

## **PECTORALIS MAJOR REGIONAL FLAP: AN OBSOLETE OR AN INDISPENSABLE RECONSTRUCTION TECHNIQUE?**

F. Mușat<sup>1</sup>, R. Hainăroșie<sup>1,2</sup>, C. Pietroșanu<sup>1,2</sup>, S.M. Pituru<sup>1</sup>, D.N. Păduraru<sup>1,3</sup>, O. Andronic<sup>1</sup>

<sup>1</sup>The University of Medicine and Pharmacy “Carol Davila”, Bucharest, Romania

<sup>2</sup>Institute of Phono-audiology and Functional ENT surgery “Prof. Dr. Dorin Hociotă”, Bucharest, Romania

<sup>3</sup>III<sup>rd</sup> Department of General Surgery, University Emergency Hospital, Bucharest, Romania

### **ABSTRACT**

Pectoralis major myocutaneous flap (PMMC) has been used for almost 40 years for the reconstruction of head and neck defects. Since then the technique has been modified and aesthetically and functionally improved expanding the indication of surgical removal of large tumors otherwise inoperable. This review highlights the role pectoralis major pedicled flap plays in the context of free flaps and other modern developments of the technique. Beyond the ethical component and obtaining the informed consent of the patient. There are several factors, which must be taken into account when choosing between a pectoralis major flap and a free flap reconstruction technique: resource constraints, patient co-morbidities, cases of extended neck dissections, of vessel depleted neck or free flap failure, post radiotherapy oro-cutaneous fistula and post chemotherapy residual neck disease. Head and neck tumor risk factors, indications and complications of this type of flap have been reviewed in a contemporary context. In the era of modern reconstruction techniques, pectoralis major flap is still a valid first intention management option, especially but not exclusively in developing countries, and also as salvage procedure in cases of free flap failure.

**Key words:** Free flaps, Head and neck tumors, Pectoralis major pedicled flap, Reconstruction techniques

### **Corresponding Author:**

Dr. Silviu Mirel Pituru.

**Address:** The University of Medicine and Pharmacy “Carol Davila” Bucharest, Romania

**E-mail:** [piturus@yahoo.com](mailto:piturus@yahoo.com)

**Tel.:** 0040722488675

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### **INTRODUCTION**

Modern surgery faces new challenges by making aesthetic aspect almost as important as restoring the function while a surgeon's every decision is automatically related to costs and compliance with legislation requiring informed consent to obtain benefits and risks any medical act with a potential risk, the lack of which signifies a doctor's abuse on the patient. Moreover, one can observe more complex patient typologies and a constant evolution of pathologies and their risk factors.

Pectoralis major myocutaneous flap (PMMC) has been used since 1979 for the reconstruction of head and neck defects [1]. Since then the technique has been modified and aesthetically and functionally improved expanding the indication of surgical removal of large tumors otherwise inoperable. As

such, PMMC has been over the time adapted for a wide range of applications [1].

Pectoralis major flap had been successfully used over the time as a technique which does not require special training of the surgeon and brings many other advantages such as less surgical time, aesthetic similarity between the donor site and the recipient area and suitability for patients with co-morbidities or undergoing radiotherapy.

### **RECONSTRUCTION SURGICAL OPTIONS**

There are several major options to apply in reconstructive purpose for head and neck surgery: split skin grafts, pedicled flaps and free flaps. Split skin graft is used to protect exposed muscle or fascia areas (eg. Eyelid reconstruction, after maxillectomy and other ablative procedures) and for aesthetic purposes. Pedicled flaps can involve

pectoralis major muscle flap (with skin- PMMC or without skin- PMMF), deltopectoral flap, supraclavicular flap, trapezius flap, latissimus dorsi flap. Free flaps used for pharyngoesophageal reconstruction can be visceral (jejunum and free omentum and gastro-omentum) which have been replaced by the more commonly used fasciocutaneous flaps (radial forearm free flap and anterolateral thigh flap) [2].

