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Pectoralis major myocutaneous flap in salvage reconstruction following free flap failure in head and neck cancer surgery

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Abstract

Objective: This study aimed to compare the results of the pectoralis major myocutaneous (PMM) flap in primary and salvage head and neck cancer surgery.

Methods: A total of 160 patients were enrolled in this study. The salvage group consisted of 30 patients who received immediate PMM flap surgery following free flap failure. In the primary group, the PMM flap was primarily chosen for 130 patients. Related information was collected and analysed. The University of Washington (UW)-Quality of Life questionnaire, version 4, was mailed to every patient.

Results: Partial necrosis was significantly lower in the primary group (n = 13, 10.0%) than in the salvage group (n = 7, 23.3%). Surgical site infection was found in 10 (7.8%) patients in the primary group and in six (20.0%) patients in the salvage group. The mean composite quality of life scores were 66.8 ± 20.5 and 66.2 ± 22.1 in the two groups, respectively. Differences in scores for domains of activity, mood, and anxiety were significant. Disease-specific survival and recurrence-free survival rates were not different between the two groups.

Conclusion: PMM flap salvage reconstruction has a higher complication rate and poorer functional results, but similar survival prognosis, compared with primary surgery.

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Introduction

The superiority and benefits of free flaps for repairing head and neck defects have been well described.[1,2] However, in critically ill and older patients with uncontrolled diabetes, cardiopulmonary failure, and renal insufficiency, use of a pedicled flap not only represents an alternative to free tissue transfer, but is also a preferable option, with fewer risks for the patient. Harvesting and management of free flaps have recently greatly improved, but even in renowned medical centres, complete failure of a free flap is sometimes inevitable.[3,4] Therefore, selection of an appropriate reconstruction method to fill the residual defects in these patients is challenging.

Since the pectoralis major myocutaneous (PMM) flap was first introduced by Ariyan et al.,[5] it has been widely used for head and neck reconstructive surgery with a rather long pedicle. This pedicle includes the thoracoacromial artery as the axial vessel, which can even reach the level of the skull base. However, with advances in microsurgery, the PMM flap has most recently been used only as a remedy method. Chiummariello et al.[6] reported 12 patients who underwent primary PMM flap reconstruction as a salvage procedure and found that there was no flap loss. Anicin et al.[7] first compared the oncological results of using the PMM flap in primary and salvage head and neck cancer surgery. These authors found significantly better disease-free survival and locoregional control in the primary surgery group than in the salvage group. Unfortunately, they failed to report functional outcomes using an authoritative scale.

Therefore, the current study aimed to compare the results of the PMM flap in primary and salvage head and neck cancer surgery with a focus on quality of life and survival analysis.

Methods

The Zhengzhou University institutional research committee approved our study and all participants signed an informed consent agreement. All experiments were performed in accordance with relevant guidelines and regulations.

Patients who had received PMM flap reconstruction after head and neck cancer treatment at the Department of Head and Neck, The Affiliated Cancer Hospital of Zhengzhou University, from 2007 to 2016 were eligible. Medical and surgical records of the identified patients were reviewed for relevant information on body mass index, clinical characteristics (based on International Union for Cancer Control 2010), treatment, wound healing, flap vitality, interval to recurrence, and interval to death. In our medical department, free flap transfer was the preferred reconstruction method in most patients, but a salvage PMM flap was performed immediately if total necrosis of a free flap occurred (salvage group). A PMM flap was primarily chosen in most of the patients (primary group). Anti-inflammatory treatment was routinely performed postoperatively. After a follow-up of at least 12 months, the University of Washington (UW)-Quality

of Life (QoL) questionnaire, version 4, was mailed to each patient.

The UW-QoL scale consisted of 12 single-question domains, and they were scaled evenly from 100 (best) to 0 (worst) with three to six response options based on the hierarchy of responses. The domains were appearance, activity, pain, recreation, speech, swallowing, shoulder, saliva, mood, taste, anxiety, and chewing.

