

Integration of Synthetic and Biological Materials in the Surgical Treatment of Nasal Septal Perforations

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Abstract

Background: Nasal septal perforation (NSP) represents a challenging clinical condition with significant functional impact and heterogeneous presentation. Surgical repair remains the treatment of choice for symptomatic moderate and large perforations, yet optimal techniques are still debated.

Objective: To evaluate the effectiveness of the sandwich graft technique using polydioxanone (PDS) plates combined with cartilage graft and platelet-rich fibrin (PRF) membranes in the surgical treatment of moderate nasal septal perforations.

Materials and Methods: A prospective study was conducted on 22 patients with moderate NSPs (1-2 cm), treated between April 2022 and December 2025. The surgical technique consisted of bilateral PDS plates with interposed cartilage graft and PRF membranes. Patients were followed endoscopically at 1, 3, 6, and 12 months postoperatively.

Results: Complete closure of the perforation was achieved in 77% of cases at the first postoperative evaluation, increasing to 91% at 6 and 12 months. Partial closure persisted in 9% of patients, all of whom were smokers. No major complications were reported.

Conclusions: The sandwich graft technique using PDS plates and PRF membranes is a safe, effective, and reproducible method for repairing moderate nasal septal perforations, offering high success rates and favorable functional outcomes.

Keywords: Nasal septal perforation (NSP), sandwich graft technique, polydioxanone (PDS) plates, platelet-rich fibrin (PRF) membranes.

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INTRODUCTION

Nasal septal perforation (NSP) represents a complex clinical entity that poses significant challenges in both therapeutic management and prognostic evaluation, due to its substantial impact on nasal respiratory function and the heterogeneity of clinical presentations^{4,5}. The condition is defined by the presence of a defect in the nasal septum resulting from disruption of the mucosal continuity on both sides, with involvement of the underlying cartilaginous and/or bony structures^{4,7}.

The etiology of NSP is diverse; however, traumatic causes – particularly postoperative injury – are reported as the most frequent⁵. In certain cases, septal perforation may represent the initial manifestation of systemic inflammatory or autoimmune diseases such as sarcoidosis, granulomatosis with polyangiitis, or systemic lupus erythematosus, as well as neoplastic or infectious conditions.

From a clinical perspective, a considerable proportion of patients remain asymptomatic, with NSP being incidentally diagnosed during routine otorhinolaryngological examination. Symptomatic patients may present with nasal crusting, epistaxis, local pain, nasal obstruction, and mucosal irritation. The severity of symptoms is often correlated with the size of the perforation; large septal defects are typically associated with more severe symptomatology and less predictable therapeutic outcomes^{1,3,5}.

The management of NSP is stepwise⁵. Initial conservative measures include nasal irrigation and topical emollients, while estrogen-containing nasal sprays may contribute to alleviating local dryness. Nevertheless, symptomatic perforations or those of moderate to large size usually require surgical intervention.

Modern surgical techniques aim to optimize functional outcomes and reduce complication rates. Compared with traditional flap-based methods, the sandwich graft technique reduces flap preparation time and does not require epithelial membrane transposition for defect closure^{2,6}.

The aim of the present study was to evaluate the efficacy of the sandwich graft technique using polydioxanone (PDS) plates in the treatment of moderate nasal septal perforations.

MATERIALS AND METHODS

A total of twenty-two patients with moderate nasal septal perforations (diameter 1–2 cm) were prospectively

included in this study. Nine patients developed septal perforation intraoperatively during primary or revision septoplasty and were considered to have problematic perforations. Eleven patients presented with previously existing postoperative septal perforations following prior septal surgery, while two patients developed septal perforation as a sequela of a septal abscess.

Patients received medical care at the Republican Clinical Hospital “Timofei Moşneaga” and Magnum Clinic between April 2022 and December 2025. Written informed consent was obtained from all patients after they were informed about the procedure and potential risks. All authors approved the publication of the study, and all patients provided written consent for publication.

Inclusion Criteria

- Involvement of the cartilaginous septum in the perforation;
- Idiopathic, traumatic, or postoperative etiology;
- Symptomatic nasal septal perforation requiring surgical repair.

Exclusion Criteria

- Severe debilitating diseases;
- Atrophic rhinitis;
- Malignant sinonasal tumors;
- Diffuse sinonasal diseases, including nasal polyposis;
- Posterior septal perforations;
- Recently operated septal perforations;
- Nasal granuloma.

