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Clinical Analysis of Pectoralis Major Myocutaneous Flap for Reconstruction of Tissue Defects after Pharyngolaryngeal Cancer Surgery

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Abstract

Objective: To explore the methods and effects of pectoralis major myocutaneous flap in pharyngolaryngeal cancer surgery. **Methods:** Among 23 cases of pharyngolaryngeal cancer patients, the surgical procedure was based on pathologic conditions, and the surgical defects were repaired by pectoralis major myocutaneous flap. **Results:** Among 23 patients, there were 1 case of skin flap necrosis, 4 cases of pharyngeal fistula, 1 case of hypopharyngeal esophageal stenosis; except 1 case of pharyngeal fistula died of carotid artery rupture caused by infection, 1 case of hypopharyngeal esophageal stenosis required a gastric tube, and the rest patient's swallowing function is normal. **Conclusion:** The blood supply of pectoralis major myocutaneous flap is reliable with the tissue volume enough for reconstruction. It turns out to improve patient survival and postoperative quality of life with the application of pharyngolaryngeal cancer surgery.

Keywords

Pectoralis Muscles, Surgical Flaps, Pharyngolaryngeal Neoplasms, Reconstruction, Curative Effect

1. Introduction

Pectoralis major myocutaneous flap (PMMF) is a pedicle flap technique used in reconstructive head and neck surgery [1] [2]. PMMF has the advantages of good blood supply, no need to change location, high tolerance to radiotherapy, high survival rate, and simple operation [3]. PMMF is not easy to necrosis, and the

safety of clinical application is good; it can repair skin or mucosal defects, but also fill the gaps of larger tissue defects, and the application methods are flexible and diverse; at the same time, because of the myocutaneous flap, it has a wide range of transferability and can be used to repair most of the head and neck tissue defects below the eyebrow arch. With the development of otolaryngology, head and neck surgery, the PMMF is widely used to repair large area tissue defects. Since 2008, our department has applied the PMMF to repair tissue defects, and its surgical procedures have been continuously improved. The results are satisfactory. The PMMF is shown to be reliable in otolaryngeal surgery [3]. The PMMF has abundant blood supply, strong anti-infection ability, low necrosis rate, and easy survival; the transferable skin area is large, and at the same time, it can provide a large number of muscles to repair defects; the muscle pedicle is long, and the flap can be extended to repair multiple types of composite defects of the head and neck, meeting most of the repair requirements of the head and neck; during the operation, there is no need to change the patient's position, and the wound of the donor site can be directly sutured without skin grafting; the operation is simple, does not require vascular anastomosis, and is easy for clinical promotion. In our practice, we have found that PMMF is irreplaceable. The report is as follows.

2. Materials and Methods

2.1. Clinical Data

From January 2008 to December 2020, 25 cases (23 males and 2 females) of post-operative tissue defect repair and functional reconstruction were performed with PMMF. Two patients were lost to follow-up due to incorrect contact information and were excluded from observation. The remaining patients were included in the observation. The ages of them ranged from 45 to 72 years old with a median age of 60.4 years. Twenty-three patients with malignant tumors of the throat were staged according to the 2002 UICC. The clinical data are shown in Table 1.

The 23 patients, 16 underwent 6 MV-X-ray radiotherapy for 50 Gy/25F/5W, while 7 patients with local recurrence underwent 6 MV-X-ray radiation therapy for 48 Gy/40F/4W.

Table 1. Clinical data of patients undergoing PMMF surgery.

