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Research Article

# Comparison of the success rate of fascia lata graft and temporal muscle fascia graft in endoscopic treatment of anterior skull base cerebrospinal fluid rhinorrhea

## *Anterior kafa tabanı BOS rinoresinin endoskopik tedavisinde fasya lata grefti ile temporal kas fasya greftinin başarı oranlarının karşılaştırılması*

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## Abstract

**Aim:** The aim of this retrospective study is to describe our experiences of cerebrospinal fluid (CSF) rhinorrhea and assess success rate of fascia lata and temporal fascia of repairing the skull base defects

**Material and Methods:** Patients with CSF rhinorrhea managed by department of otolaryngology from 2007 to 2021 were included. Demographic information, site of leak, etiology, body mass index (BMI), surgical approach, graft material, and any recurrence of leak of the patients was collected.

**Results:** Out of the 66 patients included in the study, 25 were male and 41 were female and the median age was found to be 43.7 (ranging from 19 to 72). The median Body Mass Index (BMI) was found to be 27.5 (ranging from 19 to 46). The success rate of endoscopic method in repairing CSF rhinorrhea was found to be 90.4%. Fascia lata was used as graft material in 35 patients, while temporal muscle fascia was used in 31 patients. Recurrent rhinorrhea was detected in 5 of 31 patients (16.1%) in whom temporal muscle fascia was used as a graft, while recurrence was detected in 2 of 35 patients (5.7%) in whom fascia lata graft was used (p=0.170). While rhinorrhea recurrence was detected in 6 of 27 obese patients (22.2%), revision surgery was required in only 1 (2.6%) non-obese patient (p=0.011). Complications such as hematoma, alopecia and leg pain related to the graft site were seen in 4 operated patients.

**Conclusion:** Patients presenting with CSF rhinorrhea can be successfully treated with endoscopic sinus surgery. The success rate of using temporal fascia graft and fascia lata graft in defect repair is similar in rhinorrhea repair. In our study, it was determined that the only factor affecting treatment success was high BMI.

**Keywords:** cerebrospinal fluid, endoscopic, rhinorrhea, skull base

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## Öz

**Amaç:** Bu retrospektif çalışmanın amacı, beyin omurilik sıvısı (BOS) rinoresi olan kafa tabanı defektlerinin onarımında fasya lata ve temporal fasyanın başarı oranını değerlendirmektir.

**Gereç ve Yöntemler:** 2007-2021 yılları arasında kulak burun boğaz kliniği tarafından tedavi edilen BOS rinoreli hastalar çalışmaya dahil edildi. Hastaların demografik bilgileri, sızıntının yeri, etiyolojisi, vücut kitle indeksi (VKİ), cerrahi yaklaşım, greft materyali ve herhangi bir sızıntı rekürrensi toplandı.

**Bulgular:** Çalışmaya 25'i erkek, 41'i kadın 66 hasta dahil edildi. Ortanca yaş 43.7 (19 - 72) olarak bulundu. Median Vücut Kitle İndeksi (VKİ) 27.5 (19-46) olarak bulunmuştur. Endoskopik yöntemin BOS rinoresini onarmadaki başarı oranı %90,4 olarak bulunmuştur. Greft materyali olarak 35 hastada fasya lata kullanılırken, 31 hastada temporal kas fasyası kullanıldı. Temporal kas fasyası kullanılan 31 hastanın 5'inde (%16,1) rekürren rinore saptanırken, fasya lata grefti kullanılan 35 hastanın 2'sinde (%5,7) rekürrens saptandı (p=0,170). Obez 27 hastanın 6'sında (%22,2) rinore nüksü saptanırken, obez olmayan sadece 1 (%2,6) hastada revizyon cerrahisi gerekmiştir (p=0,011). Ameliyat edilen 4 hastada greft bölgesine bağlı hematom, alopesi ve bacak ağrısı gibi komplikasyonlar görüldü.

