



Frontal sinus repair after bifrontal craniotomy: a single center experience

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Abstract

In this study, we analyzed the patients who underwent surgery using their adipose tissue, which is a practical and economical approach to the reconstructing the frontal sinus during bifrontal craniotomy. The study aimed to evaluate the economic feasibility and safety of this classical technique to repair the frontal sinus and reduce complications. Patients who were underwent bifrontal craniotomy for anterior skull base tumors and underwent intraoperative frontal sinus repair between January 1, 2016 and January 1, 2022 were retrospectively evaluated. Demographic characteristics of the patients (age, gender), duration of hospitalization, etiological causes, post operation complications, management of complications, and follow-up periods were analyzed. A total of 25 patients were included in the study. Of the patients, 11 were male (46%) and 14 were female (54%). The median age of the patients was 59 (49.5–66) years. The median duration of hospitalization and follow-up period were 7 (6–8.5) days and 27 (17–48) months, respectively. Cerebrospinal fluid leakage developed as a complication in only one patient (4%) in the postoperative period. We applied the classical technique of using the patient's own adipose tissue for repair after frontal sinus opening that occurs in bifrontal craniotomies for anterior skull base tumors. This is a practical, effective, and economical method that causes less harm to patients.

Keywords: bifrontal craniotomy, frontal sinus, reconstruction, rhinore

1. Introduction

Bifrontal craniotomy is an effective surgical method for treating tumors in the sellar region, and in anterior skull base and anterior cerebral artery aneurysms (1-5). However, it may be necessary in this technique to enter the frontal sinuses and pass the lower border of the craniotomy through the orbital rim or slightly lower (6). Performing the procedure toward the frontal sinus can cause leakage of cerebrospinal fluid and a consequent and frequent infection (5,7-9). To prevent these complications that occur due to the opening of the frontal sinus, the connection of the frontal sinus with the intracranial space must be closed.

Different methods have been tried by neurosurgeons to block the connection between the intracranial space and the frontal sinus. Few methods aim to close this area with autologous tissue such as the patient's own adipose tissue, muscle tissue, or fascia. Synthetic materials such as polymethyl methacrylate, hydroxyapatite cement, or bone wax have also been used for the same technique (1,10-15). Patients' own tissue may be preferred due to its availability and low chances of rejection by the body. Synthetic materials are expensive, unlikely to be absorbed, and can cause inflammation and infection.

In this study, we analyzed patients who underwent surgery in which their adipose tissue was used, which is a practical and economical approach to reconstruct the frontal sinus. Results from 34 patients showed that the classical technique is an economical and safe method to repair the frontal sinus and

reduce complications.

2. Materials and Methods

Patients who underwent bifrontal craniotomy for anterior skull base tumors and underwent frontal sinus repair between January 1, 2016 and January 1, 2022 at the Kahramanmaraş Sütçü İmam University Neurosurgery Clinic were retrospectively evaluated. The study received approval from the local ethics committee. (Date June 21, 2022; Session Number: 2022/21; Decision No.: 04). A total of 25 patients who met the study criteria were included. Of these patients, adipose graft from the patient was used for frontal sinus repair. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Common demographic information (age, gender), duration of hospitalization, etiologic causes, types of postoperative complications, complication management, and follow-up periods of the patients were analyzed. Statistical Package for Social Sciences v20.0 was used for statistical analyses. Categorical data were presented as number (n) and percentage (%), while numerical data were presented as median (1st and 3rd quartiles).

2.1. Surgical technique

The operation was performed under general anesthesia with the

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patient in the supine position. A coronal skin incision was made at the hairline, and the skin flap and periosteum were lifted. The bone flap was removed by opening a temporal burr hole and performing a craniotomy in lower border up to the orbital rim. Next, the frontal sinus was opened. The mucosal membrane of the frontal sinus was exposed, immediately disinfected using povidone-iodine, and sealed with bone wax to prevent air embolism. The sagittal sinus was ligated as anteriorly as possible and cut. After the tumor was removed, an adipose graft was taken from under the patient's scalp tissue for frontal sinus repair during closure. The bone wax in the frontal sinus was removed and the adipose graft was placed in the frontal sinus. Furthermore, the connection between the frontal sinus and the intracranial distance was closed. Next, the dura, bone, and skin flaps were closed in accordance with the procedure. During postoperative follow-up, 1 g of ceftriaxone 2 × 1 was administered to the patients for 5 days. Patients were discharged when their general condition improved.

3. Results

All patients included in the study were operated on through surgery to treat olfactory groove tumors (100%). Of the patients, 11 were male (46%) and 14 were female (54%). The median age of the patients was 59 (49.5–66) years. The median duration of hospitalization and follow-up period were 7 (6–8.5) days and 27 (17–48) months, respectively. Cerebrospinal fluid leakage developed as a complication in one (4%) patient in the postoperative period. In this patient, complication was observed at the 48th hour after the surgery. The patient also developed a fever at the postoperative 72nd hour. In this patient, the leak disappeared on day 4 using fluid restriction and antibiotherapy. The demographic data of the patients according to their gender and presence of complications are presented in Table 1.

