Augmentation Rhinoplasty With Expanded Polytetrafluoroethylene and Prevention of Complications

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Objective: To optimize the long-term results and reduce complications of augmentation rhinoplasty using expanded polytetrafluoroethylene (e-PTFE).

Methods: There are certain key principles. The implant should be shaped to conform to the contour of the underlying nasal structure. It should be formed in a gentle curve, without twisting the implant, to preserve mechanical stability as well as to maintain aesthetic appearance. A strict sterile technique during the procedure and a good aseptic technique in the postoperative period are important to prevent infection. External fixation of the implant helps stabilize it.

Results: Based on the above principles, 1700 patients underwent augmentation rhinoplasty with e-PTFE from 1999 to 2009. The criteria evaluated included complications and postoperative results: (1) bleeding volume, (2) postoperative swelling of the nose, and (3) pathologic and aesthetic outcomes. Extrusion of the prosthesis developed in 3% of cases; malposition of the prosthesis in 3%; slight bleeding and swelling in 80%; moderate bleeding and swelling in 18%; severe bleeding and swelling in 2%; and infection in 1%. Ninety-three percent of the patients reported aesthetic satisfaction.

Conclusion: In this study, adherence to these operative principles played an important role in reducing complications, in preserving the stability of the position of the prosthesis, and in maintaining the aesthetic contour of the nose.

Arch Facial Plast Surg. 2010;12(4):246-251

Solid silicone facial implants were used frequently before 2000. Since 1996, however, the use of expanded polytetrafluoroethylene (e-PTFE), which displays many of the features of an ideal implant material in facial plastic surgery, has been widely accepted. (Gore-Tex [W. L. Gore Associates Inc, Phoenix, Arizona] and Tisuthes [Shanghai Suokang Medical Implants, Shanghai, China] are currently the main suppliers of e-PTFE material in China.) Compared with silicone implant material, e-PTFE is a little softer, has a natural texture, and allows for tissue ingrowth, which is expected to lead to improved outcomes in augmentation rhinoplasty with e-PTFE. However, with long-term follow-up, some authors have reported an overall complication rate as high as 20% (in China) and difficulty in removing the e-PTFE prosthesis from the nose after surgery, which has discouraged the use of this type of prosthesis for augmentation rhinoplasty in Asia. However, there are many articles reporting the use of e-PTFE in many non-Asian countries, with satisfactory results. We describe the use of both Gore-Tex and the Tisuthes soft-tissue patch in augmentation rhinoplasty in 1700 patients from 1999 to 2009 and summarize a series of retrospective experiences in operation design and techniques aimed at improving the operative outcome and minimizing complications.

Methods

Contraindications to augmentation rhinoplasty include acne on the nose, large pores with or without overactive sebaceous glands, nasal hypertrophy or atrophic scar, menstruation, and general poor health. The nasal contour design is discussed with the patient before the operation in order to point out any alteration of the nasal contour and to explain all the procedures that we believe are necessary. It is very important to have a consensual opinion regarding the outcome. Preoperative design of the nasal augmentation, with frontal and lateral views, and 3-dimensional drawings of the nose are key to achieving a satisfactory result.

The principles of e-PTFE nasal prosthesis design are as follows: (1) the length of the prosthesis can be as much as 5 mm longer than the nasal dorsum; (2) the gradient of the prosthе-
sis on both sides of the dorsum is tapered to the shape of the nasal dorsum; (3) the contour of the ventral aspect of the prosthesis should also be shaped to match the surface contour of the nasal dorsum (including the angle of the nasal tip); and (4) the cross-sectional area on the tip of the prosthesis cannot be less than $4 \times 10^{-4}$ mm$^2$ (Figure 1). A strict aseptic technique is required during the procedure. Local anesthesia (5 mL of lidocaine, 2%, with 1:200,000 parts of epinephrine) was used to infiltrate along the superficial layer of the nasal periosteum and cartilage on the nasal columella, nasal tip, and dorsum. Then, 5 to 7 minutes after local anesthesia is administered, the procedure is started. Creating the prosthesis includes the following steps: (1) be precise and do not repeatedly twist or fold the prosthesis; (2) make certain that the cross-sectional area of the tip surface of the prosthesis is at least $4 \times 10^{-4}$ mm$^2$; and (3) trim the bending columella, making sure that there is a natural curve without rebound (Figure 2).