## MATERIALS AND METHOD

This review highlights the role pectoralis major pedicled flap plays in the context of free flaps and other modern developments of the technique. Are there ways to improve the use of this flap or should we abandon it in favor of other types?

A series of published researches and review articles have been studied in order to establish the contemporary importance of pedicled pectoralis major muscle flap. Particularly for highlighting the statistical relevance, well documented studies on large number of cases have been considered. The research for literature review was conducted using the PubMed, Scopus and WoS platforms with searching syntax: pectoralis major reginal flap. The results were filtered by the criteria: date of publication after year 2000 and manuscripts published in English.

## RESULTS

### Tumor incidence and risk factors

Reconstructive surgery post-tumor ablation is an important current issue in a context of an overall European incidence of lip, oral cavity and pharynx cancer and of laryngeal cancer of 11.0 and 4.4 respectively. A higher incidence can be observed in men (18.2 and 8.8 respectively) over women (4.9 and 0.8 respectively). Particularly, Romania occupies the third place in Europe regarding lip, oral cavity and pharynx and also laryngeal cancer incidence in men (29,6 and 14,1 respectively) while in women there are no significant differences compared to European average [3].

Another debatable subject is whether the advanced age of the patient plays an unfavorable role for free flap reconstruction. Given the fact that the population is aging rapidly, health care systems will deal with an increased number of elderly patients with head and neck tumors. Many studies point out that in these cases PMMC is a safer choice of reconstruction. On the other hand, a study which compares two age groups of 66 patients each, older than 80 years and younger than 80 years respectively who underwent free flap reconstruction

of the head and neck, concluded that there are no significant differences regarding flap success, complications and length of hospitalization, suggesting that in elderly patients free flaps can be as successful as pedicled flaps [4].

## INDICATIONS

The indications of PMMC can be categorized based on the type of reconstruction: primary reconstruction (of the oral cavity, neck and face and pharynx) and salvage reconstruction (in cases of pharyngo-cutaneous fistula, free flap failure, exposed prosthesis) [5].

There are several factors which must be taken into account when choosing between a pectoralis major flap and a free flap reconstruction technique. One study addressing those factors concluded that pectoralis major flaps were chosen in 58 situations due to resource constraints (36%), for medically compromised patients (20%), in extended neck dissections (19%), in cases of vessel depleted neck (9%) and free flap failure (9%), post radiotherapy oro-cutaneous fistula and post chemotherapy residual neck disease (7%) [6].

## COMPLICATIONS

In literature there have been reported several types of complications of PMMC which can be classified as related either to the flap itself or to the thoracic donor site. A more frequently used classification is based on the type of their management: major complications require surgical intervention while conservatory approaches resolve minor complications.

Major complications are considered to be total flap necrosis and partial flap necrosis. Minor complications are skin paddle dehiscence, fistula (oro-cutaneous and pharyngo-cutaneous), seroma and infection, all treated conservatively. The overall complications associated to PMMC reconstruction vary greatly: 40% (from 100 cases), 36.1% (from 371 cases) [7], 63.1% (from 168 cases) [8], 27% (from 81 cases) [9], 60% (from 25 cases) [5].

The most relevant complication which can quantify the success of the procedure remains total flap loss. A study comprising 202 cases of PMMC reconstructions revealed an overall flap necrosis rate of 6% (partial flap necrosis – 5% and flap loss 1%) [10] and another 478 patients study indicated 4.4% total flap necrosis [11]. Other analyses report 0 cases of total flap loss from 45 PMMF procedures [2], 58 pectoralis major flaps [6] and 81 pectoralis major flaps [9].

Recipient site complications (96%) are more likely to occur compared to donor site ones (4% [12],

5,5% [10], 6% [9]). Donor site complications refers to wound dehiscence (0,81% [9]), infection (6.3% [10], 0,81% [9]), rib osteochondritis or osteomyelitis (1,5% [10]), hematoma (0.5% [10], 0,81% [9]), seroma (0.5% [10], 0,81% [9]) and shoulder dysfunction.

