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Septal perforation repair using costal chondro-perichondrial graft: a case report

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Septal perforation is an anatomical defect of the nasal septum that leads to impaired nasal function, including obstruction and respiratory issues. In this study, a novel surgical approach was introduced to address septal perforations, focusing on the use of costal composite chondro-perichondrial grafts bilaterally in a symmetric manner. This composite graft, composed of costal cartilage and perichondrium, provides mechanical support, aids vascularization, and minimizes perichondrial shrinkage. A case study of a 23-year-old patient with septal perforation resulting from multiple rhinoplasty procedures is presented. The surgical procedure involved the use of a composite graft to close the septal perforation and correct the nasal deformity. The postoperative results demonstrated successful septal perforation closure and relief from nasal discomfort. This study highlights the advantages of this method, particularly its simplicity and straightforward surgical procedures for closing septal perforations of various sizes, and its suitability for rhinoplasty surgeons who are familiar with costal cartilage harvesting.

Abbreviations: CT, computed tomography; PDS, polydioxanone suture

Keywords: Case reports / Costal cartilage / Nasal septal perforation / Rhinoplasty

Case Report

INTRODUCTION

Septal perforation is an anatomical defect of the mucosa, bone, and/or the cartilaginous nasal septum [1]. Abnormal communication between the two nasal cavities causes a loss of intranasal laminar airflow, resulting in impaired nasal airway function [2]. Disturbance of the laminar airflow may cause an inspiratory whistling sound. In addition, there is damage to the respiratory epithelia and a sense of obstruction, dryness, and crusting, which leads to nasal obstruction, epistaxis, and postnasal drip [3]. Prior surgical procedures, septal trauma, intranasal drugs, occupational exposure, inflammation, infections, and malignancies are causes of septal perforation. Septal perforation is mostly iatrogenic in adults [4].

Numerous surgical techniques, including flap procedures and interpositional grafting, have been explored as potential methods for treating septal perforations. However, standardized surgical protocols to achieve consistent outcomes have not been clearly elucidated. In this study, we introduced a novel method using two costal composite chondro-perichondrial grafts bilaterally as interpositional grafts to obturate a septal perforation. Survival of the composite graft can be enhanced by increased vascular ingrowth between the perichondrial portion and the nearby mucoperichondrial flap attachment [5]. In addition, the mechanical support provided by the cartilage in the composite graft strengthen the resistance to shrinkage of the perichondrium after grafting. Notably, this surgical approach is advantageous for rhinoplasty surgeons already familiar with harvesting costal cartilage because of their technical familiarity with harvesting costal composite chondro-perichondrial grafts.

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CASE REPORT

A 23-year-old woman visited our clinic for correction of a nose deformity. The patient had a history of five rhinoplasty procedures. Owing to several previous surgeries followed by infection, her nose contracted, resulting in a nasal soft triangle deformity along with septal perforation. She complained of nasal stuffiness, dryness, crusting, and whistling. The septal perforation was examined using a facial computed tomography (CT), and a septal perforation of 5.3 × 7.1 mm was observed in the lower third of the nasal septum (Fig. 1A). The surface area of the septal perforation was 28.49 mm^2.

To correct the septal perforation, we planned to use an interpositional graft with a composite graft (made of two chondro-perichondrial grafts) harvested from the costal perichondrium and rib cartilage to close the septal defect while correcting the contracted nose deformity (Fig. 2).

Under intravenous anesthesia, the nasal septum was injected with 2% lidocaine and 1:100,000 epinephrine. Using an inverted-V-shaped columellar incision and bilateral infracartilaginous incision, the nasal envelope was elevated, exposing the lower lateral cartilages. The septum was accessed via a medial crural approach through a membranous septum located between the medial crura of the lower lateral cartilage. Bilateral mucoperichondrial flaps of the septum were raised to expose the location of the septal perforation and to prepare room for the placement of the interpositional composite graft, which consisted of the costal cartilage and its perichondrium.

A 2.5 cm incision was made along the costal cartilage of the left seventh rib. After exposing the bone-cartilage junction and superior and inferior borders of the cartilage, a longitudinal incision was made along the superior and inferior borders of the cartilage using a scalpel blade 15. Additionally, a vertical incision was made on the perichondrium of the rib-cartilage junction and 4 cm medial to the junction.

