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Surgical Technique

The Use of the Composite Muco-perichondrial-cartilaginous Vascularised Septal Flap in the Reconstructive Surgery of the Skull Base Defects

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REZUMAT

Utilizarea lamboului compozit muco-pericondro-cartilaginos septal, vascularizat, în chirurgia reconstructivă a defectelor bazei craniului

Lamboul septal mucopericondral (lamboul Hadad) este vascularizat de către artera septală posterioară, derivată din artera sfenopalatină. Acest tip de lambou a fost descris, în 2006, de către chirurgii Hadad și Bassagasteguy. A fost utilizat pentru reconstrucția defectelor bazei craniului după ablația tumorilor ce implicau această regiune. Autorii descriu un lambou muco-pericondro-cartilaginos, derivat din cel original, de tip Hadad. Recoltarea laboului și tehnica de reconstrucție vor fi descrise. Acest tip de lambou a fost utilizat pentru reconstrucția defectelor bazei craniului la 7 pacienți, după înlăturarea tumorilor maligne nazo-sinusale ce implicau baza craniului. Rezultatele vor fi prezentate.

Cuvinte cheie: defecte ale bazei craniului, lambou muco-pericondro-cartilaginos, neoplasme nazo-sinusale, chirurgie reconstructivă endoscopică

ABSTRACT

The mucoperichondrial septal flap (Hadad flap) is vascularised from the posterior septal artery, derived from the sphenopalatine artery. This type of flap was described, in 2006, by surgeons Hadad and Bassagasteguy. It was used to reconstruct the skull base defects after removing skull base tumors. The authors will describe a modified muco-perichondrial-cartilaginous flap derived from the original Hadad flap. The flap harvesting and the reconstructive technique will be described. This kind of flap was used to reconstruct the skull base deffect on 7 pacients, after removing sinonasal neoplasm involving the skull base. The results will be presented.

Key words: skull base defects, muco-perichondrial-cartilaginous flap, sinonasal neoplasm, endoscopic reconstructive surgery

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BACKGROUND

The original vascularised nasoseptal muco-perichondrial flap was described and used, in the endoscopic reconstructive surgery of the skull base tumors, for the first time in 2006, by two surgeons, Hadad and Bassagasteguy [1]. This kind of vascularised flap provides the surgeons the ability to close large skull base deffects after removing sinonasal tumors. The vascularisation is provided by the posterior septal branch of the spheno-palatine artery [1]. The flap is well vascularised and the surgeon is able to harvest a large surface flap using almost all septal mucosa from one nostril. Sometimes, if the defect that had to be reconstructed was very large, some authors reported that they harvested the nasal mucosa from the nasal floor too. Some modifications were reported on patients where the flap was created by using bilateral nasal mucosa, but no advantage was gained by sub-maximal, bilateral septal flap harvesting as compared to a single, large, long, unilateral flap, taken to the vestibular skin anteriorly and to the inferior meatus laterally including the palatal floor [2,3]. Bilateral mucosal elevation leaves denuded septal cartilage and bone on both sides of the septum which prolongs the return of nasal mucosal function unless a formal posterior septectomy is also performed. The large surface area of the nasoseptal flap allows great versatility of movement [4]. It is capable of reaching any single segment of the ventral skull base, including the sella turcica, planum sphenoidale, clivus or the cribriform plate [4,5]. At its largest dimension, the nasoseptal flap is able to cover an entire anterior craniofacial defect from the frontal sinus to the planum sphenoidale and from orbit to orbit. The good vascularisation of the flap and the origin of the vascular source provide the surgeon with the ability to rotate the flap almost all directions [5].

Limitation of the nasoseptal flap were reported in children under 9 years old, where the flap does not provide enough matherial in order to close important skull base defects [5]. The septal cartilage growth is maximal between 10-13 years of age. After 14 years of age the flap can be used in reconstruction surgery and provides enough matherial to close skull base defect.

METHODS

We started using this kind of flap in 2005 for closing skull base defects, after sinonasal tumor removal. In the period between 2005 and 2009 we used the standard nasoseptal flap on 13 patients for reconstructing the skull base defect after sinonasal malignancy removal.

