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UTILITY OF HADAD FLAP IN RECONSTRUCTION OF ANTERIOR SKULL BASE DEFECTS FOLLOWING ENDOSCOPIC TRANSNASAL, TRANS SPHENOIDAL APPROACH TO PITUITARY-OUR EXPERIENCE

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ABSTRACT:

Objective: To study the utility of Hadad flap in reconstruction of anterior skull base defects following endoscopic transnasal, transsphenoidal approach to pituitary tumours in conjunction with multi-layered reconstruction.

Setting: The study was conducted in the departments of Otorhinolaryngology and Neurosurgery in a tertiary care referral hospital.

Patients: 20 consecutive patients with pituitary tumours underwent endoscopic transnasal transsphenoidal approach for resection followed by reconstruction of consequent skull base defects with Hadad flap in conjunction with multilayered approach.

Results: 3 out of 20 (15%) patients had early postoperative CSF leak, 2 out of which ceased after repositioning of malaligned Hadad flap.1/20 (5%) patients continued to have delayed postoperative CSF leak.

Conclusion: Hadad flap has proved itself to be the workhorse of anterior skull base reconstruction in most instances. It has heralded an era of vascularised flap based reconstruction in endoscopic transnasal transsphenoidal surgeries.

Key words: Nasoseptal flap, endoscopic transnasal transsphenoidal surgery.

INTRODUCTION:

Hadad flap has been proven to be the work horse for anterior skull base defects in most instances. It is very effective in separating the nasal cavity from the cranial cavity and has proven to be very robust. It helps in preventing ascending infection into the cranial cavity and is very useful in preventing CSF leaks. It is based on the posterior septal branches of sphenopalatine artery. The pedicle is very stable and provides adequate supply to the flap ensuring good reconstructive results. In this study we present our experience with reconstruction using the Hadad flap for endoscopic transnasal transsphenoidal surgeries as an approach to pituitary tumours.

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MATERIALS AND METHODS:

20 patients who came to our institute with pituitary tumours were operated. Detailed history was taken and a complete clinical examination including neurological work up, ophthalmological work up and hormonal level evaluation was done. CT scan of nose, paranasal sinuses and brain with one millimetre cuts in all planes along with MRI of the brain was done. *Informed and written consent was taken from all patients. The institutional ethics committee approval was taken.* The procedures were performed by a team of neurosurgeons and otolaryngologists at our institute. After intubation and an oropharyngeal pack, the nasal mucosal corridor was decongested with cottonoids dipped in a combination of 4% lignocaine and 1:10,000 adrenalines. The nasal septums on either sides or middle turbinates were infiltrated adequately with 1 in 100,000 adrenaline under endoscopic guidance (zero degree, 4mm wide, and 18cm length). Partial middle turbinectomy was done in order to visualize superior turbinate and sphenoidal ostium. The first incision was made at the junction between nasal floor and septum postero-anteriorly. If a larger defect was expected, the incision was taken more laterally along the floor of the nose to increase the width of the flap. The second incision was made along the inferior most aspect of the sphenoidal opening and advanced superiorly and anteriorly, the limit being the septo columellar junction. Care was not to include the olfactory mucosa and the dorsal strip of cartilage. The third vertical incision connected to the most anterior aspect of the previous two incisions. The nasoseptal flap was then elevated using an elevator in the mucoperichondrial and mucoperiostial plane from anterior to posterior direction till the posterior choana. A relaxing incision was made along the arch of the choana to increase the range of rotation. This flap was placed temporarily in the nasopharynx or the maxillary sinus after rotating so as to prevent damage during tumour removal and to obtain a better access to the tumour site. This was followed by posterior septectomy. Mucoperiostium of the sphenoidal rostrum was elevated bilaterally. Widening of the sphenoid ostium was done bilaterally so as to open the anterior face of sphenoid and gain access into the sphenoid cavity. Intersinus septum was identified and dissected. Mucosa of the sphenoid sinus resected after visualizing internal carotid artery bulge and optico carotid recess. Sella was identified and the floor was thinned out upto the limit of tuberculum sellae superiorly and cavernous sinuses bilaterally thus exposing the dura. After placing incision over the dura, the tumour was visualized and resected meticulously using a two surgeos, two/four handed technique wherein one surgeon handled the endoscope and a dissector and the other surgeon provided suction and held a forceps. After excision of the tumour, the reconstruction was done using surgicel, fascia lata, fibrin glue and flap. The dead space after tumour removal was filled with surgicel, fascia lata was placed in an underlay fashion and then the dural defect along with sellar floor was covered with Hadad flap sealed with fibrin glue. This was followed by packing bilateral nasal cavities with Merocel after ensuring haemostasis. Prior to this, a barrier of gelfoam was created over the flap so as to prevent misplacement of the graft during nasal pack removal. Under the cover of intravenous antibiotics, the nasal pack remained insitu for 3 days. Imaging was done in the form of CT scan with contrast on the first post operative day to check for evidence of residual tumours. Patients were placed on bed rest with head end elevation of 30 degrees and asked to avoid straining. The pack was removed on the 3rd post operative day.

