

Clinical Paper  
Head and Neck Oncology

# Indications and outcomes for 100 patients managed with a pectoralis major flap within a UK maxillofacial unit

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**Abstract.** There are few studies reporting the role of the pedicled pectoralis major (PPM) flap in modern maxillofacial practice. The outcomes of 100 patients (102 flaps) managed between 1996 and 2012 in a UK maxillofacial unit that preferentially practices free tissue reconstruction are reported. The majority (88.2%) of PPM flaps were for oral squamous cell carcinoma (SCC), stage IV (75.6%) disease, and there was substantial co-morbidity (47.0% American Society of Anesthesiologists 3 or 4). The PPM flap was the preferred reconstruction on 80.4% of occasions; 19.6% followed free flap failure. Over half of the patients (57%) had previously undergone major surgery and/or chemoradiotherapy. Ischaemic heart disease ( $P = 0.028$ ), diabetes mellitus ( $P = 0.040$ ), and methicillin-resistant *Staphylococcus aureus* (MRSA) infection ( $P = 0.013$ ) were independently associated with flap loss (any degree). Free flap failure was independently associated with total (2.0%) and major (6.9%) partial flap loss ( $P = 0.044$ ). Cancer-specific 5-year survival for stage IV primary SCC and salvage surgery improved in the second half (2005–2012) of the study period (22.2% vs. 79.8%,  $P = 0.002$ , and 0% vs. 55.7%,  $P = 0.064$ , respectively). There were also declines in recurrent disease ( $P = 0.008$ ), MRSA ( $P < 0.001$ ), and duration of admission ( $P = 0.014$ ). The PPM flap retains a valuable role in the management of advanced disease combined with substantial co-morbidity, and following free flap failure.

**Key words:** pectoralis major; flap; co-morbidity; complications; survival; mortality; oral cancer.

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The pedicled pectoralis major (PPM) flap has been used successfully for reconstruction of the head and neck region over the last three decades.<sup>1,2</sup> During this time, free tissue transfer has become increasingly accepted as the gold standard for reconstruction, particularly within the developed

world, because of a number of factors including: improved flap success rates,<sup>3,4</sup> fewer complications and improved oral function,<sup>5</sup> and better quality of life outcomes.<sup>6</sup> Nevertheless, recent publications from around the world have highlighted the continued importance of the PPM flap as a

reliable single-stage reconstructive option following salvage surgery,<sup>7–11</sup> and the flap remains popular for general applications within the developing world.<sup>1,2</sup> Whilst surgical units within the United Kingdom (UK) continue to use the PPM flap, its role within UK maxillofacial practice has not

been defined. The aims of this study were to review the indications and outcomes of a cohort of 100 patients undergoing reconstruction with a PPM flap within a UK maxillofacial unit that preferentially performs free tissue transfer, and to identify factors associated with an adverse perioperative outcome.

## Patients and methods

A retrospective review of case records was performed based on a contemporaneous database kept by the study institution. Data recorded included demographic details, indications, pathological staging (TNM American Joint Committee on Cancer 2002), type of surgical resection, American Society of Anesthesiologists (ASA) grade, co-morbidity, previous treatment, flap complications, methicillin-resistant *Staphylococcus aureus* (MRSA) status, length of hospital admission, recurrence of disease, and death.

A traditional myocutaneous PPM flap was raised using a defensive deltopectoral incision. Flap loss was classified based on conventional descriptions.<sup>1,12</sup> Total loss encompassed complete necrosis of the skin, subcutaneous tissues, and distal muscle paddle, whilst partial necrosis of the skin and subcutaneous paddle was defined as major loss if greater than 40% and minor loss if less extensive.

The decision to use a PPM flap was taken in conjunction with the same head and neck anaesthetist, and in the latter half of the study period, with a multidisciplinary head and neck oncology team. The cohort was subdivided on the basis that the PPM flap was either the preferred initial reconstruction, with the principle reason for this choice being identified, or the PPM flap was used because of initial free flap failure. Patients who had previously undergone major surgery and/or chemoradiotherapy were defined as undergoing salvage surgery.