Disease	Cases	Tumor grading				N grading			Repair body parts
		T_1	T_2	T_3	T_4	N_1	N_2	N_3	
Tonsil cancer	1	0	0	0	1	0	1	0	1 case of oropharyngeal mucosal defect
Tongue root cancer	2	0	1	1	0	0	0	2	2 cases of tongue root defect
Laryngeal cancer	2	0	0	0	2	1	1	0	2 cases of neck skin defect
Hypopharynx cancer	11	0	4	5	2	1	9	1	10 cases of hypopharyngeal mucosal defect
Local recurrence of laryngeal and hypopharyngeal carcinoma	7	—				—			1 case of esophageal entrance defect

2.2. Methods

According to the location and extent of the primary tumor, the primary lesion was resected with appropriate operation pathway, and 4 cases of ipsilateral modified neck dissection and 14 cases of bilateral modified neck dissection were performed. According to the actual defect tissue, the size and shape of the flap were determined, and the distance between the donor site and the recipient zone was determined correspondingly. The skin and subcutaneous tissue were cut with the pectoralis major muscle exposed, and the pectoralis major muscle was cut from the flap under the periosteum surface. The musculocutaneous flap was turned up from the inside to the outside, and the pectoralis major fascia and the dermis were sutured intermittently, and the blunt dissection was separated between the pectoralis major muscle fascia and the pectoralis minor muscle. Then this was followed by seeing or touching thoracic acromion, the acromion of the arteries and veins, determining the position of the pedicle, lifting the flap, completely separating the pectoralis major and the pectoralis minor muscle, directly looking at the thoracic muscle supply of the thoracic and thoracic peak arteries, and cutting the pectoralis major muscle along both sides of the vascular pedicle until the lower edge of the clavicle. And then the subcutaneous tunnel was made, and the PMMF was transferred to the affected area, and the defect tissue was sutured. See Figure 1.

3. Results

The 23 patients in this group, 22 had recovered with musculocutaneous flap and 1 with musculocutaneous flap necrosis. In 11 patients with pharyngeal mucosal defects, 4 cases of pharyngeal fistula, 3 cases cured after changing a medical

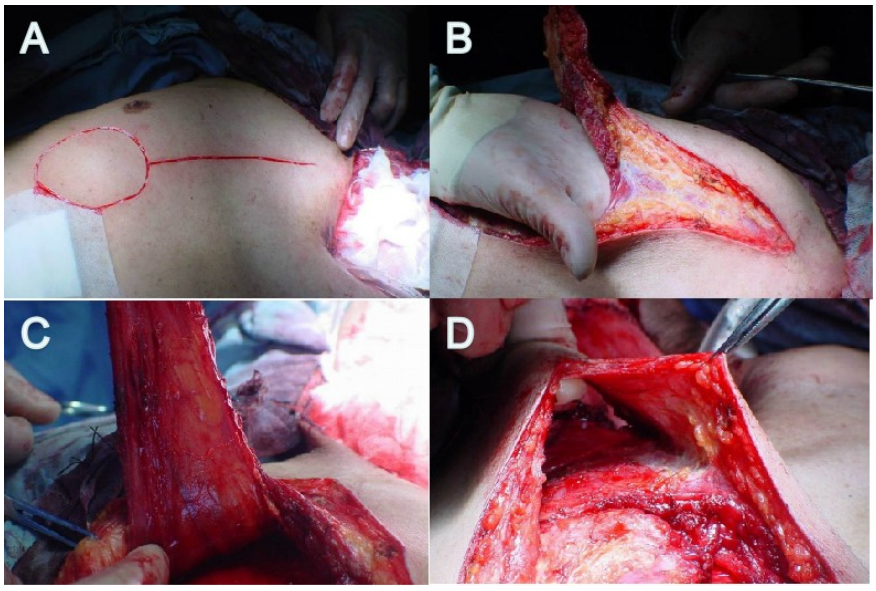

Figure 1. (A) Determine the size and shape of the flap Figure, (B) Blunt separation of the pectoralis major and pectoralis minor muscle, (C) Confirm vascular pedicle, (D) Making a subcutaneous tunnel.

