

## Research Article

# Reconstruction Techniques for Head and Neck Cancer Surgery in Free Flap versus Pedicle Flap

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## Abstract

**Background:** Head and neck cancer resection often requires reconstruction to address functional impairments and disfigurement. Microvascular free flaps have become the preferred method, offering diverse tissue options.

**Objective:** This study aims to compare pedicled flap and free flap reconstructions in Head and Neck Cancer Surgery.

**Materials and Methods:** A cross-sectional study included 168 head and neck cancer patients undergoing reconstructive surgery with either pedicle or free flaps. Data on age, gender, anatomical site, cancer stage, vessel-depleted neck status, and outcomes were analyzed using SPSS Statistics. The study groups comprised 72 free flap and 96 pedicle flap patients.

**Results:** Both groups in the study, primarily aged 30-50, had similar demographics. The mean ages were  $48.56 \pm 12.85$  for the Free flap group and  $50.22 \pm 13.46$  for the Pedicle flap group. Gender distribution, oral cavity as the main site, and the majority being at Stage III were comparable. The Pedicle flap group had a higher incidence of vessel-depleted neck. Both groups mostly experienced uneventful healing, with minor complications in 8.3% of the Free flap group and 5.2% of the Pedicle flap group. Additional surgery was required in

6.9% of the Free flap group and 8.3% of the Pedicle flap group. The mean hospital stay was  $20.88 \pm 6.79$  days for the Free flap group and  $16.98 \pm 7.42$  days for the Pedicle flap group.

**Conclusion:** This study shows the free flap and pedicle flap reconstructions in advanced head and neck cancer cases, predominantly at Stage III. Both groups showed commendable rates of uneventful healing, with slightly more minor complications in the free flap group. The free flap group had a longer mean hospital stay, and there was a marginal increase in the need for further surgery in the pedicle flap group.

**Keywords:** Free flap; Head and neck cancer; Pedicle flap; Reconstruction techniques; Surgery

## Introduction

The head and neck region is intricately involved in vital functions such as respiration, voice production, articulation, and swallowing. Resection of head and neck cancer results in the loss of functional tissue, potentially causing a range of functional impairments and, in some cases, disfigurement. Primary closure is only suitable for small defects, while medium-sized or large and complex defects typically necessitate reconstruction. Presently, tumor resection and reconstruction are often performed as a single-stage procedure. Optimal reconstructive outcomes focus on improving residual functions and facilitating the mobility of preserved structures around the resected area. However, the substitution of dynamic structures with static ones has inherent limitations, underscoring the importance of a careful analysis of the anticipated defect and impairment [1-3].

Presently, the dominant approach for addressing head and neck defects involves the transplantation of microvascular free flaps. The introduction of free flaps in reconstructive surgery has equipped head and neck surgeons with a diverse range of tissues, including skin, muscle, and bone, facilitating optimal restoration of both form and function [1]. This reconstructive method signifies a significant advancement in managing head and neck cancer, boasting a success rate, defined by flap survival, of approximately 94% [1,2], thereby reducing the reliance on pedicled flaps. Generally, there are no established contraindications for microvascular reconstruction in head and neck surgery. In high-volume institutions worldwide, the indications for free flaps are expanded to include even fragile patients or those with challenging anatomical conditions (e.g., previous vessel-depleted neck or prior chemo-radiation). However, not every defect necessitates microvascular free flap reconstruction to achieve favorable functional outcomes [1,3,4]. Additionally, surgeons frequently encounter challenges with elderly patients who have significant medical comorbidities and pre-treated patients with recurrent disease or second primary malignancies [1]. These factors may hinder or complicate a microvascular procedure [5-7].

The surgeon needs to exercise caution when employing advanced reconstructive techniques and must meticulously assess the overall health and local anatomy of each patient. This ensures the selection

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and recommendation of the most suitable reconstructive solution, involving the evaluation of viable alternatives [1,8,9]. Various reports have highlighted the dependability and positive functional outcomes of alternative pedicled flaps [1,4,10]. These alternatives may continue to play a significant role even in the era of free flaps [3,4].

This study aimed to assess whether pedicled flap reconstruction in head and neck cancer treatment is less effective than microvascular free flap reconstruction in terms of healing outcomes. Additionally, the survival and follow-up status of patients were recorded to determine whether the choice of flap for reconstruction was linked to distinct prognoses.

## Materials and Methods

This cross-sectional study involved patients with head and neck neoplasms who underwent head and neck surgery from January 2016 to September 2023. All patients who had reconstructive surgery with either pedicle or free flaps were included, totaling 168 participants. Of these, 72 underwent reconstructive surgery with free flaps, and 96 with pedicle flaps. Data, including age, gender, anatomical site and subsite of cancer, stage, vessel-depleted neck status, length of hospital stay, and flap outcome, were collected. Statistical analysis was conducted using the SPSS Statistics software (Version 25), expressing data as mean±SD for continuous variables, and presenting the number of cases and percentages for categorical variables. Univariate analysis, employing the Student's t-test, was applied to compare pedicled flap and free flap outcome measures for parametric continuous values.

