

Repair of Nasal Septal Perforation Using Polycaprolactone Plate and Temporalis Fascia Graft

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Trauma is the predominant cause of septal perforation resulting from surgical operation for nasal septum including submucosal resection. A 24-year-old female patient was diagnosed with nasal septal perforation after septoplasty. The patient manifested no specific symptoms except for occasional nasal bleeding, whistling and stuffy nose. Nasal septal perforation measuring 5×5 mm² in size was observed at the anterior portion of nasal septum. The present study involves the repair of nasal septal perforation employing a polycaprolactone (PCL) plate and temporalis fascia graft, and discusses the consequences of complete closure of perforation without complications.

KEY WORDS: Septum · Perforation · Repair · Polycaprolactone plate · Temporalis fascia.

INTRODUCTION

Nasal septal perforation is clinically frequent disease in which the osseous or cartilaginous portion of the nasal septum is defective together with the mucous membrane on both sides. Nasal septal perforation is attributed to several factors, such as trauma inside of the nasal cavity, cauterization used for hemostasis of nasal bleeding, inflammatory disease, inhalation of aspiratory stimulants, heavy metal intoxication, and tumors, and unknown causes. Among them, the predominant surgical cause includes submucosal resection.¹⁾

Closure of nasal perforation is one of the most fascinating and challenging procedures in nasal reconstructive surgery. It is a challenge for both the surgeon and the patient, with the primary goal of restoring anatomical and functional integrity. Surgical success is based on a precise definition of etiology, location and the method employed during the intervention along with particular attention to pre- and post-

operative care.²⁾

The present study introduces the repair of nasal septal perforation using a polycaprolactone (PCL) plate and temporalis fascia graft. The consequence of complete closure of the perforation surgically was demonstrated through the follow-up.

CASE REPORT

A 24-year-old female patient, who was diagnosed with nasal septal deviation in a private clinic in 2012 and a history of nasal septal deviation correction without underlying diseases, presented to the ENT department for a personal medical examination and treatment in March 2019. The examination revealed nasal septal perforation. The patient manifested no specific symptoms except for occasional nasal bleeding, whistling and stuffy nose. The nasal septal perforation measuring 5×5 mm² in size was observed at the anterior portion of the nasal septum during the nasal en-

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oscopic examination conducted in the outpatient department (Fig. 1). No other specific findings were observed during the additional examination via paranasal sinus computed tomography (PNS CT) (Fig. 2). No potential causes of nasal septal perforation such as syphilis or tuberculosis were detected during the pre-operative examination. The caudal portion of the left nasal septum was split vertically with a #15 scalpel, and the perichondrial sub-layer was separated. Subsequently, the mucous membrane flap around perforation was lifted sufficiently to expose the nasal septum around the perforation. The temporal skin of the scalp was incised and the top and bottom of the temporal fascia were separated by using 'Freer Elevator'. The temporalis fascia measuring 2×2 cm² was harvested (Fig. 3). A PCL plate measuring 8×8 mm² was designed, which was slightly larger than the perforation. The plate was wrapped with the prepared temporalis fascia and sutured in order to avoid exposure of

the PCL plate (Fig. 4). The PCL plate wrapped with temporalis fascia was placed on the defective portion of the nasal septum and covered with a mucous membrane flap (Fig. 5). The anchor sutures of the two points were performed in order to fix the graft using Vicryl 4-0. Silastic sheet were inserted on both sides of nasal septum and the three points were sutured using Nylon 3-0. The operation was termi-



Fig. 1. Preoperative endoscopic view showing 5×5 mm² septal perforation in the nasal cavity.



Fig. 3. The PCL plate was larger than the size of the perforation and the temporalis fascia.