The Student's t test, chi-square test, and nonparametric Mann–Whitney test were used for comparative analyses. The Kaplan–Meier method was used to analyse recurrence-free survival and disease-specific survival rates. All statistical tests were two-sided and a p value less than 0.05 was considered statistically significant. Statistical analyses were performed using SPSS for Windows, Version 13.0 (Chicago, IL, USA).

Results

A total of 160 PMM flaps were used in 160 (all men) patients for head and neck reconstruction. The mean age was 63.5 (range: 43–81 years) years. The primary and salvage groups consisted of 130 and 30 patients, respectively. In the salvage group, 10 patients first underwent radial forearm flap harvest and 20 patients first received anterolateral thigh flap reconstruction. The mean age of patients in the primary group was significantly older than that of patients in the salvage group ($p = 0.006$) (Table 1). The mean flap size in the primary group was significantly smaller than that in the salvage group ($p = 0.031$). The rate of systemic disease (hypertension, heart disease, and diabetes) in patients in the primary group was significantly higher than that in the salvage group

Table 1. Characteristic of the patients, tumours, and treatment.

	Primary group (n = 130)	Salvage group (n = 30)	p
Age (range), years	68.9 (53–81)	54.3 (43–67)	0.006
Flap size (cm^2)	73.4 (54–150)	84.2 (60–180)	0.031
Systemic disease	100	4	<0.001
BMI, kg/m^2			
<18.5	10	2	
18.5–25	98	21	
>25	22	7	NS
Tumour site			
Tongue	59	14	
Mouth floor	41	9	
Buccal	15	4	
Gingiva	15	3	NS
Tumour stage			
T2	12	4	
T3	50	12	
T4	68	14	NS
Node stage			
N0	72	19	
N+	58	11	NS
Neck dissection			
Selective	131	30	
Radical	15	4	NS
Postoperative radiotherapy	60	15	NS

Values are reported as numbers unless indicated otherwise. BMI: body mass index; NS: non-significant.

(76% vs 13.3%, p <0.001). There were no significant differences in body mass index, the primary tumour site, tumour stage, neck dissection, node stage, and postoperative radiotherapy between the groups.

There was no total flap necrosis in either of the groups. In the primary group, the rate of partial necrosis was significantly less than that in the salvage group (10.0% [n = 13] vs 23.3% [n = 7], p = 0.047). Surgical site infection (SSI) was observed in 10 (7.8%) patients in the primary group compared with six (20.0%) patients in the salvage group, with no significant difference between the groups (p = 0.083).

A total of 113 (70.6%) patients returned the questionnaire. The mean composite QoL scores were 66.8 ± 20.5 and 66.2 ± 22.1 for the primary and salvage groups, respectively, with no significant difference between the groups (Table 2). However, scores for the domains of activity, mood, and anxiety were significantly higher in the primary group than in the salvage group (all p < 0.05). Patients in the primary group tended to score better in the shoulder domain than did patients in the salvage group (p=0.077). No significant differences were observed in the other domains.

The mean follow-up time was 51 months (range: 16–94 months). No significant difference was found in the recurrence-free survival rate between the two groups (Figure 1).A total of 58 patients developed recurrence (15 local, 32 regional, and 11 distant) in the primary group and 13 patients (5 local and 8 regional) developed recurrence in the salvage group.

No significant difference was found in the disease-specific survival rate between the two groups (Figure 2). A total of 39 patients died of head and neck cancer in the primary group and 10 patients died in the salvage group.

Discussion

Free flap transfer is the preferred procedure in repairing head and neck defects in our cancer centre. However, the number of older patients has been increasing owing to an overall increase in life expectancy.[8] Furthermore, a reduction in cardiac, respiratory, renal, and immunological function, which occurs with age, can seriously affect

Table 2. Comparison of quality of life scores between the two groups.