Furthermore, there have been described some uncommon complications after PMMC. Thus, Kim et al [12] report two unusual donor site complications: pneumoperitoneum, pneumo-mediastinum and breast tissue necrosis. There are situations when the hair follicles do not fully atrophy which can lead to another unwanted effect like dysphagia from a hirsute esophagus after reconstructive surgery of the pharynx and esophagus with PMMC [13]. A case of galactorrhoea was reported as unique complication of a pharyngolaryngeal defect reconstruction with PMMC [14]. A study comprising 45 patients who underwent total laryngectomy, partial pharyngectomy and reconstruction using the PMMF revealed a more favorable rate of complications (6.7% overall) compared to free flap and PMMC or fascio-cutaneous free flap procedures [2]. Another study comprising 93 patients, 64 of whom underwent reconstruction with pedicled flap and 29 with free flap, showed that there are no significant differences between the two types of procedures regarding healing outcomes: minor complications occurred in 5% respectively 7% of cases, partial necrosis in 6% respectively 10% of cases and total necrosis in 2% respectively 0% of cases [15]. Furthermore, this study pointed out that pedicled flap procedures involve a decreased length of hospital stay (a mean of 17.6) compared to free flap procedures (a mean of 21.1), idea also supported by other studies. Patients have been informed about the surgical risks, benefits, consequences as well as the risks of not having the surgical treatment.

**DISCUSSIONS**

Over the time, this simple yet effective type of reconstruction has been adapted in order to be used in all sorts of head and neck defects (**Fig. 1**) and studies demonstrate further improvement can be achieved with results comparable to those from free flap procedures. For example, in order to decrease the rate of skin paddle necrosis, John P. Campana suggests that the skin paddle should be kept over the body of the muscle and not extended over the rectus sheath [9].



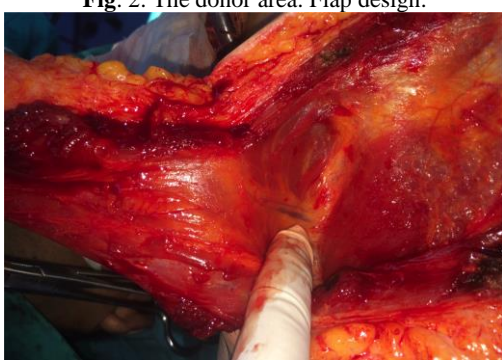
**Fig.1:** Large cervical defect after extended total laryngectomy for a malignant tumor extended to the anterior cervical area.

Also the technique has suffered modifications for three major purposes: increasing the functionality of the flap, improving the post procedural aesthetic aspects and perfecting some steps of the procedure. Variations of technique in the first case include removing the skin paddle (pectoralis major myofascial flap - PMMF), incorporating bonny tissue for osseous mandible reconstructions, associating free flaps (radial forearm, fibula, anterolateral thigh flaps) or other muscular flaps (latissimus dorsi and deltopectoral flaps), introducing the tubed version of the flap for oesophageal reconstruction and proposing the selective neuro- anastomoses which provide muscle action [1]. However, the use of this type of flap for oral cavity defects has been decreasing in favor of the more pliable free flaps which have better results in terms of speech and swallowing [10].

Aesthetic modifications relate to post procedural aspect of the donor site and the technique for its closure when large skin pads are involved [1]. The third type of innovation aim to perfect the technique paying attention to certain details such as: further protecting the pedicle, endoscopic harvesting of the pedicle and increasing the mobility of the flap by using a horizontal transection of the pectoralis major fibers above the emergence of the thoracoacromial artery. Furthermore, to improve the vascularization of the flap, the lateral thoracic artery and afterwards the third intercostal perforating branch of the internal thoracic artery were included, along with the thoracoacromial artery [1] (**Fig. 2,,3**).