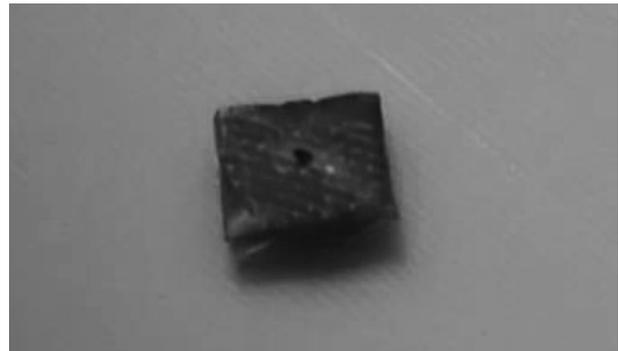


Fig. 4. The PCL plate was covered with temporalis fascia.

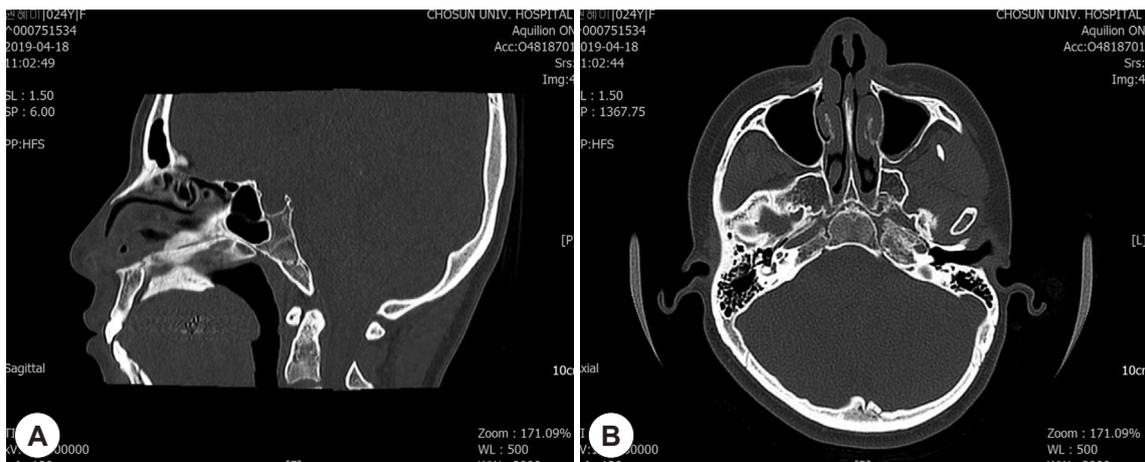


Fig. 2. Preoperative paranasal sinus-computed tomography (PNS CT) shows septal perforation. A: sagittal view. B: axial view.

nated when the nasal cavity was completely packed using Meroceel (Medtronic, Jacksonville, FL, USA) to prevent nasal bleeding and nasal septal hematoma. The Silastic sheet was left for 3 weeks and then removed after the complete closure of nasal septal perforation (Fig. 6). During the 6-month follow-up of the patient no specific complications or additional nasal septal perforations were detected.

DISCUSSION

Nasal septal perforation is an intractable disease of the nasal septum. Trauma is the predominant cause of the disease. Submucosal resection is the primary factor inducing

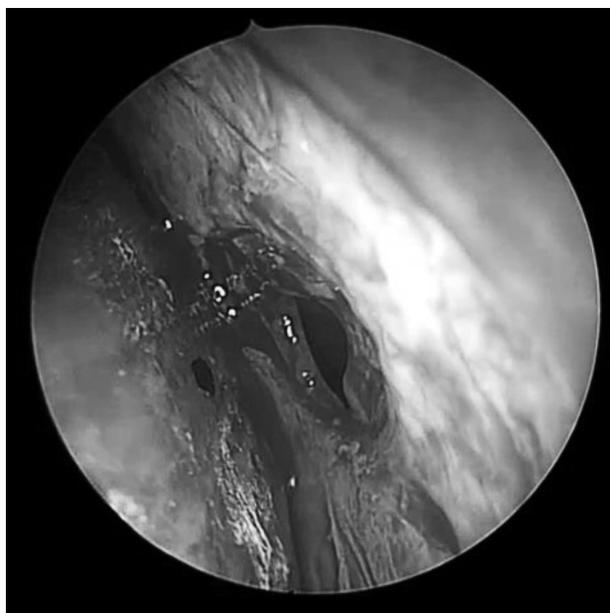


Fig. 5. The PCL plate and temporalis fascia complex were inserted into the perforation site.