The patients were followed up after 1 week, 2 weeks, one, two , three and six months and one year after surgery.

RESULTS:

Out of the 20 consecutive patients who were operated, eight were females and twelve patients were males, with ages ranging from nineteen to sixty two(19-62yrs.). Most of the patients presented with headache and diminished vision. 3 patients had craniopharyngioma, one with Rathke's pouch cyst, while the rest had pituitary macroadenoma. Patients were operated using endoscopic transnasal transsphenoid approach. All the skull base defects were repaired using Hadad flap and fibrin glue. Fascia lata was used in 18 patients in an underlay fashion for added support to the flap. Intraoperative CSF leak was noted on table in 10 patients. Three (15%) of the above patients who had intraoperative CSF leak had post operative leak too. When re-explored surgically, the Hadad flap

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had misaligned due to loss of alignment between the bony defect and the flap in two patients. CSF leak ceased after repositioning the flap. One (5%) of the patient continued to have CSF leak after replacing flap

Fig.-1. Preoperative CT images showing Pituitary tumours.

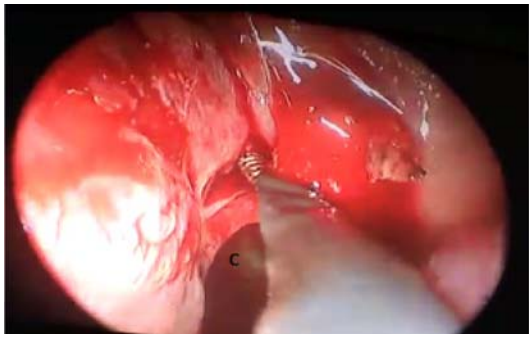

Fig.-2: Inferior limit of pedicle above choana.

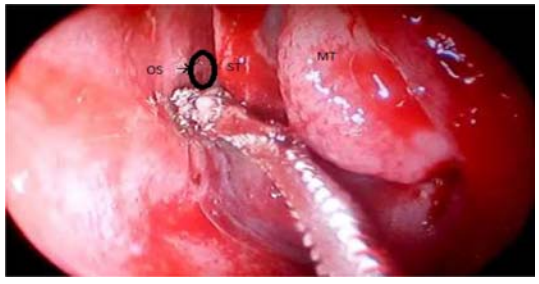

Fig.-3: Superior limit of pedicle below sphenoid os.

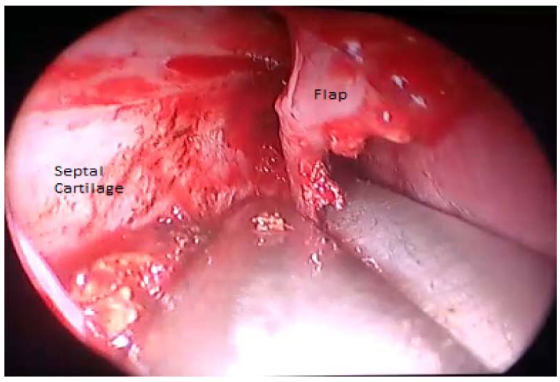

Fig.-4: Incisions on superior part of septum and floor.

