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# Cerebro-Spinal Fluid Leak in Skull Base Reconstruction Using Hadad - Bassagasteguy Flap after Endoscopic Endonasal Transsphenoidal Surgery: A Case Series

## ABSTRACT

**Objective:** To determine the incidence of cerebrospinal fluid (CSF) leak after Hadad-Bassagasteguy Flap (HBF) reconstruction after endoscopic endonasal transsphenoidal surgery for skull base pathologies from 2016 to 2020 at the University of the East Ramon Magsaysay Memorial Medical Center.

### Methods:

**Design:** Case Series

**Setting:** Tertiary Private Training Hospital

**Participants:** Charts of 35 patients who underwent endoscopic endonasal transsphenoidal surgery with reconstruction using Hadad-Bassagasteguy flap between January 2016 to February 2020 were reviewed and data on demographics, date of procedure, mass size, final diagnosis, presence of preoperative, intraoperative and postoperative CSF leak, placement of lumbar drain and course in the wards were collected.

**Results:** There were 23 women and 12 men with ages ranging from 21 to 71 years. Four patients (11.4%) had postoperative CSF leak after reconstruction with HBF. Two of these four patients had episodes of nose blowing and sneezing weeks after surgery, prior to the development of the CSF leak. The other two patients experienced CSF leak 3 days postoperatively.

**Conclusion:** HBF has been a workhorse for reconstruction of skull base defects after transsphenoidal surgery, and based on our experience remains to be so, making it possible for expanded approaches and a wide variety of pathologies to be operated on via the endonasal route.

**Keywords:** *Hadad-Bassagasteguy flap, Hadad flap, cerebrospinal fluid leak; CSF leak, Endoscopic endonasal transsphenoidal surgery*



**The transsphenoidal route** is the standard approach for pituitary or sellar tumors of the skull base.<sup>1</sup> Endoscopic endonasal transsphenoidal surgery (EETS) is a minimally invasive technique that is the current approach of choice for pituitary and sellar tumors.<sup>2,3</sup> Expanded endonasal approaches have been developed, making it possible to access the skull base through the nasal cavity, enabling access to the suprasellar, parasellar and retrosellar spaces.<sup>4</sup> However, cerebrospinal fluid (CSF) leak has been one of the feared complications of endoscopic endonasal transsphenoidal surgery.

Hadad *et al.*<sup>5</sup> described the Hadad-Bassagasteguy Flap (HBF) to reconstruct skull base defects after endoscopic endonasal expanded approaches. It utilizes a neurovascular pedicle flap of the nasal septum mucoperiosteum and mucoperichondrium based on the nasoseptal artery, a branch of the posterior septal artery and the terminal branches of the internal maxillary artery.<sup>5</sup> This technique has reduced the incidence of cerebrospinal fluid leak after expanded endonasal approaches from >20% to 4-6%.<sup>2,5-7</sup> A number of studies have been published in the success of their EETS using HBF.<sup>2,5-7</sup> However, after a search of HERDIN Plus, the ASEAN Citation Index (ACI), WHO Global Index Medicus - Western Pacific Region Index Medicus (WPRIM), Directory of Open Access Journals (DOAJ), PubMed (MEDLINE and PubMed Central), and the Cochrane Database, we found no local published data regarding its utilization and surgical outcomes in the Philippines.

This study aims to determine the incidence of cerebrospinal fluid leak after HBF reconstruction after endoscopic endonasal transsphenoidal surgery for skull base pathologies from 2016 to 2020 at the University of the East Ramon Magsaysay Memorial Medical Center.

## METHODS

With University of the East Ramon Magsaysay Memorial Medical Center Research Institute for the Health Sciences Ethics Review Committee approval (RIHS ERC Code: 0865/H/2020/093), hospital records of all adult patients who underwent EETS with reconstruction using HBF between January 2016 and February 2020 were considered for inclusion in this case series. Charts with incomplete data were subsequently excluded.

The surgical technique for the harvest of the HBF followed the technique of Hadad *et al.*<sup>5</sup>. We utilized a multilayer technique with the use of abdominal fat graft, septal cartilage graft, HBF, Monomeric N-butyl-2-cyanoacrylate glue and a bioresorbable nasal dressing.

Medical records were individually reviewed, and the patient's age, sex, date of procedure, size of mass, final diagnosis, presence of preoperative, intraoperative and postoperative CSF leak, placement of lumbar drain after EETS and course in the wards were recorded by the

first author in a data collection form. The presence of intraoperative CSF leak was determined based on the intraoperative findings in the operative technique. The occurrence of postoperative CSF leak was determined based on the course in the wards of each patient, daily physical examination record, and nasal endoscopy reports in the charts.