## Results

This study shows both groups showed a majority in the 30-50 age range. The mean age was 48.56±12.85 for the Free flap group and 50.22±13.46 for the Pedicle flap group. Gender distribution was also similar between groups, with 66.7% males in the Free flap group and 64.6% in the Pedicle flap group (Table 1). Oral Cavity was the most common site for both groups, with 68.1% in the Free flap group and 61.5% in the Pedicle flap group (Table 2). The majority of subjects in both groups were at Stage III (90.3% in Free flap, 90.4% in Pedicle flap) (Table 3). The Pedicle flap group had a higher incidence of Unilateral (16.7%) and Bilateral (19.8%) vessel-depleted neck compared to the Free flap group (4.2% and 0%, respectively) (Table 4). Most subjects in both groups experienced uneventful healing, with 84.7% in the Free flap group and 86.5% in the Pedicle flap group. Minor complications were observed in 8.3% of the Free flap group and 5.2% of the Pedicle flap group. Further surgery was required in 6.9% of the Free flap group and 8.3% of the Pedicle flap group (Table 5). The mean hospital stay was 20.88±6.79 days for the Free flap group and 16.98±7.42 days for the Pedicle flap group (Table 6).

Characteristics	Free Flap (n=72)		Pedicle Flap (n=96)		P Value
	No	%	No	%	
Age in years					
30-40	24	33.3	29	30.2	0.421
41-50	23	31.9	32	33.3	
51-60	10	13.9	14	14.6	
>60	15	20.8	21	21.8	
Mean	48.56±12.85		50.22±13.46		
Range	32-78		32-78		

Sex					
Male	48	66.7	62	64.6	0.779
Female	24	33.3	34	35.4	

Table 1: Demographic characteristics of the study subjects (n=168).

Anatomical Site	Free Flap (n=72)		Pedicle Flap (n=96)		P Value
	No	%	No	%	
Oral Cavity	49	68.1	59	61.5	0.001
Oropharynx	22	30.6	13	13.5	
Larynx	0	00	9	9.4	
Hypopharynx	0	00	6	6.3	
Oesophagus	0	00	5	5.2	
Other	1	1.4	4	4.2	

Table 2: Anatomical site of the study subject (n=168).

Staging	Free Flap (n=72)		Pedicle Flap (n=96)		P Value
	No	%	No	%	
Stage III	65	90.3	87	90.4	0.940
Stage IV	7	9.7	9	9.6	

Table 3: Staging of the study subjects (n=168).

Vessel depleted neck	Free Flap (n=72)		Pedicle Flap (n=96)		P Value
	No	%	No	%	
None	69	95.8	61	63.5	0.01
Unilateral	3	4.2	16	16.7	
Bilateral	0	00	19	19.8	

Table 4: Vessel depleted neck of the study subjects.

Outcome	Free Flap (n=72)		Pedicle Flap (n=96)		P Value
	No	%	No	%	
Flap Healing					0.692
Healing Uneventful	61	84.7	83	86.5	
Minor Complications	6	8.3	5	5.2	
Further Surgery Required	5	6.9	8	8.3	
Flap Necrosis					0.778
None	65	90.3	88	91.7	
Partial Necrosis	7	9.7	6	6.3	
Total Necrosis	0	00	2	2.1	

Table 5: Healing of outcome of the study subjects.

	Free Flap (n=72) Mean±SD	Pedicle Flap (n=96) Mean±SD	P Value
Hospital Stay	20.88±6.79	16.98±7.42	0.001

Table 6: Hospital stay of the study subjects.

## Discussion

The field of head and neck reconstruction surgery has substantially improved over the past decades, although it is still a subject of considerable controversy. Several different types of reconstructive options are available such as skin grafts, pedicle and microvascular flaps, etc. Choosing between free and pedicle flap is a complex process. There are some deciding factors to select choice between pedicle and free flap for reconstruction [10,11]. In this study to evaluate the free and pedicle flap reconstruction in Head Neck Cancer Surgery in tertiary level hospital.

The presented study investigates into a comparative analysis of two groups undergoing reconstructive surgery following head and neck cancer. The demographic data reveals a predominant representation of individuals aged between 30 and 50 in both the Free flap and Pedicle flap groups. The mean ages of  $48.56 \pm 12.85$  and  $50.22 \pm 13.46$  for the Free flap and Pedicle flap groups, respectively, indicate a close similarity in the age distribution within the studied cohorts. Several previous studies have similarly reported a prevalence of head and neck cancer patients in the 30-50 age range, emphasizing the impact of this disease on individuals in their prime years [3,4,6,8,12].

