Delayed Infection of Porous Polyethylene Implants After Oncologic Maxillectomy and Reconstruction: 2 Case Reports and Review of Literature

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Abstract
Medpor porous polyethylene implants are commonly used for facial skeletal reconstruction due to reported biocompatibility, fibrovascularization, and durability. While uncommon, late implant infections are an important consideration. We report delayed infections in 2 patients after unilateral total oncologic maxillectomy and reconstruction using Medpor implants for an ossifying fibroma and squamous cell carcinoma, respectively. In the first patient, annual interval computed tomography (CT) scans showed no recurrence of tumor or inflammatory changes. The second was lost to follow-up after adjuvant chemoradiation 1 year after resection. Patients both presented with swelling, drainage, and erythema around the implant at a mean of 4.5 years following maxillectomy. Both failed several attempts at conservative treatment. Cultures of implants removed at a mean of 2.5 months after infection grew α-hemolytic Streptococcus in the first and multiple organisms in the second, showing that the potential for delayed infection should be considered years after reconstruction.

Introduction
Facial reconstruction is often required in cases of facial trauma, congenital deformity, and oncologic resection of the oral cavity or maxillary sinus tumors. In cases that result in loss of the bony facial skeleton, implants can be used to reestablish mid face support and projection. Autogenous materials remain the gold standard, but they are associated with some disadvantages, including donor site morbidity, increased surgical complexity, noncorresponding geometry, graft warpage, and resorption. These complications have led to development and use of allo- genic implants.

Allogenic implants can be used in the reconstruction of a variety of bony and soft tissue facial defects. Because they do not require a donor, these implants have the advantage of being readily available and cause no donor site morbidity. In recent years, porous biomaterials have found favor due to their allowance of tissue ingrowth. Medpor high-density porous polyethylene is one such material used in facial reconstructive and aesthetic operations composed of an interconnecting framework of pores. Pores ranging in size from 160 to 358 μm allow for fibrovascular ingrowth and integration. Collagen deposition throughout the material leads to a stable complex, providing resistance to contractile forces and infection. Although generally regarded as safe, these implants are not without risk, most commonly including infection, implant migration, and extrusion. This article describes 2 cases of delayed infection of Medpor implants used in oncologic maxillectomy and reconstruction.

Case Description/Summary
Two patients were identified requiring maxillectomy and reconstruction with a Medpor implant for an ossifying fibroma and squamous cell carcinoma, respectively.

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In the first case, a 57-year-old Caucasian female initially presented to her dentist for tooth extraction due to continuous pain. Her pain continued postextraction, and after further workup, she was admitted due to continued jaw pain, weakness, and anemia (Figure 1). A maxillofacial CT scan revealed a 4 cm mass in the left maxillary cavity. A CT-guided biopsy revealed a spindle cell and collagenous neoplasm and a diagnosis of cemento-ossifying fibroma of the left maxillary sinus. The patient underwent subsequent excision and total maxillectomy with placement of a Medpor implant. The patient was compliant with postsurgical care and yearly follow-up via interval CT scan. Three years after surgery, the patient presented with left facial pain, left otalgia, postnasal drainage, and halitosis which responded to antibiotics. Six years postreconstruction, she presented with swelling and erythema under her left orbit. Culture from left infraorbital swab showed \( \text{Escherichia coli} \) and \( \text{Proteus mirabilis} \). After a prolonged course of oral clindamycin over 6 weeks, the infection had not yet resolved, so it was elected to proceed with removal. The implant was removed and replaced by an orbital floor plate. On postoperative follow-up, it was noted that the wounds healed well with some left lower eyelid edema and no signs of infection.

In the second case, a 56-year-old African American male presented to his dentist for loose teeth and was treated for an abscess. After referral to a physician, it was noted that the patient had increasing left-sided yellow–green rhinorrhea, intermittent left facial pain, and recent 20-pound weight loss (Figure 1). Patient was found to have a 5 x 6 cm ulcerative and erosive left hard palate mass involving the entire left maxillary alveolus. A CT scan was done, and biopsy of left hard palate revealed squamous cell carcinoma staged T2N2b. The patient had a good response to induction chemotherapy with cisplatin and underwent a total maxillectomy with reconstruction of the zygomatic arch and orbital floor with a Medpor implant and palatal prosthesis with postoperative radiation therapy. Patient was lost to follow-up for 3 years, until he presented with a left lower eyelid swelling, erythema, and a 2-week history of left actively draining pustules. Conservative measures were taken, including incision and drainage and an 8-week course of oral clindamycin, but the patient experienced continued fluctuating edema and drainage. After poor response to conservative therapy, the patient underwent removal of the implant and reconstruction of the orbital floor with titanium. Culture from the removed prosthesis showed \( \text{Proteus mirabilis} \), coagulase negative \( \text{Staphylococcus, Citrobacter koseri, Candida tropicalis, and Escherichia coli} \), and the antibiotic regimen was changed from clindamycin to ciprofloxacin. The patient responded well to treatment, and the infection resolved. There was some left lower eyelid edema early in the postoperative course, but the wounds healed well with a good cosmetic result. The patient was then once again lost to follow-up.