perforation during surgical treatment. Further, nasal septal perforation is attributed to multiple factors, such as the habit of nose-picking, post-traumatic nasal septal hematoma, cryosurgery of nasal turbinates, and repetitive cauterization for hemostasis of nasal bleeding. Diphtheria, typhoid, syphilis, septal abscess, tuberculosis, Wegener's granulomatosis, and sarcoidosis constitute the inflammatory causes. The disease can be also induced by exposure to inhalant stimulants, cocaine, or to heavy metals such as chromium, mercury, lead, and copper. Nasal septal perforations may result from tumors or cancers such as leukemia or unidentified factors.¹⁾³⁾

Symptoms of septal perforation include epistaxis, nasal crusting, whistling, nasal obstruction, and saddle-nose deformity, which prompts patients to visit facial plastic surgeons for surgical repair.⁴⁾ While posterior perforations often remain asymptomatic, large and more anterior perforations can create significant distortions in the laminar airflow and heat-moisture exchange.⁵⁾⁶⁾

No specific treatment for nasal septal perforation is needed unless symptoms such as nasal stuffiness, crust, and nasal bleeding are found, which warrant prompt treatment.⁷⁾⁸⁾ Treatment entails surgical and non-surgical interventions. Non-operative interventions may include nasal cleaning, topical intranasal application of ointments or steroids. The use of a button-type closing plate first developed by Dencke and Meyer, and the adoption of Silastic button first introduced by Facer, Kern, and Pierre, have resulted in satisfactory resolution of symptoms. Such methods are frequently employed for the management of patients diagnosed with vascular diseases or active granuloma, or for cases considered high risk for operation. However, the meth-

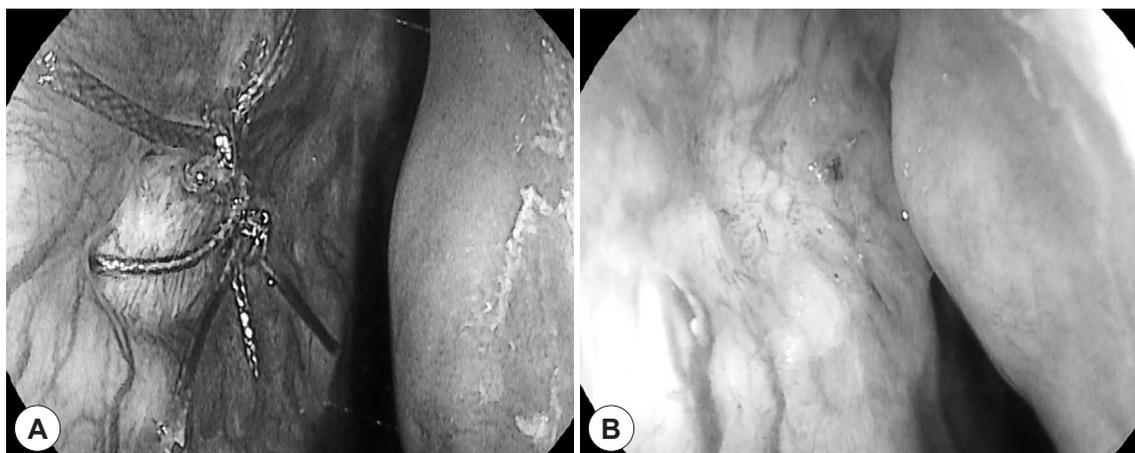


Fig. 6. Postoperative nasal cavity reveals complete closure of septal perforation. A: POD 3 weeks. B: POD 6 months.