**Sonuç:** BOS rinoresi ile başvuran hastalar endoskopik sinüs cerrahisi ile başarılı bir şekilde tedavi edilebilir. Defekt onarımında temporal fasya grefti ve fasya lata grefti kullanımının rinore onarımındaki başarı oranı benzerdir. Çalışmamızda tedavi başarısını etkileyen tek faktörün yüksek VKİ olduğu tespit edilmiştir.

**Anahtar Kelimeler:** beyin omurilik sıvısı, endoskopik, rinore, kafa tabanı

## Introduction

Abnormal connections between structures separating the subarachnoid space and nasal cavity can lead to cerebrospinal fluid (CSF) leakage. CSF rhinorrhea can occur due to traumatic or non-traumatic reasons depending on the formation mechanism. Traumatic CSF rhinorrhea cases due to iatrogenic injuries during endoscopic sinus surgery are more common (1). Among non-traumatic reasons are congenital defects, spontaneous CSF rhinorrhea, or intracranial and nasal cavity tumors invading the skull base (2). After confirming that rhinorrhea is due to CSF leakage, the defect area should be identified with appropriate imaging techniques, and surgical repair should be performed to prevent the risk of meningitis and other intracranial complications.

Open intracranial approaches, which have limited indications today, have been replaced by endoscopic endonasal approaches with high success rates and low morbidity. In commonly used endoscopic repair techniques for CSF rhinorrhea, waterproof repair can be achieved with tissue grafts, vascularized flaps, and synthetic dural grafts (3). The success rate of multilayer repair with free grafts for most defects smaller than 1 cm in the skull base is over 90%, while vascularized local or regional flaps are preferred for repairing defects larger than 3 cm (4). Studies show that vascularized flaps are superior in large dural defects or high-flow CSF leaks, but the choice of a specific technique for repairing defects smaller than 1 cm is based on the surgeon's preference rather than evidence-based data (5).

The aim of this study is to evaluate the results of the endoscopic endonasal treatment of CSF rhinorrhea cases and to investigate the success rate of two graft type fascia lata and temporal fascia controlling the CSF rhinorrhea.

## Material and Methods

This study was conducted after the approval of the local ethics committee. Between 2007-2021, demographic information, comorbid diseases, previous nasal surgeries, graft type, presenting complaints, localization of skull base defect, defect size, flow rate, presence of encephalocele, intraoperative and postoperative complications, revision surgery for CSF leakage, and clinical follow-ups of patients operated for CSF rhinorrhea were retrospectively reviewed from medical records.

Patients describing rhinorrhea and confirmed with preoperative beta-2 transferrin test were included in the study if they had undergone paranasal computed tomography (CT), magnetic resonance imaging (MRI), or MRI cisternography. Patients with anterior skull base defect size less than 1 cm and those with low flow rate were included in the study. Patients who had previously undergone CSF rhinorrhea repair, and those with missing information during the retrospective review and patients with high-flow CSF were not included in the study.

## Surgical Technique

All patients in the study were operated with endoscopic endonasal approach under general anesthesia. Functional endoscopic sinus surgery was performed to recognize the skull base and to determine the defect location. The operation steps were modified according to the defect localizations and unnecessary sinus manipulations were avoided. In patients in whom the defect location could not be determined by pre-operative imaging methods, intrathecal fluorescein (0.1ml 10% fluorescein diluted in 10 ml CSF) was administered just before the surgery. After the location of the CSF leak was determined, the tissues around the defect were removed and the borders of the defect were determined. In cases with encephalocele, the encephalocele was excised with bipolar cautery and sent for histological examination. The bone at the edges of the defect was rounded and a smooth surface was obtained. Fascia lata and temporal muscle fascia graft are harvested using a standard technique. The graft material to be used for repair was determined according to the surgeons' preference. Two-layer repair was preferred for defect repair. The graft that was advanced through the skull base defect was laid underlay between the dura and the skull base, and then a second layer was laid overlay on the skull base. No tissue adhesive and rigid graft (bone or cartilage) were used. After placing oxidized cellulose (Surgicel; Ethicon, USA) and a nasal tampon on the graft, a foley catheter was inflated in the nasal cavity to support the graft inferiorly. No lumbar drainage was placed in any patient.