The overlying perichondrium and costal cartilage were sliced together to preserve their intact attachment. The cartilaginous portion of the graft was thinned using a scalpel blade (no. 11) to match the thickness of the septum after it was positioned bilaterally, with each graft facing the other. The composite graft was then bisected at its center, allowing each graft to be placed on either side of the septal perforation. The graft was 2.0 × 1.2 cm in size (Fig. 3A). Composite grafts were positioned between the mucoperichondrial flaps at the location of the septal perforation (Fig. 3B). The perichondral side of each graft faced the nasal cavity. The grafts were inserted bilaterally and fixed with two sutures on the lower caudal border of the remaining septum using 5-0 polydioxanone suture (PDS). In addition, a trans-septal suture with 4-0 PDS was used on the upper border of the graft to secure its position of the composite graft.

Along with septal perforation repair, the scroll ligament and hinge complex were released, and the soft tissue deficiency in the left soft triangle was grafted with an auricular composite graft. The columellar incision was sutured with a 7-0 nylon su-

Fig. 1. Pre- and postoperative computed tomography scans of septal perforation of a 23-year-old woman. (A) Preoperative scan (axial plane and coronal plane). (B) Postoperative 8-month scan (axial plane and coronal plane).

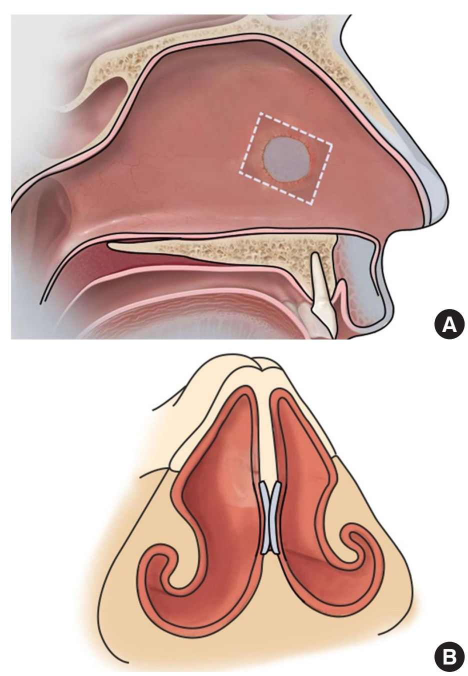

Fig. 2. Illustration of septal perforation repair using bilateral costal composite chondro-perichondrial graft. (A) Location of the interpositional graft (white dotted line). (B) Bilateral placement of the composite graft, with perichondrium layer facing the nasal cavity.

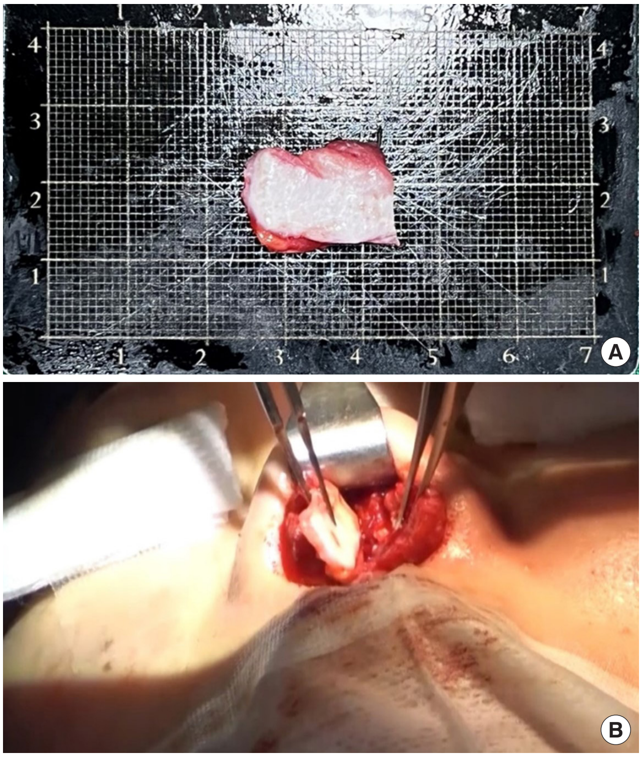

Fig. 3. Intraoperative clinical photographs. (A) Harvested costal composite chondro-perichondrial graft (costal cartilage side). (B) Placement of the costal composite chondro-perichondrial graft as a bilateral interpositional graft.

ture and the infracartilaginous incision was closed with 6-0 Vicryl suture. Silicone sheets were placed on both sides of the septum as septal splints.

