

Abstract

The basal interhemispheric approach (BIA) often requires opening of the frontal sinus, which may increase the risk of postoperative cerebrospinal fluid (CSF) leakage. The optimal method for frontal sinus closure remains unclear. We retrospectively evaluated different closure techniques and their association with postoperative complications in patients undergoing BIA. Our findings suggest that closure strategy influences CSF leakage risk and should be tailored to individual surgical conditions.

Introduction

The basal interhemispheric approach (BIA) provides direct midline access to suprasellar and anterior skull base lesions and is widely used in neurosurgery. However, opening of the frontal sinus during this approach creates a potential pathway for postoperative cerebrospinal fluid (CSF) leakage, which may lead to meningitis, reoperation, and prolonged hospitalization. Various reconstruction techniques for frontal sinus closure, including fibrin glue, artificial dural substitutes, bone paste, and pericranial flaps, have been proposed. Nevertheless, the optimal closure strategy remains unclear, and comparative clinical evidence is limited. This study aimed to evaluate the impact of different frontal sinus closure methods on postoperative complications, particularly CSF leakage, in patients undergoing BIA.

Materials and Methods

Between 2018 and 2024, 102 patients underwent BIA at Juntendo University Hospital. After excluding recurrent cases and pediatric patients younger than 15 years, 76 patients were included. Closure methods were categorized as fibrin glue only (F), fibrin glue plus DuraGen (D+F), fibrin glue plus bone paste (F+B), fibrin glue plus pericranial flap (P+F), and combined methods (P+F+D, D+F+B). Postoperative complications including CSF leakage, olfactory dysfunction, and infection were evaluated. Statistical analyses were performed using Fisher's exact test. A p-value < 0.05 was considered significant.

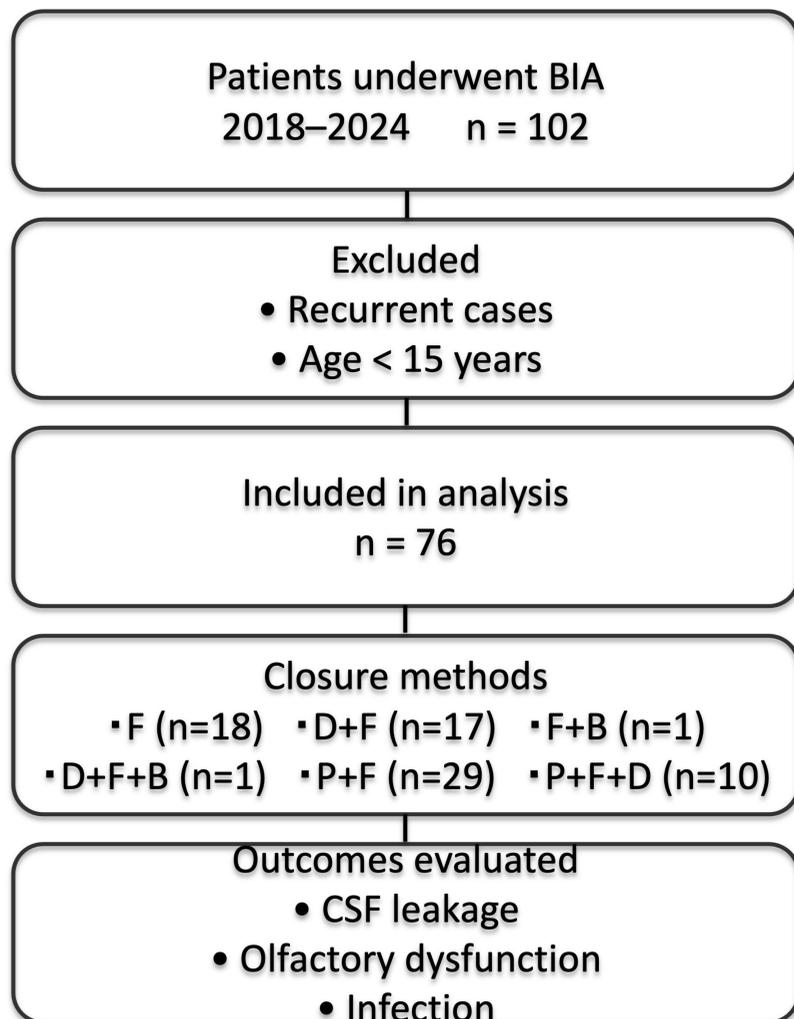


Figure 1. Patient selection and study flow diagram.

