Alloplastic Implants and Homografts in Nasal Reconstruction

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Grand Rounds Presentation
April 2005
Implants in Nasal Reconstruction

Historically, various materials used—some bizarre:

- Vaseline, paraffin, gold, silver, aluminum, porcelain, celluloid, ivory, cork, stones from the Black Sea, fingernails, toothbrush handle

More recent materials include:

- Metals (titanium), ceramics, polymers (silicone, polyethylene, PTFE, polyesters, polyamides)
Goals

- Create an aesthetically inconspicuous nose while preserving the functional aspect
- Defects must be appreciated in three layers: inner lining, structural foundation and outer covering
- Structural grafting is often required to:
  - Provide rigidity to the sidewall and resist lateral collapse during inspiration
  - Prevent cephalic retraction of the alar margin
  - Establish nasal contour and projection
Use of Alloplastic/Homograft Material

Preferred graft material to rebuild structure is autologous cartilage; however,

- Cartilage may be in short supply
- Donor site morbidity may preclude autologous cartilage harvest
- Quality of available cartilage may preclude use
- Bone grafting has several drawbacks as well
Options

- **Alloplasts**
  - Silicone
  - Porous High Density Polyethylene
  - Extended PTFE

- **Homograft**
  - Alloderm
  - Rib cartilage
Solid Silicone Rubber [Silastic]

- Solid, non-porous implant which is not incorporated into surrounding tissues
- Capsule-forming
- Elicits minimal inflammation
- Tendency to extrude/migrate
- Cannot be used in thin-skinned areas
- Used as L or I-shaped implant or the “bird”
- Popular in Asian countries
“A strong academic bias against the use of alloplastic materials in the nose persists in Western countries. Influential surgeons condemn silicone implants with the fervor of a Pentecostal preacher admonishing that their use in the nose constitutes a cardinal sin of rhinoplasty, obviously ignoring the fact that long-term results using this material in the Asian nose have been excellent. As a result, few Western surgeons who advocate augmentation of the Asian nose with alloplasts have reported their results, and those who dare to submit such reports often assume a deferential, quasi-apologetic posture.” McCurdy Facial Plastic Surgery, 2003
Silicone Augmentation Results

- Ahn 2004: 100 silicone augmentation rhinoplasties with 2-5 yr follow up
  - No extrusions; 5 patients revised for misalignment, 2 for tip graft shifting, 1 for recurrent dorsal edema
- Lam 2003: 1079 rhinoplasties with the “bird”
  - 3% infection rate; 3% displacement; no mobility or extrusion encountered
- Several smaller series with low complication rates
Complications of Silicone Implant

- May induce skin changes (atrophy, color changes, telangiectasia, swelling)
- Extrusion linked to excessively large implants with overlying skin tension
Porous High-Density Polyethylene-PHDPE

- Medpor formed by sintering PHDPE particles together to form lattice with 100-250 micrometer pores
- Pore size allows for fibrovascular ingrowth of tissue and does not form a capsule; less trouble with migration, more difficult to remove
- Pore size large enough to allow ingress of macrophages (>50 micrometer)
PHDPE/Medpor

- Can be bent in hot, sterile saline and retain bend when cooled
- Available as pre-formed dorsal graft, columellar strut, external valve batten graft
- Has been used in cleft-lip rhinoplasty, post-trauma reconstruction, revision rhinoplasty

Figure 1 Preformed PHDPE nasal implants. Left: 1.1-mm columellar strut; center: nasal dorsal implant with tip; right: 0.85-mm external nasal valve batten.
Placement of PHDPE Implants
PHDPE Complications

Literature review documenting morbidity associated with PHDPE implants (Yaremchuk, 2003) found low rate of infection and extrusion

- Largest series of 187 patients receiving multiple nasal implants reported 5 infections (3 early and 2 delayed) and no implant extrusions
Expanded Polytetrafluoroethylene [Gore-Tex]

- Relies on extremely strong carbon-fluorine bonds
- Nonstick and non-thrombogenic secondary to electronegative surface
- Pores of 10 to 30 micrometers
- Host tissue ingrowth occurs at periphery of implant only

Figure 2  SAM family of implants. GORE SAM is a trademark of W.L. Gore & Associates. (Courtesy of W.L. Gore & Associates.)
ePTFE/Gore-Tex

- Has been used to augment nasal dorsum, lateral nasal wall, premaxilla, supra-tip area, columellar strut, radix, shield grafts, “total lower lateral cartilage reconstruction”

- Literature review by Ham et al in 2003 of 769 Gore-Tex rhinoplasties reports 18 infections and two cases of inflammation requiring removal

- Literature cites 2-3% infection rate
Alloderm

- Acellular human dermis obtained from donated human skin
- Provides soft tissue augmentation that is stable after an early period of resorption (6 months); must overcorrect
- Can be used to camouflage contour irregularities created by alloplastic or autoimplants in nasal reconstruction
Irradiated Homograft Rib Cartilage

- Appears to be stable over time
- Risk of warping decreased if carved from core
- Easy to carve and stabilize with sutures
Follow up IHCC

- Clark (2002) reported 18 patients who underwent removal of extruding alloplastic implant and replacement with IHCC. One pt required revision secondary to warping.
- Burke (2004) reported on 118 patients receiving IHCC with resorption compromising cosmesis in 11%
- Dermirkan (2003) reported no resorption after use of IHCC in 65 patients
- Several other recent reports with low rates of resorption or other complications
Failed alloplastic materials

- Proplast: no longer manufactured in United States; PTFE implant which fractures into microfragments creating chronic inflammatory response
- Supramid: polyamide mesh; undergoes degradation with loss of bulk and is associated with severe inflammatory response
- Mersilene: polyester fibrous mesh; acute and chronic inflammatory response which does not diminish with time
Methods of culturing human chondrocytes is an active area of research.

Recently, the engineering of human nasal septal neocartilage has been described without the use of biodegradable scaffold.