Descriptive statistical evaluation was performed using Microsoft Excel 2019 Version 16.52 (Microsoft Corp., Redmond WA, USA) and data was presented using percentages, means and standard deviations.

## RESULTS

A total of 35 hospital records were included in this series. They represented 23 women and 12 men with ages ranging from 21 to 71 years old (mean, 47 years). The different pathologies were 28 (80%) pituitary macroadenomas, two (5.7%) craniopharyngiomas, two (5.7%) squamous cell carcinomas, and 1 each (2.8% each) pituitary cyst, chordoma, and idiopathic CSF leak. Depending on pathology, the different surgical approaches used were two transplanar, two transclival, and 31 transsellar.

Four (11.4%) of the 35 patients had postoperative cerebrospinal fluid leak. The first patient had CSF leak 1 week after surgery after the patient purposely blew his nose and sneezed despite strict instructions to refrain from such actions. The second patient had CSF leak at home 2 weeks postoperatively, also after intentional nose blowing and frequent sneezing. He had been ambulatory on discharge and was able to maintain upright position and flex his head anteriorly without CSF rhinorrhea. The third and fourth patients developed CSF leak 3 days after surgery with no identified aggravating cause.

Eleven (31.4%) patients did not have a postoperative lumbar drain, which were the ones with no gross intraoperative CSF leak during EETS. All patients who had a postoperative lumbar drain (68.6%) had an intraoperative CSF leak. The 4 patients who had postoperative CSF leak had a postoperative lumbar drain placed after the EETS.

Among the patients who experienced post-operative CSF leak, three were diagnosed with pituitary macroadenoma and one was diagnosed with craniopharyngioma. In terms of size, the mean diameter of the mass among the patients was  $3.1 \pm 1.28$  centimeters. The four patients who experienced post-operative CSF leak had a mass diameter ranging from 2.5 to 3.8cms.

Postoperative CSF leak of the three patients resolved by repositioning of the previously laden HBF. The postoperative CSF leak of the fourth patient was resolved by utilizing a lateral nasal mucosal wall flap to reconstruct the defect. All the CSF leaks were identified at the lateral and superior edges of the HBF. No recurrence of CSF leak was noted after the repair in all 4 patients.

## DISCUSSION

In our study 11.4% of patients had a postoperative CSF leak which is higher than rates reported internationally. It is of note that of the four patients who had CSF leak, two had an aggravating cause - purposeful nose blowing and sneezing with most of the force passing through the nasal cavity instead of releasing it through the mouth. It is also noteworthy that the postoperative CSF leak in the two patients occurred only after the incident of nose blowing. Blowing through the nose and sneezing may lead to increased intracranial pressure, which in turn, may cause a CSF leak.<sup>8</sup> Furthermore, these actions may displace the HBF, thereby causing CSF rhinorrhea.

Carabba *et al.*<sup>9</sup> showed that the incidence of CSF leak after expanded endonasal approach without the HBF was 24%.<sup>9</sup> Since the advent of HBF, reports have shown a decrease in postoperative CSF leak after expanded endonasal approaches to 4-6%.<sup>2,5-7</sup> If we exclude the two patients who had an external aggravating cause, the rate of spontaneous post-operative CSF leak would then be 5.7%, which is within the range of reported complication rates of other published studies.<sup>2,5-7</sup> To the best of our knowledge, there are no other reports in the Philippines that provide an incidence of postoperative CSF leak after reconstruction using HBF.

There are various reasons why CSF leak can occur postoperatively even with reconstruction and these are: 1) Insufficient size of the flap, 2) Tucking of flap margins, 3) Reverse placement of the flap, 4) Pedicle constriction which leads to flap ischemia, 5) Incomplete denudation of the bony margin of the reconstructed defect, 6) Flap retraction, and 7) Ineffective arrangement of the multilayer reconstruction.<sup>10,11</sup> In our case, the most likely cause for the other 2 patients who did not have any aggravating cause is incomplete denudation of the bony margin of the reconstructed defect. The CSF leak was noted to occur at the edges of the HBF where the incomplete denudation of the bony margin may have occurred.

There are numerous limitations in this study. The study sample size is small with only 35 patients. Due to the small sample size, no inferential statistical analysis could be done to assess for associations between age, pathology of the mass, size of the mass, presence of intraoperative CSF leak and presence of lumbar drain. Also, the small sample size may not be representative of the population. The study also lacks a control group. This study is a retrospective study and was based on chart review. A prospective study would be better to evaluate the associations between other factors that may lead to CSF leak.

Indeed, the HBF has become a workhorse for reconstruction of skull base defects after transsphenoidal surgery, and based on our experience remains to be so, making it possible for expanded approaches and a wide variety of pathologies to be operated on via the endonasal route.

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