Table 1. Comparison of demographic data, duration of hospitalization, follow-up period, and complications of patients according to their gender

Parameter		Sex		Total
		Male	Female	
Rhinorrhea (n%)	Yes	0 (0%)	2 (8%)	2 (8%)
	No	11 (44%)	12 (48%)	23 (92%)
Total		11 (44%)	14 (56%)	25 (100%)
Additional procedure (n%)	Yes	0 (0%)	2 (8%)	2 (8%)
	No	11 (44%)	12 (48%)	23 (92%)
Total		11 (44%)	14 (56%)	25 (100%)
Age (year) (median)(1st and 3rd quartile)		59 (55 – 66)	58.5 (44.75 – 66.5)	
Hospitalisation (day) (median)1st and 3rd quartile)		6 (6 – 8)	7 (5.75 – 9.25)	
Follow-up period (month) (median)(1st and 3rd quartile)		25 (18 – 52)	32.07 ± 19.48 (5 – 65)	

4. Discussion

Bifrontal craniotomy is one of the most commonly used surgical methods in neurosurgical practice. The bifrontal

approach provides excellent access to the pathology area. However, since a larger craniotomy area is used with a bifrontal craniotomy, the bone graft removed also brings some problems (16,17). The opening of the frontal sinus during this procedure is inevitable in most cases. The border of the craniotomy extends to the frontal sinus and then the frontal sinus is exposed. If frontal sinus repair is not performed correctly, subsequent complications will most commonly originate from the frontal sinus(7,11,18).

Complications originating from the frontal sinus are difficult to manage and increase morbidity. The most important of these complications are cerebrospinal fluid (CSF) leakage and frontal sinus infections. CSF leakage is a critical complication for the patient and clinician to deal with after surgery(19,20). Meningitis and intracranial abscesses may develop after these complications. This may result in rapid deterioration in the patient's general condition and neurologic examination (21). This can lead to a prolonged hospital stay and life-threatening consequences. Therefore, frontal sinus repair is as important as the surgery performed and should be managed well(22).

When repairing the frontal sinus opened by bifrontal craniotomy, the frontal sinus mucosa must first be removed for obliteration, and the debris must be scraped from the frontal sinus wall. The frontal sinus must then be obliterated. This must be done meticulously. Otherwise, the mucosa may become polyferous and subsequently cause various complications, such as mucocele abscess. These are also problems that increase morbidity. After carefully removing the mucosa, the frontal sinus can be repaired by filling it with different materials(16,17).

Different materials and techniques have been reported for frontal sinus repair. Among the most commonly used methods is the use of the patient's own tissues such as fat or muscle(23-26). Synthetic materials such as polymethyl methacrylate, hydroxyapatite cement and its derivatives, or bone wax have been used for frontal sinus repair (27-31). These materials are preferred for their antibacterial properties and easy availability. These methods are generally more expensive than the traditional technique of using the patient's own tissues and do not always provide adequate closure in terms of sinus repair(32).

In addition, they do not prevent infections adequately, on the contrary, they may increase infection rates (33). Bone wax may lead to inflammation and wound healing problems (29,34).

The use of the patient's own tissues for frontal sinus repair has long been a preferred method (34,35). Some authors have reported significant decreases in infection rates after the use of adipose grafts (36).

Some of the adipose tissue used with this technique eventually vascularizes and prevents the development of

infection, while some of it forms fibrous tissue and closes the connection between the intracranial area and the frontal sinus (37-39). Because of these benefits, using the patient's own tissue has become very popular among surgeons (40).

In our center, we use the patient's own adipose tissue, which is the classical technique, for repair after frontal sinus opening in bifrontal craniotomies performed for anterior skull base tumors. It has been reported that the adipose graft can be taken from the patient's abdominal tissue or scalp tissue. In our center, we use scalp tissue. It is possible to remove enough adipose tissue from both locations. The reason why we take adipose grafts from under the scalp is that the scalp tissue opened for bifrontal craniotomy is of sufficient size and width in all patients, allowing us to take the required amount and size of adipose graft. This eliminates the need to take an adipose graft from the abdomen with a second incision. Thus, we do not impose an additional surgical burden due to a second incision.

This method is a practical, effective and low-cost method that causes less harm to patients.

Out of 25 patients who underwent the procedure in our clinic, only one patient had cerebrospinal fluid leakage. Cerebrospinal fluid leakage stopped on the 4th postoperative day without the need for additional surgical procedure and there was no additional deficit in the patient. Therefore, it was concluded that this method, which is more effective and economical compared to using different exogenous materials, was successful.

Conflict of interest

The authors declared no conflict of interest.

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None to declare.

Authors' contributions

Concept: E.C.K., K.Z.Y., Design: E.C.K., Data Collection or Processing: E.C.K., K.Z.Y., Analysis or Interpretation: E.C.K., Literature Search: E.C.K., Writing: E.C.K.

Ethical Statement

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. The study was approved by the Clinical Studies Bioethics Committee of the Medical Faculty of Kahramanmaraş Sutcu Imam University (Date June 21, 2022; Session Number: 2022/21; Decision No: 04).

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