## Statistical analysis

Categorical variables were analysed using the  $\chi^2$  test or Fisher's exact test, and continuous variables using the Mann-Whitney *U*-test or Spearman's correlation coefficient. Univariable and multivariable binary logistic regression analyses were performed to identify factors associated with adverse perioperative outcomes: flap loss (any degree), major/total flap loss, prolonged hospital admission (above median stay), unplanned intensive therapy unit (ITU) admission, and 30-day mortality. Multivariable analyses were performed

using a stepwise backward procedure, incorporating all variables with  $P < 0.10$  on univariable analysis.

The primary long-term outcome measure was overall survival (as of September 2012). Cancer-specific survival was the secondary end-point. Patients who died within 30 days of surgery or who did not undergo resection for malignancy were excluded from the long-term survival analyses. Kaplan-Meier survival curves were constructed to analyse long-term survival trends, and the associations of variables determined by application of the log-rank test. Statistical significance was defined as  $P < 0.05$ . Statistical analyses were performed using IBM SPSS Statistics for Windows, version 20.0 (IBM Corp., Armonk, NY, USA).

## Results

### Demographic data

Between December 1996 and June 2012, 102 consecutive PPM flaps were performed on 100 patients. A full dataset was available for all patients. Demographic and disease variables are listed in Table 1. The number of flaps performed significantly increased over the study period ( $P < 0.001$ , Spearman correlation coefficient), with the majority of flaps (73.5%,  $n = 75/102$ ) being performed in the latter half (2005–2012) of the series, and the greatest number in 2010 ( $n = 17$ ). All patients had been treated for oral

malignancy at some stage. Seventy-seven had primary squamous cell carcinoma (SCC), of whom 88.3% ( $n = 68$ ) had stage IV disease and 59.7% ( $n = 46$ ) had nodal neck disease. Patients in the first quarter (1996–2000) were significantly more likely to have either locally recurrent or metastatic disease (46.2% vs. 12.4%,  $P = 0.008$ , Fisher's exact test). Salvage surgery for SCC following previous major surgery and/or chemoradiotherapy was undertaken for 38 patients. One of these patients died within 30 days of surgery and was excluded from the long-term survival analyses. There was no difference in tumour parameters or the incidence of metastatic disease across the study period, except for a significantly greater incidence of primary stage IV SCC in the second half of the series (22.2% vs. 48.0%,  $P = 0.008$ ,  $\chi^2$  test).

### Indications for PPM flap

The cohort was subdivided into two main subgroups based on whether the PPM flap was used as the initial reconstruction of choice ( $n = 82$ , 80.4%), or because of previous free flap failure ( $n = 20$ , 19.6%) (Table 2). Free flap failure was most commonly a radial ( $n = 8$ ) or deep circumflex iliac artery (DCIA) flap ( $n = 8$ ), and 25% ( $n = 5$ ) of these free flap failures occurred in patients who had previously had oncological treatment. The types of surgical resection undertaken are listed

Table 1. Data on 100 patients undergoing 102 pedicled pectoralis major (PPM) flap procedures.

Variable	Median (range)	<i>n</i>
Patient demographics		
Age, years	62 (28–88)	
Gender, female/male		33/67
ASA grade	2 (1–4)	
1		2
2		53
3		45
4		2
Indications for surgery	102	
Squamous cell carcinoma		
Primary		77
Stage 1		1
Stage 2		5
Stage 3		3
Stage 4		68
Recurrent (<6 months)		6
Metastatic (isolated neck)		7
Osteoradionecrosis		5
Other primary or recurrent tumour <sup>a</sup>		3
Other metastatic tumour <sup>b</sup>		2
Bleeding major vessels <sup>c</sup>		1 (2)

ASA, American Society of Anesthesiologists.

<sup>a</sup> Adenoid cystic carcinoma ( $n = 1$ ), meibomian gland carcinoma ( $n = 1$ ), nerve sheath tumour ( $n = 1$ ).

<sup>b</sup> Melanoma ( $n = 1$ ), small cell cancer ( $n = 1$ ).

<sup>c</sup> One PPM flap for late complication of chemoradiotherapy following primary SCC resection.

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