All patients underwent complete otorhinolaryngological evaluation, including rigid endoscopic examination of the nasal cavity using 0° and 30° endoscopes. The assessment aimed to exclude sinonasal polyposis or other nasal pathologies, determine perforation localization, and evaluate perforation dimensions (fig.1).

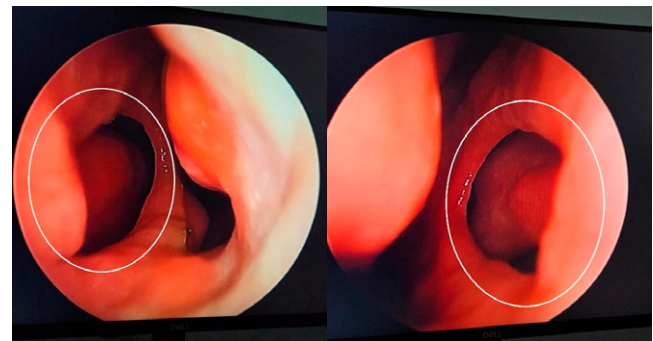


Figure 1. Preoperative endoscopic images with visualization of the defect of the nasal septum

Additionally, all patients underwent computed tomography (CT) of the paranasal sinuses with axial and coronal sections to assess sinonasal structures and exclude associated pathology (fig.2).



Figure 2. Tomographic sections with visualization of the defect of the nasal septum, as well as adjacent rhinosinus structures

Laboratory Investigations

Complete blood count (CBC);
Coagulation tests: prothrombin time (PT), activated partial thromboplastin time (aPTT), INR, and bleeding time;
Serology for hepatitis B and C viruses (HBV, HCV) and human immunodeficiency virus (HIV);
Liver and renal function tests.

Surgical Technique

All patients underwent surgery under general anesthesia. To minimize intraoperative bleeding, the septal mucosa was infiltrated with 1% lidocaine and 1:100,000 epinephrine. Preoperative nasal mucosal decongestion was achieved using cotton pledgets soaked in 0.1% xylometazoline hydrochloride, maintained for 5 minutes.

The procedure continued with elevation of the septal mucosa, creating two mucoperichondrial flaps, followed by freshening of the perforation margins. Two PDS plates were positioned at the septal defect, extending approximately 1 cm beyond the perforation margins on both sides. A cartilage graft was interposed centrally between the two PDS plates, constituting the core component of the sandwich technique.

Fixation of the cartilage graft was achieved using a 5-0 PDS suture passed sequentially through one PDS plate, the center of the cartilage graft, and the contralateral PDS plate, traversing all layers to ensure stable fixation and prevent graft displacement.

Subsequently, platelet-rich fibrin (PRF) membranes obtained by blood centrifugation were repositioned and secured onto the PDS plates using fine 5-0 PDS sutures

in a U-shaped pattern, ensuring stability of the reconstructive complex and promoting tissue integration.

Postoperatively, all patients received antibiotic therapy until removal of silicone nasal splints. Vitamin A oil-based drops and saline nasal irrigations were recommended until crust elimination. Silicone nasal splints were removed three weeks postoperatively.

Endoscopic evaluation was performed weekly after splint removal until complete healing. All patients were followed clinically and endoscopically at 1, 3, 6, and 12 months postoperatively to assess graft status and integration.

RESULTS

The study included 22 patients with nasal septal perforation, comprising 5 women and 17 men, aged between 18 and 40 years. The maximum perforation size was 20 × 20 mm, and the minimum was 10 × 10 mm. In the majority of cases (n = 20; 91%), the etiology was submucosal resection of the nasal septum. The most common clinical symptom was nasal crusting, reported by 14 patients (64%).

At the first postoperative evaluation, complete closure of the perforation was achieved in 77% of patients (n = 17), while 23% (n = 5) exhibited partial closure. At 3 months postoperatively, the success rate increased to 86%, with complete closure in 19 patients and partial closure in 3 patients. At the 6-month follow-up, complete closure was observed in 20 patients (91%), with partial closure persisting in 2 patients (9%), both of whom were smokers. At the 12-month follow-up, the success rate remained stable at 91%, with persistent partial closure in the same two patients (fig.3).