ods have disadvantages associated with sensation of foreign bodies, nasal closure, sustained bleeding, and escape of the button from a large size of perforation etc.¹⁾

Surgical procedures used to treat cases of nasal septal perforation include middle turbinate mucosal flap, inferior turbinate flap, labiobuccal flap, bipediced septal mucoperichondrial flap, nasal floor mucoperiosteal flap, and vestibulo-conchal flap, which are currently used to reconstruct nasal septal perforations of relatively larger size. However, these methods require multiple interventions to overcome the difficulties associated with intranasal sutures.⁸⁾

Graft materials used for the reconstruction of nasal septal perforation include several approaches, such as nasal septal cartilage, perpendicular plate for ethmoid, periosteum of nasal bone, temporal fascia, pericranium, periosteum of mastoid, auricle, and middle nasal concha.¹⁾ Synthetic materials such as acellular dermis, fascia lata, polydioxanone (PDS) have gained in popularity in recent times. The study demonstrates a comparable success rate using autologous and homologous grafts.

More recently, interposition grafting using both synthetic and autologous grafts has been reported. Interposition grafts of polydioxanone (PDS) plates combined with a temporoparietal fascia (TPF) graft have demonstrated the highest success rates, ranging from 90% to 100%. This approach does not attempt to close or approximate the mucosal edges across the perforation; however, it provides an ideal scaffold of mesenchymal origin to revascularize and promote mucosal regrowth.⁴⁾

Thus, in the present study, the interposition graft, using temporalis fascia and PCL plate instead of PDS plate, was carried out. The advantages of 3D-printed PCL plate include bioabsorption, biocompatibility, origin from three-dimensional and microporous structures, and excellent resistance to load mechanical strength, all of which promote tissue in-growth and neovascularization.⁹⁾ These advantages have prompted the investigation of PCL plate as a mechanically and structurally implantable scaffold in rhinoplasty. The PCL plate is a safe implant material for nasal reconstruction; it exhibits good stability via incorporation into the host tissue and maintenance of immune response.⁴⁾ Recent animal tests and rhinoplasty employing the PCL plate showed favorable outcomes without significant complications. However, the reconstruction of nasal septal perforation using the PCL plate and temporalis fascia has yet to be reported.

In the present study, the reconstruction of nasal septal perforation was carried out using an interposition graft via an endoscopic intranasal approach employing PCL plate and temporalis fascia. Compared with the conventional mucous flap, the operation was simple and required less time; however, the harvest of temporalis fascia has a morbidity.

The rates of successful reconstruction of nasal septal perforation vary widely. Thus, the surgical approach and the use of flaps and grafts is based on the size and location of perforation, adequate visibility of operation site, securing healthy and sufficient mucous flap, and obtaining pertinent grafts.⁸⁾

Some studies have investigated the predictive factors of surgical outcome in perforation repair. A recent systematic review found that large perforations measuring over 2 cm in size increased the risk of surgical failure. However, bilateral closure of the defect with a vascularized flap improved healing. Interposition grafts appeared to facilitate closure, but this factor was not statistically significant. Successful outcome was reported for 78% of patients with large perforations and in 90% of cases involving small-to-moderate perforations, but most studies comprised small patient series.¹⁰⁾

The effect of perforation size was also seen, with a good closure rate for small perforations. Large perforations still remain a challenge.¹⁰⁾ Thus, the larger perforations need further investigation.

Even though the size of perforation is not too large in this case, the use of PCL graft in the framework of temporalis fascia graft facilitated not only the regrowth of the septal mucosa but also the management of temporalis fascia via insertion and fixation.

In the present study, Silastic sheet were fixed on both sides of the nasal septum for 3 weeks without any inflammatory response. The complete closure of nasal septal perforation was observed. The follow-up of outpatient over 6 months revealed no specific complications or additional nasal septal perforations. Thus, the use of a PCL plate and temporalis fascia in the reconstruction of nasal septal perforation yielded successful clinical and patient outcomes without complications.

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