After surgery, the patient visited the clinic for regular check-ups and stitch removal. The septal splints were removed on postoperative day 7. Follow-up visits to examine the operative results of the septal perforation were conducted at 1, 2, 3, 6, and 8 months postoperatively. CT scans were reviewed at 1, 3, 6, and 8 months. Septal perforation was successfully obstructed. The perichondrium underwent mucous metaplasia and its volume decreased, causing the vestibular lining to become flat, resembling the nasal mucosa, which was confirmed with CT scans and nasal endoscopy at the 8-month follow-up examination (Figs. 1B, 4). In addition, the patient experienced relief from nasal discomfort, including stuffiness, dryness, and crusting, and was satisfied with the postoperative results.

DISCUSSION

Septal perforation is a common postoperative complication of septal procedures, including septal cartilage harvesting, by plastic or ear, nose and throat surgeons [6]. CT scan is an objective tool used to locate and measure the sizes of septal perforations.

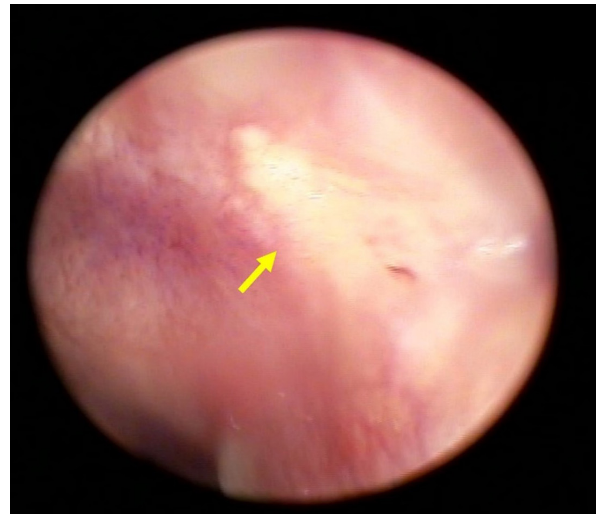

Fig. 4. Nasal endoscopic photograph of the septal perforation reconstruction at postoperative 8 months (yellow arrow).

These perforations are typically categorized based on their size: small (approximately ≤1 cm), medium (1 to 2 cm), and large (≥2 cm). Septal perforations can occur in both the cartilaginous and bony septa. These are further classified as either anterior or posterior. The exit of the incisive canal serves as a reference point for distinguishing between anterior and posterior nasal perforations [2]. In practice, approximately 92% of the nasal perforations are observed in the anterior portion, whereas 8% occur in the posterior portion. Anterior perforations are more likely to be associated with trauma and tend to be more symptomatic, often presenting with symptoms such as bleeding and crusting [1]. Small perforations seldom heal naturally but become larger with persistent friction, such as from abnormal turbulent air forces and mechanical picking [7]. There have been many trials of different surgical techniques for correcting septal perforations.

Surgical methods for addressing septal perforations can be categorized into two main approaches. The first approach involves the use of distant or pedicled flaps. Inferior meatus, inferior turbinate, anterior ethmoidal artery septal, and greater palatine artery pedicled flaps have been advocated for septal perforations [8-11]. Although flap procedures have high success rates in closing septal perforations, they have certain disadvantages associated with them. The flap procedure unilaterally closes the perforation, leaving the other side for secondary healing. Also, as the donor site mucosa or perichondrium is concomitantly elevated, the donor site is left to heal with secondary intention. The need for secondary surgeries for flap division is another drawback, and the large size of flap elevation required for rotation poses a challenge. Furthermore, when considering flap shrinkage, the flap size must be significantly larger than the perforation site to ensure adequate defect coverage. The need for a larger flap size can result in substantial donor site defects.