Variable	Value
Patients	76
Median age (years)	56.5 (24–79)
Male / Female	36 / 40
Mean BMI	23.3 (16.2–36.4)
Diabetes	3 (3.9%)
Frontal sinus opening (mean)	47.2 mm
Ethmoid sinus opened	11 (14.5%)
CSF leakage	3 (3.9%)
Olfactory dysfunction	2 (2.6%)
Infection	0 (0%)

Table 1. Patient characteristics and postoperative outcomes

Results

The median follow-up period was 57.5 months (range, 5–100). The median age of the 76 patients was 56.5 years (range, 24–79), with a male-to-female ratio of 36:40. Diagnoses included meningioma in 39 cases, craniopharyngioma in 16, glioma in 6, PitNET in 6, and others in 8. The mean BMI was 23.3 (range, 16.2–36.4), and 3 patients (3.9%) had diabetes. The mean length of frontal sinus opening was 47.2 mm (range, 12.7–85.1), and the ethmoid sinus was opened in 11 cases (14.5%). Postoperative CSF leakage occurred in 3 patients (3.9%), olfactory dysfunction in 2 (2.6%), and no infections were observed. CSF leakage rates by closure method were: F (0/18, 0%), D+F (0/17, 0%), F+B (0/1, 0%), D+F+B (0/1, 0%), P+F (1/29, 3.4%), and P+F+D (2/10, 20%). All CSF leaks occurred in patients reconstructed with a pericranial flap, particularly in the P+F+D group. Olfactory dysfunction also occurred only in the P+F group. BMI and diabetes were not significantly associated with complications.

CSF Leakage Rate by Closure Method

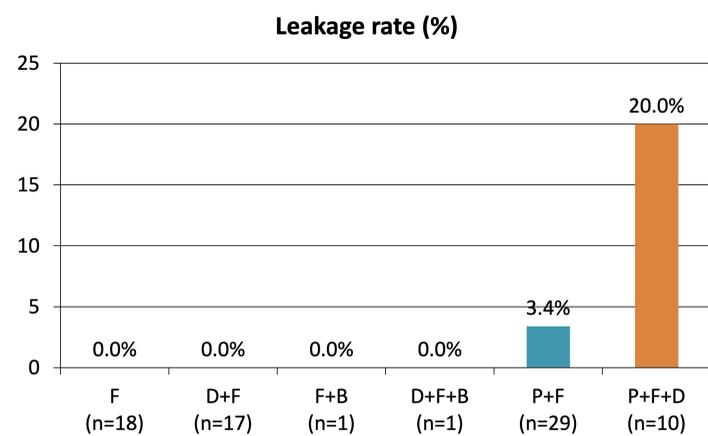


Figure 2. Postoperative CSF leakage rates according to frontal sinus closure method

Discussion

The overall incidence of postoperative CSF leakage was low. Although no statistically significant differences were observed among closure methods, a trend toward higher leakage was noted in the P+F+D group. Leakage occurred only in cases reconstructed with a pericranial flap; however, this likely reflects selection bias, as these techniques were preferentially used in larger sinus openings. Therefore, the higher leakage rate may be related to case complexity rather than the reconstructive technique itself. BMI and diabetes were not associated with complications. These findings suggest that closure strategy should be tailored to individual surgical conditions.

Conclusions

Frontal sinus closure in BIA can be performed safely, with an overall CSF leakage rate of 3.9%. However, higher leakage rates were observed in cases reconstructed with a pericranial flap, likely reflecting larger sinus openings and greater case complexity. This study provides useful insights for establishing safe strategies for frontal sinus management in BIA.

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