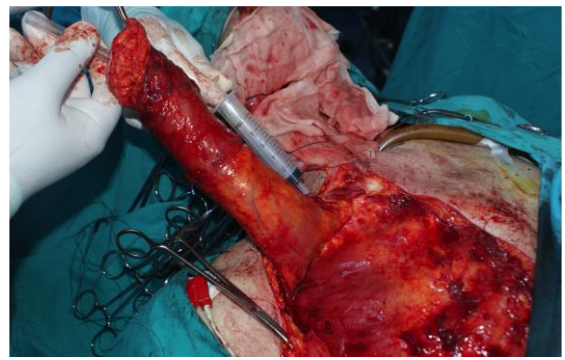
**Fig. 2.** The donor area. Flap design.



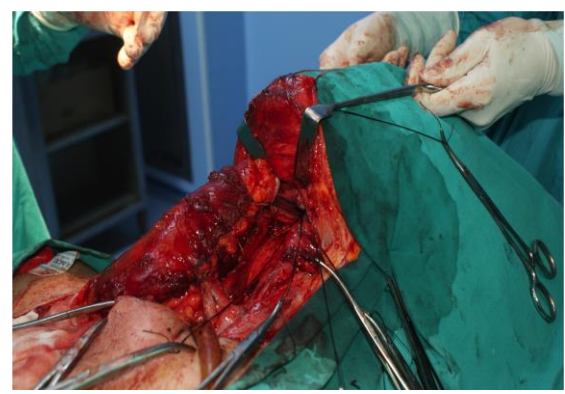
**Fig. 3.** Digital dissection. The vascular supply from the thoraco-acromial artery for the pectoralis major flap.

Although it is a markedly useful, versatile and reliable reconstruction solution (**Fig. 4, Fig. 5**), it is being increasingly replaced by modern and more elaborate surgical techniques, especially in developed countries. Thus, free flaps are gaining ground to classical pectoralis major flap.

Although overall complication rates vary greatly in reported studies, the incidence of total flap loss remains low which indicates that pectoralis major flaps are successfully employed.



**Fig. 4.** Pectoralis major flap: circular shaped with the skin inside, used for the reconstruction of the pharynx after total pharyngolaryngectomy.



**Fig. 5.** Reconstruction of a circular pharyngeal defect using a tubular shaped pectoralis major flap.

Studies show that head and neck cancer incidence increased not only in developing countries but recently also in developed countries, correlated to the intensive use of tobacco and alcohol and the higher rate of HPV (human papilloma virus) infection especially in the latter case [16].

HPV related head and neck cancer has been associated with a better prognosis and usually can be characteristic to a certain type of patient. In a developed country a typical HPV positive patient with oropharyngeal squamous cell carcinoma usually is a nonsmoking, middle-aged white man, coming from a higher socioeconomic environment and having a high number of sexual partners. Thus, the surgical treatment will be adapted in order to obtain a better aesthetical and functional result, especially for younger patients. As a consequence, in these cases, after tumor ablation, reconstruction with free flaps and modern techniques is often the preferred choice [16].

On the other hand, in developing countries (eg. from South Asia or sub-Saharan Africa) the resources for performing modern surgical approaches are not always available [17], [18]. Thus for patients with a poor socio-economic status tumor ablation is followed by classical, more accessible and cost effective pectoralis major flap technique.

**CONCLUSIONS**

While modern reconstruction techniques are not always readily available and suitable, pectoralis major flap remains a valid first intention management option, especially but not exclusively in developing countries, and also as salvage procedure in cases of free flap failure.

Pedicled flaps with all their variations and improvements and despite some disadvantages will always maintain their place as second step in the management of head and neck tumors.

PMMF is a versatile and robust flap with an important degree of rotation, easy to harvest and requires less OR time. It can reconstruct a wide variety of defects in the head and neck area and can be associated with other flaps in complex types of repairs.

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