Domain	Primary group (n = 93)	Salvage group (n = 20)	p
Pain	91.4 ± 15.9	90.7 ± 16.4	NS
Appearance	87.4 ± 20.1	79.3 ± 25.9	NS
Activity	61.5 ± 25.6	43.3 ± 19.4	0.018
Recreation	63.2 ± 22.1	61.2 ± 29.4	NS
Swallowing	77.7 ± 20.6	73.8 ± 19.3	NS
Chewing	68.3 ± 17.8	60.2 ± 23.7	NS
Speech	70.3 ± 16.4	65.7 ± 24.7	NS
Shoulder	64.9 ± 23.1	54.1 ± 15.3	0.077
Taste	83.2 ± 22.7	78.5 ± 17.8	NS
Saliva	72.1 ± 23.0	68.7 ± 28.8	NS
Mood	77.7 ± 18.3	58.2 ± 29.1	0.004
Anxiety	75.7 ± 20.8	60.6 ± 15.2	0.032
Composite score	66.8 ± 20.5	66.2 ± 22.1	NS

NS: non-significant.

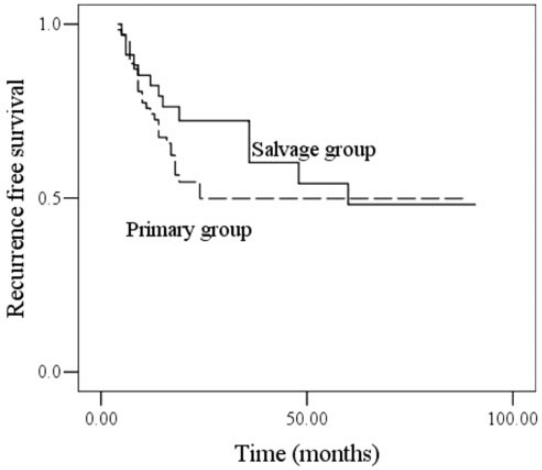

Figure 1. Comparison of recurrence-free survival between the primary and salvage groups.

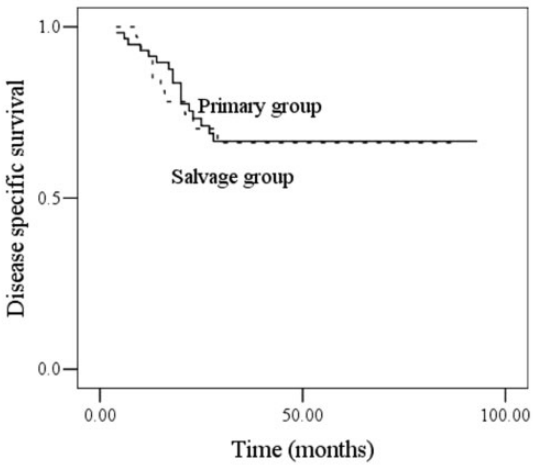

Figure 2. Comparison of disease-specific survival between the primary and salvage groups.

the choice of reconstruction methods. Therefore, patients in the salvage group had a younger age and better general health than did those in the primary group. Similar findings were also reported by Chao et al.[9] Interestingly, these authors observed that the flap size in the salvage group was greater than that in the primary group, but the two groups had a similar distribution of tumour stage. In fact, excision of the surrounding inflammatory tissue following free flap failure was usually required for achieving a fresh wound, and thus a larger defect required a larger flap.

Total flap necrosis is rare,[10] but partial necrosis is not uncommon, with a reported incidence varying from 4% to 29%.[11] In our study, there was no total flap failure, and partial necrosis occurred in 12.5% of the patients. However, patients in the salvage group had a higher rate of necrosis than did those in the primary group,

which was unexpected. All of the flaps had the same harvesting technique. Because patients in the primary group had poorer general health than did those in the salvage group, we assumed that partial necrosis should be more common in the primary group. The most plausible explanation for our unexpected finding is fibrous changes and hypovascularity of the surgical bed, as well as the larger flap size in the salvage group.[7]