## Post-operative Period

Mandatory bed rest was given to the patient in the first postoperative day and movement restriction was recommended for the following days. Patients were warned not to cough and strain. Treatment was given to prevent constipation. In addition to prophylactic antibiotic treatment, acetolazomide (250 mg) was given once daily for one week to reduce intra-cranial pressure. After the saline in the foley catheter was drained on the 5th postoperative day, the foley catheter was withdrawn on the 6th postoperative day and discharge was planned. One week after discharge, endoscopic examinations were performed in the outpatient clinic and desiccation was performed. The patients were followed up monthly for the first three months and then every 3 months for at least 1 year.

## Statistical Analysis

The suitability of the variables for normal distribution was examined using the Shapiro-Wilk test. Since the data did not show a normal distribution, the Mann-Whitney U test was used for comparisons between two groups, and descriptive statistics were presented as median (minimum-maximum). Pearson Chi-Square test and Fisher's exact test were used to compare categorical variables between groups. Categorical variables were expressed as n (%). Statistical analyses were performed using SPSS v22.0 software. A significance level of p=0.05 was used for all statistical analyses.

## Results

The data related to the study is shown in Table 1. Out of the 66 patients included in the study, 25 were male (%37.9) and 41 were female (%62.1). The median age was found to be 43.7 (ranging from 19 to 72). The median Body Mass Index (BMI) was found to be 27.5 (ranging from 19.6 to 46.6). The BMI median of patients with spontaneous cerebrospinal fluid (CSF) rhinorrhea was found to be 34.93 (ranging from 24 to 46). Out of the patients included in the study, 55 had rhinorrhea (83%), 10 had headaches (15%), and 1 had meningitis (2%). In terms of etiology, trauma was present in 34 patients (%51.5), and spontaneous CSF rhinorrhea in 32 patients (%48.5). The dural defect causing CSF rhinorrhea was in the cribriform plate in 24 patients (%36.4), in the ethmoid roof in 20 (%30.3) patients, in the frontal sinus in 4 patients (%6.1), and in the sphenoid sinus in 18 patients (27.3). Fascia lata was used as graft material in 35 patients (%53.1), while temporal fascia was used in 31 patients (%46.9). It was found that the patients were followed up for an average of 25 months (ranging from 12 to 61).

The success rate of endoscopic method in repairing CSF rhinorrhea was found to be 90.4%. The relationship between recurrence and demographic and treatment-related factors was presented in table 2. When patients with failed rhinorrhea repair were examined, it was found that there was no relationship between the location of the defect (3 patients with sphenoid sinus defect, 3 patients with cribriform plate defect and 1 patient with ethmoid roof defect) and repair unsuccessfulness (p = 0.588). Recurrent rhinorrhea was detected in 5 of 31 patients (16.1%) in whom temporal muscle fascia was used as a graft, while recurrence was detected in 2 of 35 patients (5.7%) in whom fascia lata graft was used (p=0.170). While rhinorrhea recurrence was detected in 6 of 27 obese patients (22.2%), revision surgery was required in only 1 (2.6%) non-obese patient (p=0.011). 4 patients had donor site related complications. In one patient who had

temporal muscle fascia harvested, hematoma was detected on postoperative second day and a suture were opened from the incision line and a penrous drain was placed after the hematoma was drained. Another patient who underwent temporal muscle fascia grafting developed alopecia at the incision site and was referred to the dermatology department for treatment. Two patients who underwent fascia lata grafting developed leg pain with walking and movement for 4 months after the operation. These patients were referred to the physiotherapy department and recommended for massage therapy to relax the muscle fascia. It was observed that prophylactic antibiotics and post-operative lumbar drain were not used in the patients included in the study. There were no complications related to the surgery such as new onset meningitis, increased pneumocephalus, hydrocephalus, or mucocele in the post-operative period.