prescription, 1 case of musculocutaneous flap necrosis. This patient was hypopharyngeal carcinoma with the tumor in the posterior pharyngeal wall, as well as diabetes and lung Wegener granuloma. We used musculocutaneous flap to repair the posterior pharyngeal wall in the operation. However, pharyngeal fistula appeared 7 days after surgery, musculocutaneous flap necrosis, followed by secondary neck infection, carotid rupture died half a year later. 2 cases with musculocutaneous flap were operated from hypopharyngeal esophageal entrance pathway, 1 case of hypopharyngeal esophageal stricture was discharged, 1 case with a nasogastric tube was discharged, and the patient returned to normal swallowing function. 2 patients with tongue root cancer developed mild cough after operation, and the symptoms disappeared at 3 months and 6 months respectively. 7 cases cervical skin defected repaired with PMMF, all healed.

We followed up the 23 patients until February 2021. One patient with tonsillar cancer survived for 5 years and 4 months was healthy. The 2 patients with tongue root cancer, 1 died of tumor recurrence at 3 years and 2 months, and 1 case was healthy 2 years later after operation. The 2 cases of laryngeal cancer were followed up respectively for 7 years, 4 years and 6 months, all lived in good conditions. The 11 cases of hypopharyngeal cancer, 1 case was out of contact, 4 cases died, 3 cases of recurrence of the neck and 1 case of distant metastasis. In our statistic, hypopharyngeal cancer 3 years of survival rate is 5/9, 5 years of survival rate is 2/6. In the 7 cases of local recurrence of laryngeal and hypopharyngeal carcinoma, 3 cases of them survived to date, respectively followed up 1 4 months, 2 years and 8 months, 3 years and 3 months; and 4 cases of them followed up for 3 years, all died. Among the all dead cases, 1 died of carotid rupture due to musculocutaneous flap, 2 died of suffocation due to respiratory stenosis, 1 case of local recurrence, 3 died of systemic failure, and 2 died of distant metastasis.

4. Discussion

The PMMF was first described as a local flap for chest wall reconstruction in 1968 by Hueston and McConchie [4]. The PMMF is a multifunctional axial flap, and it can also carry part of the clavicle or ribs to form a composite musculoskeletal flap. Therefore, its application range is very wide. It has been recognized as an ideal donor site for repairing oral, maxillofacial and head and neck tissue defects. The PMMF is considered a "workhorse flap" for reconstruction of pharyngeal defects and protection of the carotid axis after salvage radical neck dissection [5] [6] [7] [8] [9]. However, it is often felt that the length of the muscle pedicle is insufficient to repair the defect of the mandible or zygomatic temporal area .The most common complications in pectoralis major myocutaneous flap repair are lumen stenosis, flap necrosis, and pharyngeal fistula. In addition, upper limb dysfunction and chest donor site malformations are also common. We improved the method of skin flap extraction, and conducted comparative studies on clinical cases.

Of the 23 patients, 7 of them used PMMF to repair neck skin defects, and all patients were cured in the first stage. After resected the tumor, there were large tissue defects in the skin and subcutaneous, and the patient received radiotherapy after the first postoperative operation, the local tissue healing ability is reduced [10]. Once directly sutured, it is not easy to heal, and the pharyngeal fistula is easily formed after operation. The PMMF can repair the skin defect and fill the subcutaneous tissue defect cavity, which increases the blood supply. It reduces the effusion, protects the pharyngeal esophageal mucosa anastomosis, prevents infection of the incision, avoids the formation of pharyngeal fistula, and keeps the neck in a full shape as well. The PMMF has fewer complications and is easy to heal in the first stage.

When the PMMF repairs mucosal defects, it is easy to cause pharyngeal fistula formation. In the 11 patients used to repair mucosal defects, 4 cases with pharyngeal fistula. Considering the two different tissues, the skin and pharyngeal mucosa of the musculocutaneous flap, the healing is slow in pace, the focal contracture around the flap occurs. The digestive juice leaks out of the mucosa, causing infection. To prevent the occurrence of pharyngeal fistula, we have an anastomosis between the PMMF and the pharyngeal mucosa. The mucosa and the submucosal tissue were sutured together with the PMMF, or the mucosa and submucosal tissue are firstly reinforced and sutured, and then the PMMF is anastomosed to avoid mucosal and the PMMF from pulling and tearing off.

