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Mini Review

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Reconstructive Flaps After Salvage Nasopharyngectomy

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ABSTRACT

Importance: The emergence of new technologies for early diagnosis of recurrent nasopharyngeal cancer and new techniques of endoscopic nasopharyngectomy increase the incidence of salvage nasopharyngectomy and pose the question of the ideal flap for reconstruction of this defect.
Objectives: A review of the literature to identify the flaps used in nasopharyngeal reconstruction and their advantages and disadvantages, characteristics, and outcomes.
Methods: We reviewed the literature available in the English language to identify the various flaps used, their indications and surgical technique, complications and outcomes.
Results: Multiple flaps have been used. Local mucosal flaps such as the posterior pedicled middle turbinate mucoperiosteal flap, the posterior pedicled Nasal Septal Flap (NSF) and Floor mucoperiosteum flap (FF), pedicled flaps such as the extended glabellar fascial cutaneous flap, the Haddad-Bassagasteguy flap, the temporoparietal fascial flap and the pericranial flap and free flaps such as the radial forearm and vastus lateralis flap have been described. These flaps are used depending on the specific defect characteristics and tissue available for reconstruction. The advantages and disadvantages of these flaps are discussed.
Conclusion: No single flap is ideal for all cases. The choice of flap will have to be tailored according to the patient, the defect created, consistent with oncologic principles, donor site availability and surgeon preference. A working knowledge of available flaps is essential to provide coverage of the skull base to avoid vascular and infectious complications.

KEYWORDS: Nasopharyngeal flap; Salvage nasopharyngectomy; Nasopharyngeal cancer.

ABBREVIATIONS: NSF: Nasal Septal Flap; FF: Floor mucoperiosteum flap; HBF: Haddad-Bassagasteguy Flap; TPF: Temporoparietal fascial flap; ALT: Anterolateral thigh free flap.

INTRODUCTION

Nasopharyngeal cancer differs from other head and neck tumors in that it occurs predominantly in a younger age group and is unrelated to tobacco or alcohol exposure.[1] It is a radiosensitive tumor and the primary treatment is radiotherapy or chemoradiotherapy. Surgery is reserved for persistent or recurrent tumors after the initial therapy. The emergence of significant anatomic and technical advances coupled with improvements in instrumentation has facilitated the exposure and resection of nasopharyngeal pathology which in turn has increased the incidence of salvage nasopharyngectomy. Such resections often necessitate skull base reconstruction for defect coverage and to promote healing (especially in the setting of radiation therapy). As such, it is of utmost importance for the surgeon to consider all reconstructive options in order to choose a flap individualized for the patient. Materials for reconstruction include pedicled nasoseptal flaps, turbinate flaps, endoscopic regional flaps from extranasal sources as well as free flaps. Choices should be guided by the location and size of the defect, presence of intraoperative cerebrospinal fluid leak after resection, and history of radiation or previous sinonasal surgery.

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METHODS

A review of the published literature was undertaken to collate the data available on reconstructive techniques employed after nasopharyngectomy. A search strategy on PubMed was designed to include articles with keywords middle turbinate mucoperiosteal flap, the posterior pedicled Nasal Septal Flap (NSF), Haddad-Bassagasteguy Flap (HBF), Temporoparietal fascial flap (TPF), pericranial flap, free flap, and nasopharyngectomy/ salvage nasopharyngectomy.

RESULTS

Six case series, one retrospective chart review, and two literature reviews were included in this review (Table 1). Reconstructive methods specifically following salvage nasopharyngectomy have not been well studied therefore it is not surprising that there are no randomized controlled studies or systematic reviews regarding the subject. Table 2 lists various pedicled flaps used successfully in reconstruction after nasopharyngectomy.

DISCUSSION

In 2006, the hadad-bassagasteguy flap (HBF) was first described. The advances in instrumentation and imaging and better anatomic understanding of transnasal endoscopic approaches called for an endonasal technique in skull base reconstruction. The HBF is a neurovascular pedicled flap of the nasal septal mucoperiosteum and perichondrium based on the nasoseptal artery, a branch of the posterior septal artery and the terminal branch of the internal maxillary artery (Figure 1). In the first description of the technique, it was used on 44 patients with a variety of pathologies including Cerebrospinal fluid (CSF) leaks, meningoencephaloceles, clival chordomas, esthesioneuroblastoma, craniopharyngioma, meningiomas, and pituitary tumors. Complications included postoperative CSF leaks in two patients and a posterior nosebleed in one patient.[2]