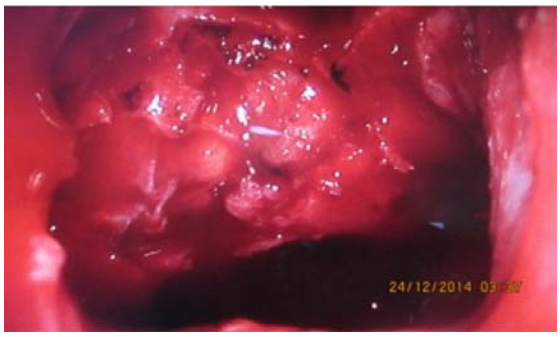

Fig.-5: Tumour Exposure.

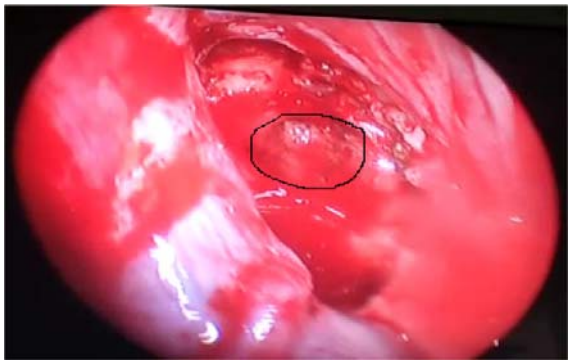

Fig.-6: Skull base defect after tumour resection.

Fig.-7: Reconstruction with surgicel.

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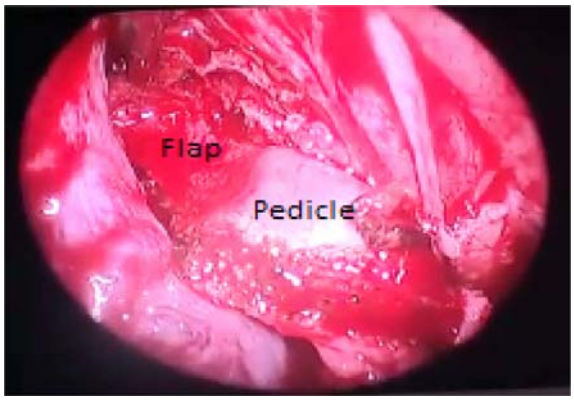

Fig.-8: Reconstruction with Hadad flap.

and this had to be strengthened with additional fascia lata, fat and fibrin glue. In this particular patient the tumour had invaded the arachnoids membrane. Minimal crusting was noted in the immediate postoperative followup period which may be attributed to the post posterior septectomy status. Thus 1 /20 (5%) patients had late post operative CSF leak in our study.

DISCUSSION:

The advent of endoscopes has revolutionized a new era in modern pituitary surgeries. Transnasal, transsphenoidal endoscopic surgeries have become the mainstay of management in pituitary and skull base lesions in the recent past. Transnasal approaches have many advantages over the traditional open transcranial approaches, which includes absence of brain retraction and manipulation, better visualization using endoscopes, lesser post operative morbidity and better cosmesis. However, it comes with its own complication which includes a high rate of post operative CSF leakage consequent to large skull base defects after tumour removal. The introduction of nasoseptal flap famously known as Hadad- Bassagasteguy flap in 2006[1], a novel reconstruction technique based on the pedicle nasoseptal flap with blood supply from posterior septal branch of sphenopalatine artery, a terminal branch of the internal maxillary artery, has been the most significant advance in transnasal endoscopic surgeries. This technique was earlier devised by Oskar Hirsh in 1952[2], but it was based on random vascular supply. Ever since the reintroduction of a modified, robust nasoseptal flap based on the posterior septal artery, it has been unanimously considered as the workhorse for closure of skull base defects and has heralded an era of vascularised flaps in sealing the skull base defects following transnasal endoscopic skull base surgeries. The nasoseptal artery lies within a strip of mucoperisotium between the inferior margin of the natural sphenoid ostium and superior edge of the choanae, thus making these the superior and inferior limits of Hadad-Bassagasteguy pedicle[1,3]. The use of this flap to separate the nasal cavity from intracranial space minimizes the risk of postoperative CSF leaks, pneumocephalus and meningitis. The nasoseptal flap is a versatile flap with a wide arc of rotation that allows the flap to reach the defects from the frontal sinus to lower clivus. It has decreased the incidence of CSF leak significantly.