**Table I.** Characteristics of the study population

| Group | | Number | (%) |
|---|---|---|---|
| Gender | | | |
| | Female | 41 | (62.1%) |
| | Male | 25 | (37.9%) |
| Revision surgery | | | |
| | No | 59 | (89.4%) |
| | Yes | 7 | (10.6%) |
| Graft type | | | |
| | Temporal Fascia | 31 | (46.9%) |
| | Fascia Lata | 35 | (53.1%) |
| Localization | | | |
| | Cribriform plate | 24 | (36.4%) |
| | Fovea ethmoidalis | 20 | (30.3%) |
| | Frontal sinus | 4 | (6.1%) |
| | Sphenoid sinus | 18 | (27.3%) |
| Fluorescein usage | | | |
| | No | 58 | (87.9%) |
| | Yes | 8 | (12.1%) |
| Etiology | | | |
| | Trauma | 34 | (51.5%) |
| | Spontaneous | 32 | (48.5%) |
| Body Mass Index Status | | | |
| | < 30 | 39 | (59%) |
| | ≥ 30 | 27 | (41%) |
| Donor site complications | | | |
| | Fascia lata | 2 | (5.71%) |
| | Temporal fascia | 2 | (6.45%) |
| | | Median | (min- max) |
| Age | | 43 | (19 – 72) |
| Body Mass Index | | 27.5 | (19.6 – 46.6) |

## Discussion

Advances in medical technology have significantly transformed the approach to repairing skull base defects. Many surgeries previously performed using open techniques can now be accomplished with endoscopic methods, resulting in high success rates, reduced invasiveness, and lower morbidity. This study presents the outcomes of using temporal muscle fascia or fascia lata grafts over 14 years of endoscopic treatment for patients admitted to our clinic with CSF rhinorrhea. The success rate of CSF rhinorrhea repair in our study was consistent with other studies in the literature, and both graft types demonstrated similar success rates in controlling rhinorrhea (6, 7).

The choice of graft to be used in CSF rhinorrhea repair is important for waterproof repair. In the treatment of patients presenting with CSF rhinorrhea, repairing with the same graft type in every patient and insisting on this graft selection may negatively affect the success of treatment. Many factors such as the location of the defect, the size of the defect, the mechanism of defect formation, CSF flow rate, easy and fast access to the graft are important in graft selection. In the literature, a wide range of graft materials such as fascia lata, temporal muscle fascia, cartilage, bone, turbinate mucosa, pedicled flaps and synthetic dura are utilized (8). According to our clinical experience, the use of rigid tissues such as bone and cartilage has a limited role in the control of rhinorrhea. It is difficult to adjust the graft thickness according to the location where the bone graft is taken and to fit this graft to the borders of the existing defect. Although there are opinions that the graft may dislodge with the valsalva maneuver and cause dural sagging in repairs performed without a rigid graft (9). In our study, dural sagging was not found in the follow-up of patients who underwent repair with fascia lata or temporal muscle fascia.

Although successful results are obtained in rhinorrhea repair with fascia lata graft, complications such as hematoma, seroma, hypoesthesia, deep vein thrombosis or pain in the leg while walking may be observed in some patients (10). In our study, the pain while walking observed in patients who had fascia lata harvested was thought to be due to fibrosis developing in the muscle fascia and these patients benefited from physiotherapy exercises. After harvesting the graft from the fascia lata, repairing this fascia and suturing it in accordance with anatomical plans may be effective in solving problems such as muscle herniation, fibrosis and bulging when walking. Deep vein thrombosis prophylaxis should be considered especially in patients with walking and mobility problems due to fascia lata.