Before placement, the implants must be soaked in a syringe containing a solution of 15 mL of normal saline, 5 mg of dexamethasone, and 16 mg of gentamicin, with repeated aspiration to evacuate air (Figure 3). A V-shaped columellar incision should be used to approach the nose. Then, a dissection is performed on the surface of the cartilages from the incision to the dorsum, which should be under the dorsal nasal fascia. The width of dissected nasal pocket should be 1 cm wider than the width of the dorsum of the prosthesis over the dorsum. Silicone nasal prosthesis sizers are inserted into the pocket to adjust its size and symmetry. The pocket needs to be cleaned with normal saline and compressed with the finger for 5 minutes to stop the bleeding. Next, the e-PTFE prosthesis is placed into the dissected pocket, and a periosteal elevator is used to make it fit.

The patient is then instructed to sit upright to make sure that the prosthesis is placed on the middle line of the face. Finally, the skin is closed with 7-0 silk suture, which is used in an interrupted fashion. Postoperative care includes the following steps: (1) hemostasis is achieved with 5 minutes of compression; (2) tape is placed over the dorsum and the nasal tip for external fixation; (3) an aluminum nasal splint or casting is applied in the usual fashion; (4) nasal splints are used as necessary; (5) a course of postoperative oral antibiotics is prescribed; and (6) erythromycin ointment is applied to the incision. A follow-up visit is scheduled for suture removal 6 days after surgery. The incision area, including the adjacent skin and mucosa, is disinfected with povidone-iodine, 2%, for suture removal. A completely sterile technique is essential. Beware of any suture residuals.
RESULTS

We performed a retrospective review (1998-2009) of 1700 consecutive primary rhinoplasty cases (1570 women and 130 men); 1355 patients received follow-up ranging in duration from 6 days to 4 years. The patients ranged in age from 18 to 57 years (male to female ratio, 8:100). Among the patients who underwent rhinoplasty, the infection rate was 1%, the prosthesis extrusion rate was 3%, and the prosthesis malposition was 3%. Ninety-three percent of the procedures resulted in aesthetic satisfaction.

Appearance was evaluated 7 days after surgery: yellow staining and slight edema were evident on the skin surrounding the nose in 80% of the patients; mild ecchymosis and edema were present in 18%; and severe ecchymosis and edema were observed in 2% (Figures 4, 5, 6, and 7).

COMMENT

During the years 1997 to 1999, the rate of complications after augmentation rhinoplasty with e-PTFE (Gore-Tex) was as high as 13% in our experience (which was published in a domestic journal in 2001). At that time, augmentation rhinoplasty with e-PTFE was based on the technique used for augmentation rhinoplasty with silicone; e.g., the e-PTFE prosthesis was inserted into the tunnel of the dorsum through a small incision in the nostril, frequently causing distortion of the prosthesis. Furthermore, to achieve a better result than with the silicone prosthesis, a larger-size e-PTFE prosthesis was often used, especially in the nasal tip, which can increase the instability of the prosthesis position and cause higher surface tension of the nasal skin. However, because the shape of the e-PTFE prosthesis was difficult to predict, many complications occurred after surgery. Even now, many plastic surgeons in China have performed augmentation rhinoplasty only with the silicone prosthesis rather than with the e-PTFE prosthesis. A recent review of the literature revealed several reports that have introduced improved techniques that could reduce the complications of augmentation rhinoplasty with e-PTFE in China. It is clear that there is a higher complication rate in augmentation rhinoplasty with e-PTFE. According to the analysis, one of the main reasons is that the prosthesis can migrate, which increases the surface tension of local skin or mucosa,2,3 causing skin redness, swelling, hardening, or purple discoloration (mostly in the tip of the nose and the dorsal area) on postoperative day 1 or 2. The red spot radiates to the surrounding skin within 1 week, and, at that time, the typical signs and symptoms of infection are redness, swelling, heat, and pain. Weeks or months after surgery, the prodromal phase of
infection of an e-PTFE implantation develops with the signs of prosthesis migration, which could manifest with a red node in some areas (mostly in and around the columellar incision). Then, the red node develops either an ulceration or a recurrent inflammatory response, which could continue for several months or longer and will not improve with antibiotic therapy. Usually, a granuloma and partial extrusion of the prosthesis will develop. The inflammation cannot be controlled unless the prosthesis is removed. According to the retrospective analysis, pure infection has typical symptoms: there are signs of redness, edema, heat, and pain on the whole area of the