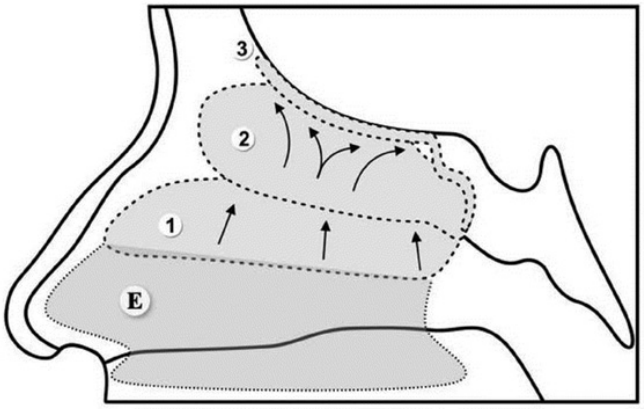

Figure 1: Drawing of the septum illustrating the septal incisions and possible modifications. Reproduced from Hadad et al[2]. *A novel reconstructive technique after endoscopic expanded endonasal approaches: vascular pedicle nasoseptal flap.*

Study	Year	Type of Study	Study Focus
Zanation	2011	Review	Skull Base Reconstruction
Kim	2013	Review	Pedicled Extranasal Flaps
Chan	2012	Case Series	Recurrent NPC
Rohaizam	2009	Case Series	Endoscopic Nasopharyngectomy
Bridger	2005	Case Series	Salvage Nasopharyngectomy
Chen	2012	Case Series	Middle Turbinate Flap
Chan	2011	Case Series	Nasopharyngectomy
Hadad	2006	Retrospective chart review	Nasoseptal Flap
Khoo	2001	Case Series	Nasopharyngectomy, free flap

Table 1: Six case series, one retrospective chart review, and two literature reviews were included in this review.

Vascular Flap	Pedicle	Advantages
Nasoseptal flap	Posterior septal artery from sphenopalatine artery	Ideal for all skull base reconstruction
Inferior turbinate flap	Inferior turbinate artery	Good for small clival defects
Middle turbinate flap	Middle turbinate artery	Good for small ACF
Pericranial flap	Supraorbital and supratrochlear arteries	Hearty flap, versatile dimensions
Temporoparietal Fascia flap	Superficial temporal artery	Usually from non-irradiated field
Palatal flap	Greater palatine artery	Long pedicle
Facial buccinator flap	Facial artery	Good for ACF, no facial incision
Occipital galeopericranial flap	Occipital artery	Long pedicle, good for posterior lesions, Usually from non-irradiated field

Table 2: Lists various pedicled flaps used successfully in reconstruction after nasopharyngectomy.

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A 2009 case series by Rohaizam et al employs this technique after endoscopic resection of locally recurrent nasopharyngeal carcinoma. They describe their experience of six patients with rT1N0M0 nasopharyngeal carcinoma. All patients had tumor recurrence after completion of primary irradiation. All six patients had negative margins after endoscopic nasopharyngectomy; HBF was used for reconstruction. Two patients had flap necrosis three to five weeks post operatively and one patient had flap necrosis at four weeks with subsequent osteoradionecrosis at 41 weeks after surgery. The authors state that the procedure is contraindicated when there is exposure of the carotid artery. Complications of procedure include flap necrosis, bleeding, nasal congestion and crusting, neck stiffness, and wound infection.[3]

Chen and his colleagues describe a posteriorly pedicled Middle Turbinate Flap (MTF) for resurfacing the nasopharynx after endoscopic nasopharyngectomy followed by resurfacing with an ipsilateral MTF. Of the 18 patients, 83.3% achieved functional recovery. In three patients, the flap failed to cover the entirety of the defect. Surgical technique involves making two parallel incisions on both sides of the middle turbinate following the sagital plane and a vertical incision anteriorly connecting the two parallel incisions (Figure 2). The mucoperiosteal flap is raised posteriorly until the posterior pedicle to avoid injury to the MT artery and then it can be rotated to cover the nasopharyngeal defect.[4] The MTF is safe and minimally invasive for reconstruction after endoscopic nasopharyngectomy; however, the disadvantage of this technique is that it often is not large enough to cover entire nasopharyngeal defect.[4]

Patel and his colleagues recently published their experience with secondary flaps in endoscopic endonasal skull base surgery.[5] These flaps are useful in situations when there is invasion of tumor into the nasal septum or when prior surgery or radiation has disrupted its vascular supply. At their institution, the endoscopic assisted pericranial flap was utilized for cases of sinonasal cancer with intradural involvement. The pericranial flap is pedicled on the deep branches of the supraorbital and supratrochlear vessels. Advantages of this flap are its ease of dissection, low risk of operative complications, length and radioresistance. No flap failures occurred in their series of 16 patients. The tunneled temporoparietal flap was used for defects in the clivus or nasopharynx. No flap failures occurred in this group of patients. Potential operative complications of this flap are donor site alopecia, facial nerve transection, and internal maxillary artery injury.