The second approach is to use interpositional grafts, often in combination with the elevation of nearby mucoperichondrial flaps. Incorporation of graft materials is recommended to relieve excessive tension on the suture line of the septal mucosa, thereby reducing the risk of wound disruption. In cases where mucosal flaps are elevated, it is common to find insufficient viable mucosal tissue to effectively close the perforation, especially in patients with larger perforations. Interpositional grafts prevent excessive tension and potential complications, such as distal flap ischemia and wound dehiscence, and help avoid reperforation of the septum [12]. The incorporation of graft materials has been shown to yield a high success rate for the treatment of septal perforations [13]. Interpositional grafts serve as a template for mucosal migration from the mucosal margin during the healing process and prevent mucosal flaps from shrinking [14]. Studies have utilized the deep temporal fascia, costal cartilage perichondrium, and acellular dermal matrix as interpositional grafts for septal perforation reconstruction [15]. Cartilages are utilized together to provide a rigid backbone to withstand turbulence and mechanical stress. These include the septal and auricular cartilages alone or wrapped with deep temporal fascia [16-19].

Costal cartilage has also been used as an interpositional graft for septal perforation obstructions. It has been suggested that costal cartilage wrapped with perichondrium provides structural support and prevents thinning of the septal mucosa [20]. Furthermore, because the perichondrium of the costal cartilage is thicker than the deep temporal fascia, it can provide better structural support to the septal mucosa, thereby providing lasting long-term results. The costal perichondrium exhibits similarities to the normal septal mucoperichondrium in the repaired area and may assist in vascular ingrowth into the mucosal flaps [15].

Our method, which utilized a composite chondro-perichondrium graft as an interpositional graft, aimed to maintain the attachment of the perichondrium and costal cartilage. In our approach, we prioritized preserving the integrity of the perichondrium-cartilage structure and achieved closure of the septal perforations by positioning two composite grafts bilaterally. This positioning ensured that raw cartilage was not exposed to the nasal cavity. Our procedure, which incorporated the use of composite grafts, enhanced the survival of both the costal cartilage and perichondrium. This is because the nutrients supplied to the perichondrium can also be obtained from the intact septal cartilage and not just from the edges of the perichondrium. During the preparation of the interpositional graft, the costal cartilage can be carved to mimic the thin, straight characteristics of the septal cartilage, while preserving the intact perichondrium superficially. These grafts can be bilaterally inserted to reconstruct the septal mucosa on both surfaces of the septum, with the perichondrium serving a role similar to that of the septal mucoperichondrium in the recipient area. In comparison to other costal cartilage interpositional graft methods, we minimized the need to elevate the mucoperichondrial flaps. In the past, to prevent the recurrence of septal perforations, mucosal flaps were raised either superiorly or inferiorly, creating bipedicled flaps to advance and close the surface exposed by the interpositional graft [15]. Our proposed method is simple and straightforward. Once the room for the composite interpositional graft is secured, there is no need to elevate the mucosal flaps to cover the area that is already protected by the perichondrium of the composite graft.

This approach is particularly beneficial for rhinoplasty surgeons who are proficient in harvesting costal cartilage. They can readily adapt to the process of obtaining a composite graft, which is composed of costal cartilage and perichondrium, while simultaneously performing aesthetic rhinoplasty using costal cartilage grafts. Furthermore, the risk of pneumothorax during graft harvesting is reduced, as harvesting the superficial layer of the costal cartilage, along with the overlying perichondrium, avoids contact with the perichondrium underneath the costal cartilage and the parietal pleura.

Our idea of utilizing a composite graft resulted in a successful outcome for correcting septal perforation and may enhance the concept of septal perforation reconstruction. A limitation of our study is that further long-term observation with an increased number of cases is required to confirm the consistent outcomes of this approach in correcting septal perforations. However, we believe that this is an interesting and readily applicable approach to correct septal perforations during aesthetic rhinoplasty procedures.

NOTES

Conflict of interest

No potential conflict of interest relevant to this article was reported.

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None.

Ethical approval

This study was exempted from the Public Institutional Review

Board (IRB) designated by Ministry of Health and Welfare, Republic of Korea (P01-202311-01-045).

Patient consent

The patient provided written informed consent for the publication and use of her images.

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