**Discussion**

Although autologous materials remain the gold standard in craniofacial reconstruction, they present with certain disadvantages. These include donor morbidity, differences in corresponding size and shape, possibility for resorption, and more complex surgeries. Alloplastic biomaterials have been developed to circumvent some of these problems. Optimal allo- genic implants should be nonreactive, malleable yet resistant to mechanical strain, and able to integrate with local tissue.

Medpor porous polyethylene is a pure, bio compatible substance with long-term stability and strength that has not been shown to resorb or degenerate. It has also been shown to allow for rapid tissue and vascular ingrowth into pores with minimal surrounding soft tissue reaction. The transportation of cellular products deep into the implant via ingrowth is thought to help in fighting infections. In addition, porous polyethylene’s negatively charged and hydrophobic surface acts as a further deterrent to local bacterial growth and subsequent infection.

The most common complications associated with facial implants using synthetic biomaterials include infection, implant migration, and extrusion. These complications often call for the removal of the implant, though in the case of Medpor, the tissue ingrowth can lead to difficult surgical removal. Complication rates of Medpor implantation generally appear to be low, but Rojas et al theorize that deficient long-term follow-up skews actual complication rates.

Certain factors have been shown to be associated with a higher risk of implant failure, including placement site and diagnosis on admission. Placement sites associated with increased risk include the nose, maxilla, and ear according to Cenzi et al. Although larger, controlled trials are needed to confirm efficacy, some possible techniques aimed at reducing the risk of infection include careful patient selection, proper procedure choice, proper infection control, surgical approach, preoperative implant shaping, and surgical technique.

A study by Farrell et al showed that 3.6% (n = 139) of patients who underwent sellar reconstruction using Medpor presented 8 to 60 months after surgery with chronic sphenoid sinusitis requiring surgical management. All 5 of the patients were found to have mucosal inflammation and edema surrounding the implant and 4 of the 5 presented with partially extruded implants. Another study by Jung et al reviewing long-term outcomes in porous polyethylene orbital implants saw a smaller rate of infection, at 1% (n = 314), with all 3 cases requiring implant exchange.

While uncommon, late implant infections are usually secondary to bacterial seeding from another active source or exposure to the upper aerodigestive tract. Local anatomic barriers determine the route of spread of many orofacial infections. Rese dient and implantation of a prosthesis can disrupt the normal barriers of bone, muscle, and fascia, altering susceptibility to infection.

In these cases, 2 patients with Medpor implants presented at around 6 and 3 years postimplantation with pain, erythema, and drainage after previous oncologic maxillectomies and placement of Medpor implants. Both failed conservative treatment, including prolonged courses of oral antibiotics and incision and drainage. The implants were removed at a mean of 2.5 months after infection and replaced with matrix orbital floor plates.
Cultures of removed implants demonstrated α-hemolytic Streptococcus in one case and multiple organisms in the other (P mirabilis, E coli, coagulase-negative Staphylococcus, C koseri and C tropicalis). After implant removal, there was resolution of both infections, and the wounds healed well.

One removed implant showed α-hemolytic Streptococci, a group which typically includes both Streptococcus pneumoniae and Streptococcus viridans. Due to its abundance in the mouth, S viridans is commonly isolated in from deep neck space infections, and Streptococcus anginosus, a type of viridans streptococci, is notorious for causing head and neck abscesses. Pneumococcus is frequently and asymptomatically present in the nasopharynx, and though they invade cells poorly, they are able to form robust biofilms during colonization.

Cultures from the second implant yielded several organisms, with P mirabilis being the most numerous. Proteus mirabilis, E coli, and C koseri are part of the normal flora of the digestive tract. Candida species are also part of the normal microbiota of the gastrointestinal and genitourinary tracts, and invasive focal infections can occur in the immunocompromised via hematogenous spread, anatomic abnormalities, or the insertion of a foreign body. Few coagulase-negative Staphylococci were cultured. These are a part of normal skin flora and possess low virulence, and infections are typically seen with foreign body insertion or immunocompromise.

In both cases, the late implant infection appears to be due to bacterial seeding from exposure to an active infection or normal upper aerodigestive and skin flora. The patients presented with infections at a mean of 4.5 years after implantation. Due to the gaps in care, it is difficult to determine the origin of the infections and whether they were affected by other factors such as insufficient hygiene or a comorbidity; however, the infections were severe enough to warrant removal of the implants.
Conclusion

Medpor porous polyethylene implants are used as allogenic implants for facial reconstructive surgery due to reported biocompatibility, fibrovascularization, and durability; however, the potential for long-term infection must be considered. Recurrent pain, drainage, and erythema several years after implant placement should trigger suspicion for prosthesis infection. While uncommon, late implant infections are usually secondary to bacterial seeding from another active source (eg, dental infection) or exposure to the upper aerodigestive tract. In these 2 cases, one polymicrobial infection and one α-hemolytic streptococcal infection lead to removal of Medpor implants 3 and 6 years after placement, respectively.

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