One of the significant advantages of the nasoseptal flap is that it can be endoscopically harvested prior to forming a skull base defect, therefore alleviating the need for external flap harvesting. Additionally, being a vascularised flap, it promotes faster healing, lower chances of graft migration in addition to providing a large surface area to cover larger defects. The nasoseptal flap is a safe, no cost, malleable, easy to harvest flap in the same field of surgery without causing any complications or side effects[4].

Depending on the dimensions of the nasal septum, HBF flap can extend from the frontal recess anteriorly to the clivus posteriorly in length and from one lamina papyracea to the other in width. The robust blood supply of the flap, pliability and extensive arc of rotation allows the coverage of a wide array of anterior, middle and posterior cranial base defects[3,5].

Hadad et al[1], in their landmark paper, reported a 4.7% rate of post operative fistula based on a study on 43 patients which included 20 cases of pituitary macro adenomas. Kassam[3] et al demonstrated a 10.66% rate of post operative CSF fistula in patients who required intra arachnoid dissection and also pointed out that, there was a learning curve associated with the success of HBF. In our study including 20 cases, there was a persistent post operative CSF leak of 5%, which is consistent with the results obtained in similar contemporary studies.

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In addition to adequate exposure and complete resection of the lesion, the outcome of endoscopic surgery depends largely on the ability to reconstruct the skull base defects. Smaller skull base defects can be sealed with materials like fat, fascia lata, middle turbinate mucosa etc[6]. However, due to expansion of the horizon of endoscopic surgeries to the extent of resecting larger lesions and the consequent larger skull base defects, the need for self sustaining flaps arises and this is addressed adequately by the nasoseptal flap. The average surface area of HBF is approximately 25cm^2.[7]The flap is tailored the size of the defect expected, although it is wise to overestimate the size and later resect the excess flap if necessary.

Many authors[4,8] emphasize on the need for using a multilayered approach to reconstruction , even while using a vascularised flap in order to support the flap, to help it remain fixed and reduce the effect of cerebrospinal fluid. Most importantly, it must be ensured that the flap must not be twisted during reconstruction and the mucosal surface is facing the nasal cavity and not the intracranial defect and that the flap is covering the bony edges of the defect.

Advance planning is of paramount importance as posterior septectomy during transsphenoidal surgery can hamper its usage because of destruction of the vascular pedicle[9]. Addressing this issue, Rivera Serrano et al developed nasoseptal rescue flap (NSRF)[5], in which HBF is only partially raised ,permitting access to the anterior face of the sphenoid avoiding injury to the feeding vessels. If there is an intraoperative CSF leak, the NSRF can be completely harvested and converted to HBF. His observation was further supported by Rawal RB et al[10] who in their study stated that the success rate of nasoseptal flap was 100%.

Other endonasal pedicled flaps that could be used in cases where HBF is contraindicated consequent to the compromised vascular supply are posterior inferior turbinate flap based on inferior turbinate artery[11], middle turbinate flap[12] based on middle turbinate artery which are both branches of posterior lateral nasal artery and lateral nasal wall flap (HB2)[13] flap based on branches of facial and anterior ethmoidal arteries. Pedicled extranasal flaps include palatal flap, pericranial flap, and facial buccinator flap and temporoparietal fascial flap[14].

CONCLUSION:

Hadad - Bassagasteguy flap is a reliable method in repairing skull base defects after transnasal transsphenoidal skull base surgeries in conjunction with multilayered reconstruction. Its use has considerably reduced incidences of post operative CSF leaks even after large skull base defects and plays a pivotal role in endoscopic skullbase surgeries.

DISCLOSURES:

(a) Competing interests/Interests of Conflict- None
(b) Sponsorships - None
(c) Funding - None
(d) No financial disclosures
(e) Animal rights-Not applicable

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