The surgical approach was a “combined” one (external approach combined with endoscopic approach) for 7 patients and endoscopic for 6 patients.

Since 2010 we have used a modified Hadad flap, also harvested from the nasal septum, that was composed not only of mucosa, but of cartilage too.

We have used the modified nasoseptal flap in 5 patients in the period between 2010-1013 and we succeeded to primary close the defect in all patients.

RESULTS

In our experience, this flap provided reliable reconstruction, even in large skull base deffect, of high presure CSF leak.

We found that it was difficult to suspend and to fix the flap in the roof of the nasal cavity.

Based on the original nasoseptal flap [1,2], we started to develop a flap that uses also the septal cartilage along with the mucoperichondrial matherial from the nasal septum. The cartilage is not disected from the soft tissue part of the flap.

In all the cases, we reccomend that the surface of the harvested cartilage should be 3-4 mm larger than the bone deffect of the skull base.

Surgical technique

Mucosal incisions are made using monopolar electrocauthery. An initial back-cut is made on the vertical plate of the palatine bone and along the posterior choana to improve pedicle mobilization for coverage of anterior defects. This continues anteriorly to the posterior edge of the nasal septum, to the nasal floor and then laterally into the inferior meatus. The incision can be extended up to the junction with the skin of the vestibule to maximize anterior coverage. Incorporating the mucosa of the hard palate greatly increases the width of the flap and is preferable to harvesting mucosa from the superior septum.

A second incision begins at the medial aspect of the sphenoidotomy, which has been previously performed with care to avoid injury to the pedicle, inferiorly. It continues forward at the level of the