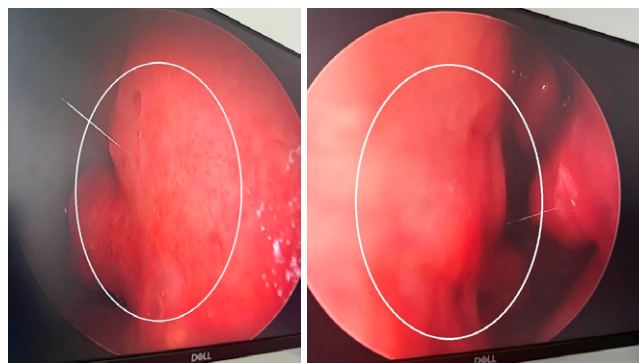


Figure 3. Postoperative endoscopic images of the nasal meatus with the assessment of the state of the nasal septum and the integration of the graft

DISCUSSION

An anatomical deformity of the cartilaginous nasal septum results in abnormal communication between the two nasal cavities, known as nasal septal perforation. The condition may arise from various causes, including intranasal drug abuse (e.g., cocaine), prolonged use of intranasal corticosteroids or vasoconstrictors, trauma, occupational exposure, infections (tuberculosis, leprosy, syphilis, HIV, invasive fungal infections), systemic vasculitides and autoimmune diseases, monoclonal systemic therapies, and neoplastic processes^{2,5}.

The most common cause remains previous septal surgery. The location and size of the perforation are closely correlated with clinical manifestations. Large anterior perforations are associated with a broad spectrum of symptoms, whereas small posterior perforations are often asymptomatic. Nasal obstruction is the most frequently reported symptom, followed by nasal discharge, crusting, local pain, and epistaxis^{3,5}.

Asymptomatic perforations generally do not require treatment. Patients with moderate symptoms should initially undergo conservative therapy, while surgical intervention is recommended for severe symptoms or when medical management proves ineffective^{2,9,10}.

Traditional surgical techniques for septal perforation repair are limited by the risk of graft displacement or loss due to insufficient fixation. To address these limitations, PDS plates were utilized to ensure firm fixation of the cartilage graft and provide temporary structural support during tissue regeneration^{4,7}.

PDS plates act as a supportive scaffold for the healing process, promoting graft integration and progressive epithelialization of the reconstructed area. The application of this method resulted in favorable outcomes in approximately 95% of cases, demonstrating the effectiveness of the sandwich graft technique using PDS plates for moderate septal perforations^{8,11}.

To further enhance septal mucosal regeneration, PRF membranes—rich in growth factors and stem cells—were incorporated into the sandwich technique. Their integration contributed to accelerated healing and improved mucosal regeneration, leading to faster and more stable epithelialization of the operated area^{6,12}.

ADVANTAGES AND LIMITATIONS OF THE TECHNIQUE

Limitations

For optimal stability of septal reconstruction, the technique requires the use of silicone nasal splints maintained in situ for approximately three weeks.

During the resorption process of the materials used—PDS plates and PRF membranes—a transient thickening of the anterior septum may occur, potentially causing temporary nasal obstruction during the first three postoperative months.

Advantages

The proposed technique does not require expensive, complex, or aggressive materials, making it accessible and reproducible in routine clinical practice.

It represents a relatively straightforward surgical procedure that can be successfully performed via an endoscopic approach with minimal tissue trauma.

Compared with rotation flap-based techniques, this method preserves ciliated epithelial function, contributing to favorable functional recovery and reducing the risk of postoperative anterior rhinorrhea.

CONCLUSIONS

Reconstructing medium-sized nasal perforations using the 'sandwich' graft technique is an effective and simple procedure, and it has shown a high success rate after postoperative monitoring.

Ethics Statement and Conflict of Interest Disclosures

Financial support and sponsorship: All authors have declared that no financial support was received from any organization for the submitted work.

Ethics Consideration: The authors declare that all the procedures and experiments of this study respect the ethical standards in the Helsinki Declaration of 1975, as revised in 2008(5), as well as the national laws. Written informed consent was provided by all the patients participants in this study. This study was approved by the Institutional Research Board and Ethics Committee.

Conflict of interest: No known conflict of interest correlated with this publication.

Availability of data and materials: The data used and/or analyzed throughout this study are available from the corresponding authors upon reasonable request.

Competing interests: The authors declared that they have no competing interests.

The use of generative AI and AI-assisted technologies: The authors did not use in this article generative AI and AI-assisted technologies.

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