When using PMMF to repair the hypopharyngeal esophagus, we found that it is necessary to suture the esophageal mucosa first, and then use PMMF for anastomosis to avoid anastomotic stenosis [11]. In one patient, we cut the mucosa longitudinally at the entrance of the esophagus, inserted the PMMF into the mucosal incision for anastomosis, and therefore the swallowing function was restored. In order to repair the hypopharynx, another patient underwent surgery using the PMMF method. The esophagus in the hypopharynx was narrowed due to a defect in the esophagus, and the patient had to use a nasogastric tube. The PMMF has a considerable tissue thickness, which is able to fully fill the tissue defect formed after the tongue root resection, and can form a good coverage for the upper laryngeal mouth. This effectively reduces coughing after eating in the future. In this group of patients, there are 2 cases as mentioned. In these patients, although they had mild cough in the early stage, they both returned to normal after 3 months and 6 months respectively.

Skin flap necrosis is the most serious complication among the repairing operations of PMMF. In order to prevent skin flap necrosis, it's must to ensure good blood supply of the musculocutaneous flap, in the preparation of the PMMF. Wang Tianqi *et al.* [12] found that many chest and shoulder arteries of the chest muscle branch were often connected with the shoulder and the scabbard were more external and vertical than predicted. Therefore, when we make the PMMF, the pedicle of the PMMF should be properly external to retain much more arterial branches, and strive to place the lateral thoracic artery. The pectoral muscle branch remains in the vascular pedicle; and the squeezing and sacral flaps

should be minimized during surgery. Firstly, the muscle fascia and the flap dermis should be sutured several times to reduce the sliding between the flap and the muscle preventing damage to the perforating vessel. Secondly, the flap should not be too large, and the subcutaneous tunnel should be wide enough to prevent the vascular pedicle from being compressed ensuring the blood supply of the musculocutaneous flap. Finally, a negative pressure drainage tube should be placed in the upper and lower fossa of the clavicle respectively, and the negative pressure drainage should be maintained in an effective level. It is not supposed to pull out too early, eliminate subcutaneous blood and effusion, and prevent the pedicle from being necrotic due to infection.

In the last two decades, due to the widespread use of free flaps, PMMF has become a secondary role in the reconstruction of head and neck defects [6] [7] [13]. Due to the superior versatility, tissue matching, reliability, functional and cosmetic effects of free skin flaps, and low donor site morbidity, free skin flaps are considered to be the first choice for most major head and neck defects [6] [14]. However, in any case, free flaps cannot completely replace PMMF as a one-stop solution for head and neck reconstruction. PMMF can not only be used as the main skin flap for head and neck reconstruction when free tissue transfer is restricted [15] [16] [17], but also in some cases where free flaps are preferentially used, in order to ensure the reliability of the donor and reduce the incidence of the donor site can also be used [5] [6] [18] [19]. It has been reported that PMMF has reliability and functional outcome benefits in pharynx reconstruction for patients with primary or recurrent pharyngeal carcinoma after radiotherapy and chemotherapy, and there are fewer major complications [19] [20] [21] [22].

5. Conclusion

In short, the PMMF is widely used in the repair of tissue defects after throat surgery because of its good blood supply and rich muscle tissue. It enjoys a high survival rate and simple operation. It works in improving the survival rate of patients; therefore, the quality of patients' lives has been improved. PMMF can safely be used in head and neck cancer patients who need salvage reconstruction, who are high risk for free flaps, and who need large volume soft-tissue flaps.

Conflicts of Interest

The authors declared that no conflict of interest exists.

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