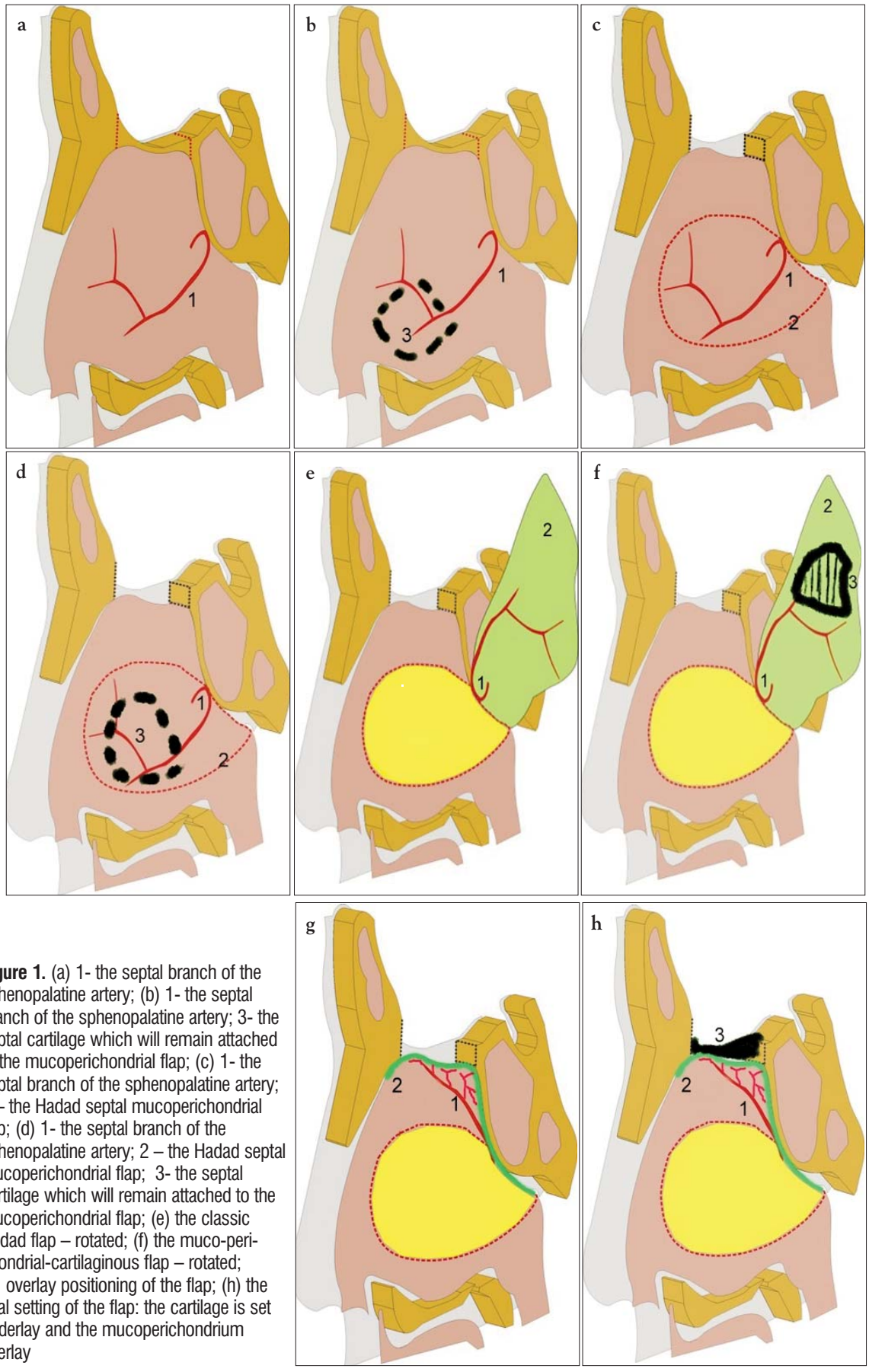

Figure 1. (a) 1- the septal branch of the sphenopalatine artery; (b) 1- the septal branch of the sphenopalatine artery; 3- the septal cartilage which will remain attached to the mucoperichondrial flap; (c) 1- the septal branch of the sphenopalatine artery; 2 – the Hadad septal mucoperichondrial flap; (d) 1- the septal branch of the sphenopalatine artery; 2 – the Hadad septal mucoperichondrial flap; 3- the septal cartilage which will remain attached to the mucoperichondrial flap; (e) the classic Hadad flap – rotated; (f) the muco-perichondrial-cartilaginous flap – rotated; (g) overlay positioning of the flap; (h) the final setting of the flap: the cartilage is set underlay and the mucoperichondrium overlay

inferior edge of the superior turbinate (ST) and middle turbinate (MT). Anterior to the MT, the incision turns superiorly to include the swell body area (another technique to increase width and gain better exposure) and is connected with the first incision anteriorly.

The dissection of the flap is made from anterior to posterior for 0,3 mm of the nasal mucosa in subperichondreal layer and then a vertical incision is made in the nasal cartilaginous septum. The flap is then dissected posteriorly until we have harvested enough cartilaginous material from the nasal septum. The composite flap is then rotated as needed to the defect. The cartilaginous part is mounted underlay in the skull base defect and provides a good fixation and suspension of the composite flap. The mucoperichondrial margins of the flap are then mounted in an underlay manned under the cartilaginous part of the flap.

This provides a better fixation and suspension of the flap. Then, the biological glue is used in order to fix the reconstructive ensemble.

We have used the modified nasoseptal flap in 5 patients in the period between 2010-1013 and we succeeded to primary close the defect in all patients.

The nasoseptal flap is so robust that some authors reported 95-97% success rate even when the flap is taken down and reused in revision surgery.

We have never encountered, but some authors reported, extremely rare cases of flap necrosis.

CONCLUSIONS

We consider that the composite mucoperichondrial-cartilaginous vascularised nasoseptal flap provides a better alternative in terms of suspension and fixation than the traditional nasoseptal flap, described by Hadad. This flap provides a robust reconstruction solution for large skull base defects. The surgeon is able to take down the flap and reuse it in revision surgery. The flap that we developed has the same limitations as the traditional nasoseptal flap: patient age under 9 years old, prior septoplasty, malignant septal involvement. The blood supply, from the sphenopalatine artery, recommends this kind of flap as the first choice in skull base reconstruction after removal of the sinonasal malignancies.

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