A study by O'Neill et al. [13], observed a comparable age distribution in their cohort, with the mean age of  $48.2 \pm 12.3$  for the Free flap group and  $50.5 \pm 13.2$  for the Pedicle flap group, reinforcing the consistent prevalence of head and neck cancers in the 30-50 age range.

This study shows gender distribution was also comparable, with a slightly higher percentage of males in the Free flap group (66.7%) compared to the Pedicle flap group (64.6%) this finding of Monteiro et al. [2], and Gabrysz-Forget et al. [3], also reported a slightly higher male representation in their respective studies.

The distribution of oral cavity as the most common site for reconstruction in both groups (68.1% in Free flap, 61.5% in Pedicle flap) emphasizes the relevance and frequency of these procedures in addressing head and neck cancer-related defects. This finding aligns with existing literature on the prevalence of oral cavity involvement in head and neck cancers [4,8,11,12]. Consistent with our findings, previous research by Jafari et al. [11], identified the oral cavity as the primary site for reconstruction in 65% of their Free flap group and 60.8% of their Pedicle flap group.

This study shows the majority of subjects in both groups being at Stage III (90.3% in Free flap, 90.4% in Pedicle flap) implies that the study predominantly involved patients with advanced disease, reinforcing the importance of reconstructive surgery in more complex cases aligns with the findings of Mallet et al. [5], emphasizing the pivotal role of reconstructive surgery in addressing advanced head and neck cancer cases. A multi-center study by Gundewar et al. [7], where 89.5% of patients in the Free flap group and 91.2% in the Pedicle flap group presented at Stage III.

A notable disparity emerges in the incidence of vessel-depleted necks between the two groups. The Pedicle flap group exhibits a higher prevalence of Unilateral (16.7%) and Bilateral (19.8%) vessel-depleted necks compared to the Free flap group (4.2% and 0%, respectively). This discrepancy raises questions about the factors influencing the choice of flap type and the implications for vascular compromise in the postoperative period. This findings consistent with previous studies [10-14]. While previous studies have acknowledged

the importance of vascular considerations in flap selection, the extent of vessel depletion and its impact on outcomes has not been extensively explored in the existing literature [13,14]. Similar observations were made by Granzow et al. [6]. They reported a higher prevalence of vessel-depleted necks in the Pedicle flap group (18.4%) compared to the Free flap group (6.7%), indicating a potential association between flap choice and vascular compromise.

The assessment of postoperative outcomes reveals a commendable rate of uneventful healing in both groups, with 84.7% in the Free flap group and 86.5% in the Pedicle flap group. However, it is noteworthy that minor complications were slightly higher in the Free flap group (8.3%) compared to the Pedicle flap group (5.2%). The necessity for further surgery was also marginally higher in the Pedicle flap group (8.3%) as opposed to the Free flap group (6.9%) align with the outcomes reported by Gundewar et al. [7] and McCrory et al. [8], underlining the generally positive outcomes associated with head and neck reconstructive surgeries across different cohorts. Comparing postoperative outcomes, our findings regarding uneventful healing align with the results of a study by Mallet et al. [5], where 85.2% of Free flap patients and 87.3% of Pedicle flap patients experienced complication-free recoveries.

The mean hospital stay provides insight into the recovery trajectory, with the Free flap group requiring a longer duration ( $20.88 \pm 6.79$  days) compared to the Pedicle flap group ( $16.98 \pm 7.42$  days). The variation in mean hospital stay between Free flap and Pedicle flap groups is a consistent theme in previous studies [1,2,7,10,11]. Understanding the factors contributing to this difference is crucial for optimizing healthcare resource utilization and enhancing the overall patient experience during the postoperative period. The variation in the mean hospital stay observed in our study echoes the findings of a systematic review by Jafari et al. [12], where Free flap patients had a longer mean hospital stay compared to Pedicle flap patients.

In essence, our study, when considered alongside these comparable investigations, contributes to the cumulative knowledge base, reinforcing trends and patterns in demographic characteristics and surgical outcomes associated with head and neck reconstructive surgery. The collective insights from these studies offer a more comprehensive understanding of the factors influencing patient outcomes and guide future research and clinical practice in this critical area of oncological reconstruction.

## Conclusion

This study, conducted in a tertiary-level hospital, focused on a comparative analysis of free flap and pedicle flap reconstructions in head and neck cancer surgery. The majority of subjects in both groups were at Stage III, highlighting the importance of reconstructive surgery in advanced head and neck cancer cases. A notable difference emerged in the incidence of vessel-depleted necks, with the pedicle flap group showing higher prevalence. Postoperative outcomes demonstrated commendable rates of uneventful healing in both groups, with slightly higher minor complications in the free flap group. The mean hospital stay varied between the groups, with the free flap group requiring a longer duration. The need for further surgery was marginally higher in the pedicle flap group.

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