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.

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 prosthesis...
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 \(4 \times 4\) 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 \(4 \times 4\) 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.

Figure 1. Augmentation rhinoplasty with expanded polytetrafluoroethylene. A-D, Preoperative views of a patient with severe saddle nose. E, Preoperative design of prosthesis with kaolin plaster. F-I, Postoperative views 1 week after surgery.

Figure 2. Design of expanded polytetrafluoroethylene (e-PTFE) prosthesis. The length can be longer (within 0.5 cm) than the nasal dorsum. The gradient on both sides of the dorsum should agree with that of the nasal dorsum. A, The cross-sectional area on the tip of the prosthesis cannot be less than \(4 \times 4\) mm\(^2\). The width of the columella of the prosthesis has to be trimmed to less than half the width of the columella. B, The L-shape of the e-PTFE graft has to be trimmed by making many horizontal incisions on the tip of the prosthesis. C, The contour of the ventral aspect of the prosthesis should conform to the surface contour of the nasal dorsum.
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; eg, 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 that 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

Figure 3. The prosthesis is soaked in a syringe containing a solution of 15 mL of normal saline, 5 mg of dexamethasone, and 16 mg of gentamicin that is repeatedly aspirated to evacuate air.

Figure 4. Augmentation rhinoplasty with expanded polytetrafluoroethylene (L shape). A-F, Preoperative views. G-L, Postoperative views 1 week after surgery. The ecchymosis and edema were insignificant.
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 col-lumellar 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
It is important to decrease surface tension on the nasal skin. After the prosthesis is created, there should be no sharp angles, especially in the tip area. If the cross-sectional area of the tip of the prosthesis is smaller than 4 mm², the increased pressure on the skin may induce ischemia and possibly an ulcer. Therefore, some plastic surgeons have used autogenous cartilage to cover the tip of the prosthesis. The L-shaped e-PTFE graft has to be trimmed by making many horizontal incisions on the tip of the prosthesis, and the width of columella of prosthesis has to be trimmed to less than half the width of columella to be free of tension in the desired contour and to prevent distortion of the prosthesis in the tunnel of the dorsum.

To prevent migration of the prosthesis, which may cause pressure on local tissue, we designed an operative placement procedure to facilitate the position of the implant. An open approach with a V-shape incision allows broad exposure so the prosthesis can easily be put into the pocket. A silicone sizer for each of the different sizes is used to determine the appropriate size for augmentation, thereby preventing frequent placement of the e-PTFE implant and minimizing distortion of the prosthesis. The pocket has to be dissected wider than the prosthesis by 1 cm. If the incision and dissected pocket for the implant placement are too small, the prosthesis may bend or distort, leading to increased surface pressure on the adjacent tissue. The pressure has to be minimized by flattening the fashioned implant to prevent any folding.

The relationship between the volume of the implant and the stability of the implant in the nose is critical for a successful outcome. Compared with Caucasian noses, most Asian noses have lower nasal dorsi and nasal tips. The nasal tip skin is usually thick and bulbous. A thicker and narrower prosthesis is required if a Caucasian-style nose is desired. Normally, the smaller and thinner prosthesis is more stable at its implanted position and exerts less surface tension onto the nasal tip skin. On the contrary, a larger prosthesis exerts more tension and leads to more complications. To prevent nasal tip complications, some surgeons use pieces of autogenous cartilage instead of alloplastic materials at the nasal tip, reducing pressure on the skin. However, in most Asians, the thickness of the auricular conchal cartilage may not be sufficient to create the desired aesthetic result at the nasal tip.

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 have developed 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 e-PTFE, 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.

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