SSI was undesired, but difficult to eliminate completely. A total of 16 (10.0%) patients in our study had an SSI, which is consistent with previous reports.[12–14] Risk factors for SSI in head and neck reconstruction surgery have been widely evaluated. Goyal et al.[13] described clean-contaminated wound classification, a longer operating time, and clindamycin prophylaxis as unfavourable factors. Similarly, Wang et al.[15] reported that a lower margin of the skin island, concurrent tracheotomy, diabetes mellitus, mandibular plate reconstruction, prior radiation, and perioperative blood transfusion were independent factors associated with SSI. While a slightly higher SSI rate was observed in the salvage group than in the primary group, this finding was expected because the salvage procedure is associated with higher complication rates.[16]

Satisfactory improvement in QoL is an important aspect of successful reconstruction. The UW-QoL questionnaire has been proven to be valid and reliable.[17,18] Fang et al.[17] first reported the QoL of patients undergoing reconstruction with the PMM flap, and their composite score was 73.4, similar to our results. This finding suggested that reconstructive surgery with a PMM flap had less effect on QoL than expected. The mean scores for activity, mood, and anxiety domains were significantly lower in the salvage group (younger age) than in the primary group in our study. Several factors are responsible for this finding. First, younger patients had more social interactions and engagements, and their previous experience with free flap harvest affected their activity.[19] Second, younger cancer survivors cared more about their health and spent more time worrying about whether there was tumour recurrence. Third, Inhestern et al.[20] described that approximately 40% of working age cancer survivors reported moderate to high anxiety scores and that approximately 20% reported moderate to high depression scores. Therefore, younger patients usually had more stress and lower scores for mood and anxiety.

The shoulder is an important component of the upper extremities, and any shoulder impairment is likely to lead to upper extremity dysfunction.[21] The reported effect of neck dissection and a PMM flap on shoulder function is associated with varying levels of impairment.[22,23] A recent study[23] showed that patients frequently had additional shoulder morbidity after PMM flap harvest, particularly after neck dissection. PMM flap harvest adds to impairment of abduction. This finding is supported by our outcomes in the primary group. Interestingly, we found slightly better shoulder function in the primary group than in the salvage group. A possible explanation for this finding is that a small proportion of patients in the salvage group had undergone a radial forearm flap reconstruction. A previous study described that radial forearm flap harvest had a significant deleterious effect on upper extremity function.[21]

A good prognosis is one of the main goals of cancer treatment. In a report by Hsieh et al.,[24] 242 patients with pathological stage IV oral squamous cell carcinoma were treated by tumour ablation with free flap reconstruction or with split-thickness skin grafts. These authors failed to show better locoregional control and a better survival rate in the free flap reconstruction group. Similar results were also shown by Fang et al.[18] Although a free flap is

currently the preferred method, the PMM flap is sometimes irreplaceable, especially in patients with free flap failure, but the survival rate in these patients remains unclear. Anicin et al.[7] first evaluated the role of the PMM flap in primary and salvage head and neck cancer surgery. These authors found significantly better locoregional control and disease-free survival in the primary group than in the salvage group, which conflicts with our outcomes. However, the definition of "salvage" was different in Anicin et al.'s[7] study; their salvage group consisted of patients with recurrent disease, and recurrent disease always has a poorer prognosis. In fact, in contrast to our expectations, the prognosis was similar in the two groups. Surgical margin status is a strong predictor of prognosis for survival. Mucke et al.[25] reported that a wider margin could be achieved by reconstructive methods and it was associated with increased survival. The surgical margin was wider in the salvage group owing to excision of necrotic tissue around the defect, and thus the salvage group might show a better prognosis.

There are some limitations in the current study. First, this was a retrospective study and there was inherent selective bias. Second, the sample size was relatively small. A future study with a larger sample size is required to confirm our findings.

In summary, PMM flap salvage reconstruction is associated with a higher complication rate and poorer functional result, but similar prognosis for survival, compared with primary reconstruction.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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