![Figure 5. Augmentation rhinoplasty with expanded polytetrafluoroethylene (L shape). A-D, Preoperative views. E-H, Postoperative views 1 year after surgery.](image)

![Figure 6. Augmentation rhinoplasty with silicone prosthesis and repaired with expanded polytetrafluoroethylene. A-D, Postoperative views 2 years after augmentation rhinoplasty with silicone prosthesis. The nasal contour was very stiff, and the texture was unnatural for an Asian. E-H, Postoperative views 2 years after repair with expanded polytetrafluoroethylene.](image)
be trimmed by making many horizontal incisions on the sectional area of the tip of the prosthesis is smaller than no sharp angles, especially in the tip area. If the cross-section area is limited to the nose.

In our retrospective analysis of all patients, we found that the tip of the e-PTFE prosthesis is normally within 3- to 8-mm thick and no less than 4 × 4 mm² on the surface section area. This meets the needs of both safety and aesthetics. Therefore, we can develop some criteria to evaluate the safety of the prosthesis. The smoothness of the dorsal and the tip surface, removability of the prosthesis, normal skin color surrounding the tip, and minimal tension when closing incision are all clinical indicators of a safe prosthesis implantation.

On retrospective review, it is clear that there is a close relationship between postoperative bleeding, edema, infection, and prosthesis displacement. Postoperative bleeding and edema reflect the quality control of the operation and surgical skill. They also influence patient satisfaction and cause psychological sequelae. The following complications were reported:

1. Slight bleeding and mild edema. If the bleeding is eventually absorbed, the skin surrounding the nose heals with yellow staining from hemosiderosis, and the edema is limited to the nose.
2. Moderate bleeding and edema. Yellow staining with purple discoloration (ecchymosis) is present, and edema extends to the epicanthus and the glabella.
3. Severe bleeding and edema. Yellow staining extends from the nose to the adjacent area, with ecchymosis and edema subsequently extending to the midface and eyelids. If the prolonged bleeding and edema last more than 5 to 6 days, action has to be taken to prevent further complication or infection. Also, reopening of the wound for control of postoperative hemorrhage should be considered.

In conclusion, for augmentation rhinoplasty with ePTFE, a lower complication rate can be achieved by strictly adhering to the following guidelines: any contraindications should be excluded before surgery; the prosthesis design should be appropriate both mechanically and aesthetically; the prosthesis should be shaped in a gentle curve; aseptic surgery techniques should be followed; and a safe operative procedure and quality postoperative management are important. Overall, our review demonstrates that augmentation rhinoplasty with the e-PTFE prosthesis can achieve long-term stable results.

Accepted for Publication: April 27, 2010.

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Author Contributions: Study concept and design: Dong and Hongyu. Acquisition of data: Dong and Gao. Analysis and interpretation of data: Dong and Gao. Drafting of the manuscript: Dong and Hongyu. Critical revision of the manuscript for important intellectual content: Dong and Gao. Statistical analysis: Dong. Obtained funding: Dong. Administrative, technical, and material support: Dong, Hongyu, and Gao.

Financial Disclosure: None reported.

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