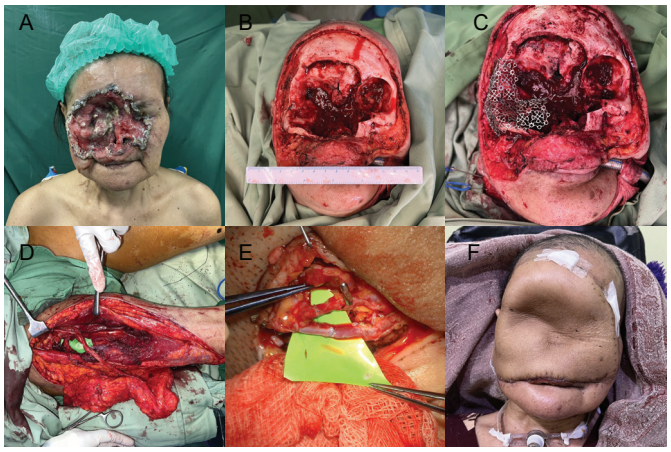

Figure 4. A) A 61-years-old female presented with Basal Cell Carcinoma T4N0M0 with large, ulcerative lesion, 8 cm x 10 cm in size on her midface. B) Wide excision with a 20 mm margin resulted in a defect with a diameter of 11 cm in width and 14 cm in length. C) Zygomatic bone reconstructed by using screw on the Maxilla and titanium mesh on Orbital floor. D) Harvesting ALT free flap from right thigh. E) End-to-End vascular anastomosis to Right Facial Artery and Right Temporal Vein. F) the outcome after 1-month post-surgery.

Discussion

The total number of patients for the last 4 year that undergone oncoreconctructive microsurgeries was 179 procedures in 170 patients. Where in 9 patients the procedure was done more than once. It may be caused by the nonvital flaps that were replaced by new flaps. As the main referral cancer hospital, our institution received patients from all over the country with previous medical treatments from their region. This may increase the difficulties faced by our surgeons.

In our study, squamous cell carcinoma was the most common type of cancer that underwent oncoreconstructive microsurgery. This result was aligned with other study done in India where 50% of head and neck cancers site are intraoral where 90% of them are squamous cell carcinoma [10]. Patients who underwent microsurgeries were squamous cell carcinoma. Immediate reconstructive surgery is widely advised in the treatment of these patients as such treatment will increase the cure rate and reduce the morbidities and improve patient's quality of life [10,11].

Anemia was the most common comorbid in the patients during perioperative. Most patients were with large tumors that bleeds easily. It is common for the patient to have blood transfusion perioperatively to decrease the postoperative mortality. According to Long et al, the preoperative anemia is not associated with the flap's survival, while post-operative anemia may have been associated with complication after surgery [12].

Patients were mostly in underweight to normal BMI. It is important to determine the patient's nutritional status in order for the postoperative wound healing. In underweight patients we consult to nutritionists to increase the patient's nutritional status since complications after surgery in patients with underweight BMi may be associated [13].

The most common type of free flap done in our institution was Anterior Lateral Thigh (ALT) free flap. The ALT free flap was more preferred option for defect repair can preserve the major vascular structure and primary donor-site closure can be done. This flap can provide large skin surface and large pedicle [14]. In our previous study, ALT free flaps also contributed as the most common flap done in our institution by 41.7% of all patients who underwent distant free flap in a year [15]. Several modifications of the flap also expand its application such as involvement of fascia for tendon reconstruction, and can be modified to according to the placement of the flap. The survival of ALT free flap relatively higher than other type of free flaps. It suggested that the perfusion in ALT free flaps was better [16]. In patients who underwent maxillectomy and mandibulectomy, the use of plate and screw were required in order to give better result to the patients.

Intraoral squamous cell carcinoma is the most common cancer diagnosed in oral cavity [17]. This result aligned with the finding in our study. ALT free flap can provide adequate size to accommodate modification for the tongue reconstruction. The option to use single perforator in tongue reconstruction is a good alternative [18].

In our study, the survival rate of vital free flaps done are on the average of 90% (Figure 5). Compared to some studies, the range of survival of free flaps are ranging from 90% to 95% (18). The cause of nonvital flaps may be varied from each case, such as vessels insufficiencies, hematoma that can cause compression on the anastomosis site, or thrombosis in artery of vein. Daily postoperative follow-up become important to evaluate the flap condition. Salvage surgeries can be done to prevent further necrosis to the flap. Non-operative salvage can also use anticoagulant agents and use of biological agents such as leech, due to its anticoagulant effect, was done to some patients with sign of flap necrosis [7,19].

Kaplan-Meier univariate analysis showed that the median survival of the patient is 22 months and 4 years overall survival is 45% (Figure 5). The choice of treatment is dependent on many factors such as the tumor's location and its stage. Surgery as the primary treatment, are often followed by postoperative radiotherapy. Compared to other study in Europe where 5-year overall survival rate of squamous cell carcinoma of head and neck typically ranges between 40% and 60% [20]. The result corresponds with the outcome observed in our institution.

Further study to determine the association of patient's demographic and comorbid features and the survival rate of the free flap is suggested. In this study it is not determined whether there is association between variables. The study on patients' quality of life after surgery is also needed in .

There were some limitations that may contribute to the conclusion of this study. The determination of flap survival was examined by physical examination. The type of reconstruction method is determined by the judgement of the surgeon.

In the future, with the high number of patients with locally advanced tumors coming to our institution in need of oncoreconstructive microsurgery, the goal is to have 100

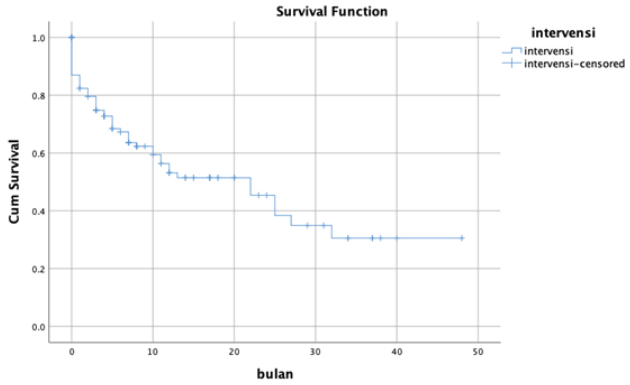

Figure 5. Kaplan Meier Curve of Patient underwent oncoreconstruction-microsurgery

microsurgeries per year or 2 surgeries per week for each oncoreconstructive microsurgery team.

Conclusion

As a freshly graduated surgical oncologist practicing in one of leading referral hospital in Indonesia, both the surgeon and the institution are committed to provide comprehensive treatment for patients with locally advanced malignancies. This involves not only eradicating tumors but also repairing resulting defects through oncoreconstructive microsurgeries, achieving a survival rate of viable flaps of up to 90%. Our institution's primary objective is to expand the utilization of oncoreconstructive microsurgery procedures in the future.

Declarations

Ethical approval

The ethical clearance was obtained from the ethics commission of health research in Dharmais National Cancer Center with the Number 085/KEPK/III/2023. Informed consent from the patients was obtained to use their medical records.

Funding

This research had no sponsorship and was fully funded by the researchers.

Data availability

Any datasets generated during and/or analyzed during the current study are available upon reasonable request to this article.

Informed Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request

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