Intranasal flaps in Patel's review included the inferior turbinate flap, the middle turbinate flap, and the anterior lateral nasal wall flap.[5] The inferior turbinate flap is a mucoperiosteal flap which is based on the inferior turbinate artery best utilized for clival or sellar defects. Its main pitfall is the potential disruption of the nasolacrimal duct. Additionally, a fat bolster is recommended for defects >1 cm due to its limited bulk. There were no flap failures in their series of three patients. Patel and his colleagues also describe the anterior lateral nasal wall flap which is an inferior turbinate flap with extension of the mucoperiosteal dissection to the lateral nasal wall and floor. It is based on branches of the anterior ethmoid and facial arteries. Its advantages are the its robust blood supply and large surface area. Potential pitfalls are disruption of the nasolacrimal duct and difficult dissection of the inferior turbinate mucoperiosteum.[5]

Khoo and colleagues have described their experience with open nasopharyngectomy with maxillary swing approach with radial forearm free flap reconstruction for recurrent nasopharyngeal carcinoma.[6] The advantages of a free flap for this purpose is that it can facilitate the healing process and minimize the risk of infection, osteoradionecrosis, and carotid rupture. The

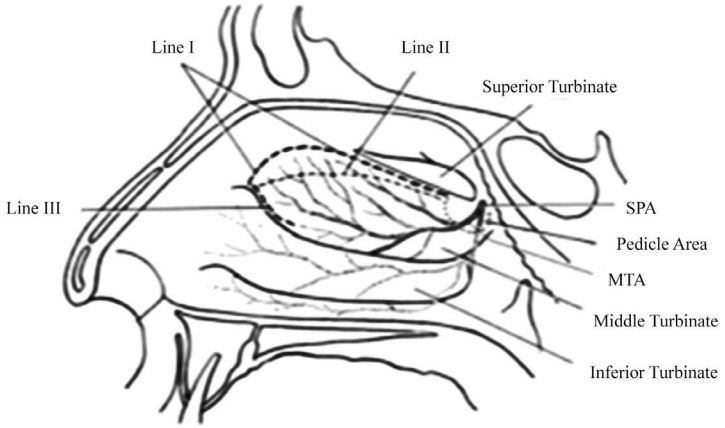

Figure 2: Diagram to outline the procedure for posterior pedicled middle turbinate mucoperiosteal flap.
Reproduced from Chen et al[4]. *A posteriorly pedicled middle turbinate mucoperiosteal flap resurfacing nasopharynx after endoscopic nasopharyngectomy for recurrent nasopharyngeal carcinoma.*

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radial forearm free flap is harvested with little donor site morbidity; it provides adequate flap size to resurface the entire surgical defect; its thinness and pliability facilitates contouring and insetting of the flap; the flap may be harvested with a long vascular pedicle. The maxillary swing approach allows for good access for insetting of the radial forearm free flap. Pearls to ensure a successful reconstruction include suturing the inferior margin flap to the cut edge of the posterior wall of the oropharynx to ensure stability, ipsilaterally it should cover the internal carotid artery, laterally the flap should be sutured to the lateral nasal wall or pterygoid muscles if a wide resection has been performed.[6] Other free flaps that have been used successfully are the Anterolateral thigh free flap (ALT), the rectus abdominis muscle flap, and the posterial tibial fasciocutaneous flap. In Chan's series of 22 patients, all patients were reconstructed with one of these flaps and there were no cases of flap failure.[7] The advantage of free flaps is their reliability, versatility, and ability to be harvested simultaneously with the resection using a two-team approach to reduce operative time.[8-10]

CONCLUSION

Surgical salvage after residual or recurrent nasopharyngeal carcinoma has been shown to achieve better control than re-irradiation. Reconstruction is necessary after resection for defect coverage and promotion of healing to prevent carotid artery blow out and osteoradionecrosis. No single flap is ideal for all cases. The choice of flap will have to be tailored according to the patient, the defect created, consistent with oncologic principles, donor site availability and surgeon preference. A working knowledge of available flaps is essential to provide coverage of the skull base to avoid catastrophic vascular and infectious complications.

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CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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