| **Table II.** Parameters affecting revision | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Group | | Total | | No Recurrence | | Revision Surgery | | p value |
| | | Number | (%) | Number | (%) | Number | (%) | |
| Gender | | | | | | | | 0.266 |
| | Female | 41 | (62.1%) | 38 | (64.4%) | 3 | (42.9%) | |
| | Male | 25 | (37.9%) | 21 | (35.6%) | 4 | (57.1%) | |
| Graft type | | | | | | | | 0.170 |
| | Temporal Fascia | 31 | (46.9%) | 26 | (44.1%) | 5 | (71.4%) | |
| | Fascia Lata | 35 | (53.1%) | 33 | (55.9%) | 2 | (28.6%) | |
| Localization | | | | | | | | 0.588 |
| | Cribriform plate | 24 | (36.4%) | 21 | (35.6%) | 3 | (42.9%) | |
| | Fovea ethmoidalis | 20 | (30.3%) | 19 | (32.2%) | 1 | (14.3%) | |
| | Frontal sinus | 4 | (6.1%) | 4 | (6.8%) | 0 | (0%) | |
| | Sphenoid sinus | 18 | (27.3%) | 15 | (25.4%) | 3 | (42.9%) | |
| Fluorescein usage | | | | | | | | 0.853 |
| | No | 58 | (87.9%) | 52 | (88.1%) | 6 | (85.7%) | |
| | Yes | 8 | (12.1%) | 7 | (11.9%) | 1 | (14.3%) | |
| Etiology | | | | | | | | 0.199 |
| | Trauma | 34 | (51.5%) | 32 | (54.2%) | 2 | (28.6%) | |
| | Spontaneous | 32 | (48.5%) | 27 | (45.8%) | 5 | (71.4%) | |
| Body Mass Index Status | | | | | | | | 0.011 |
| | < 30 | 39 | (59%) | 38 | (64.4%) | 1 | (14.3%) | |
| | ≥ 30 | 27 | (41%) | 21 | (35.6%) | 6 | (85.7%) | |

Complications such as hematoma, seroma, alopecia and hypoesthesia can also be seen in patients with temporal muscle fascia. The most important step in the treatment of hematoma is to control hypertension, coagulation disorders or renal functions that may cause hematoma formation. Especially in obese patients presenting with spontaneous CSF rhinorrhea, control of metabolic problems may prevent these complications. In our first operated patients who received temporal muscle fascia graft, 2 cm above the ear helix was preferred for the initial incision. In our patients operated on in later periods, instead of the intra-hair incision, we started to make a parallel incision to the temporal hairline similar to the brow lift operation and tried to minimize the risk of alopecia. In our study, temporal muscle fascia, which showed a similar success rate with fascia lata graft, may be preferred because of easy access, rapid graft harvesting, and minimal complications on nasal functions and donor site.

Although rhinorrhea was successfully repaired in the majority of the patients in our study, some patients required revision surgery. It is important to identify the factors leading to revision surgery, and to take appropriate measures against them. In our study, the revision surgery rate was found similar to other studies in the literature (11). In the analysis of the causes of failure of CSF rhinorrhea repair, high BMI was found to be a significant risk factor independent of the type of graft used. In the literature, success rates of spontaneous CSF rhinorrhea in patients with high BMI have been found to be lower compared to other causes (12). In our study, similar to the scientific literature, more recurrence was detected in obese patients. Metabolic disorders and increased intracranial pressure in these patients make rhinorrhea repair difficult. In addition to skull base surgery, drawing a treatment plan with bariatric surgery or dietitian consultation may be beneficial in the treatment of these patients.

Certain limitations of our study include its retrospective design, small sample number, and patient selection and graft type selection. The inclusion of patients with skull base defects smaller than 1 cm and low CSF flow rate are another limitation's related to patient selection. In future studies on this subject, prospective studies can be performed to compare different graft options, different defect size, different flow rate and larger patient groups from multiple institutions are needed to provide better estimates of graft types.

## Conclusion

Patients presenting with CSF rhinorrhea can be successfully treated with endoscopic sinus surgery. The success rate of using temporal fascia graft and fascia lata graft in defect repair is similar in rhinorrhea repair. In our study, it was determined that the only factor affecting treatment success was high BMI.

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Disclosure Statement

## Authors declare no conflict of interest.

## Ethical approval

Our study was carried out on receiving the approval of Hacettepe University Hospital Ethical Board, no. 2021/04-65.

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None

## Conflict of interest

The authors declare that they have no conflict of interest.

## Availability of data and material

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Code availability

no code available.

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