Proper Thickness of AlloDerm® in Canal Wall Down Mastoidectomy

Dennis C. Fitzgerald, MD; Matthew K. Steehler, MD; Benjamin J. Wycherly, MD
1Medstar Washington Hospital Center Department of Otolaryngology – Head and Neck Surgery, 2Georgetown University Hospital – Department of Otolaryngology – Head and Neck Surgery, 3The Connecticut Sinus and Otology Institute

INTRODUCTION

It is often a challenge to achieve rapid and complete reepithelialization of a mastoid bowl after a canal wall down mastoidectomy (CWDM). Epithelialization over exposed bone, uncovered by peristium, does not occur without significant inflammation and the formation of granulation tissue. Epithelialization after CWDM occurs primarily by migration of skin from the tympanic membrane and the skin of the external ear canal. This “race” between the migrating skin and developing granulation tissue can lead to most of the cavity being lined by exuberant granulation tissue. If this condition occurs, it leads to surface infections and purulent drainage and requires frequent office debridement, applications of local medications, and, on occasion, revision surgery. Use of potent corticosteroid solutions can sometimes reduce the granulation to the point where the epithelium around the edges will reline the cavity with dry squamous epithelium.

We describe our use of Alloderm Regenerative Tissue Matrix (LifeCell Corp., Branchburg, NJ) as a tissue cover for exposed mastoid bone. By employing this technique, we provide not only a scaffold for vascular ingrowth and epithelial migration, but also a subcutaneous connective-tissue layer that offers bulk and long-term protection against skin breakdown. Water precautions are often no longer necessary in these well healed cavities.

DESCRIPTION OF PROCEDURE

After completing a canal-wall-down mastoidectomy, a 2 x 4 cm piece of AlloDerm with a thickness of 0.33 to 0.76 mm is completely submerged and hydrated in sterile saline. This is performed in 2 separate baths for approximately 5 minutes each. The tissue is fully hydrated when it separates from the paper backing. It is important to note that there is a variability of thickness within each piece of AlloDerm (Figures 1 and 2). We have found that the best graft to line mastoid cavities has a thickness of 0.5 mm. After selecting the AlloDerm to use for the graft, several (4 to 6) pie crust slits are made in the tissue matrix to prevent the collection of blood and serum under the surface of the graft. The tissue matrix is then placed over areas of exposed bone within the mastoid defect with the dermal side (dull and rough) against the bone and with the basement membrane side (shiny and smooth) facing up. Often more than one strip of the 2 x 4 cm size is required for full coverage of the cavity.

After a metaplasty is performed, gelfoam soaked in antibiotic/steroid drops is used to partially fill the cavity. We then treat patients with 7 days of antibiotic/steroid drops. On post-operative day 7, most of the gelfoam is removed, taking care not to disrupt the AlloDerm and drops are continued. After another 2 weeks the patient is asked to stop the drops and administer an antibiotic/antifungal/steroid powder once a day. Then the patient is seen every 2 weeks until the cavity is lined with dry, clean skin.

RESULTS

Patient characteristics
29 patients (30 ears) had CWDM mastoidectomy with AlloDerm to line the mastoid defect from 2003-2008 in 30 ears. 7 patients were excluded due to failure to follow up for a total of 22 patients and 23 ears. There were 18 men and 4 women. The average age was 49 (range 12 to 89).

Surgical results
A total of 6 ears did not heal after the initial surgery and required revision (3 patients had a revision mastoidectomy, 2 patients had a mastoid obliteration, and 1 patient had a skin graft). Of those 6, 4 patients were done from 2003-2004 when we were using pieces of AlloDerm with an average thickness greater than 0.76 mm.

The average time to heal in the remaining 17 ears was 9.4 weeks (2 patients = 4 weeks, 9 patients = 8 weeks, 4 patients = 12 weeks, 2 patients = 16 weeks). None of these patients experienced skin breakdown at an average long-term follow-up of 86 weeks (range 12 to 184).

Figure 1. AlloDerm. Each of these tissues measure on average between 0.33 and 0.76 mm. The tissue on the left is much thinner compared to the tissue on the right.

Figure 2. AlloDerm demonstrating the optimal thickness of the tissue: the tissues beneath the graft are visible.

DISCUSSION

AlloDerm Regenerative Tissue Matrix (LifeCell Corp., Branchburg, NJ) is donated human dermis that has been processed to preserve the architecture of the dermal matrix and remove all cellular elements. It was introduced in 1995 and first used as a skin graft in burns patients. It has been used in otologic procedures for at least 11 years with most papers reporting its use in tympanic membrane repair.4-12 The theoretical benefit of using allograft material rather than autologous tissue include: time savings, faster healing, and use when no autologous graft is available.

We have chosen to use AlloDerm in CWDM defects to minimize granulation tissue during the initial 4 to 12 weeks of healing and to provide a thick connective tissue “cushion” that prevents breakdown over the long term. Because exposed bone will inevitably form granulation tissue, most surgeons will use harvested fascia to cover as much exposed bone as possible. The use of AlloDerm has reduced the amount of granulation tissue formed in our patients.

We have also had excellent results achieving a durable skin covering of the defect for a long period of time (average 86 weeks), demonstrating the advantage of an appropriately thick subepithelial matrix. Weber et al13 described their experience with AlloDerm in 18 patients with CWDM. In 4 patients who had biopsies between 1 to 6 months postoperatively, complete epithelialization of the AlloDerm had occurred with prominent neovascularization and host cellular infiltration of lymphocytes and fibrocytes. Thus, the subepithelial layer not only provides thickness and protection from skin breakdown but may also provide protection from infection due to its vascularized nature.

The thickness of the graft has proven to be crucial. In our early experience, we used AlloDerm thicker than 0.76 mm and had several failures. We since found the optimal thickness to be about 0.5 mm. AlloDerm is obtained from multiple sites throughout the body with varying thicknesses of dermis. It is then measured at multiple points in order to determine its average thickness. The thickness of the 2 x 4 cm harvested tissue is not uniform, and not only varies from piece to piece, but within each piece individually. Certain portions of the tissue may actually fall outside the average thickness range reported on the label and the reported thickness is only the average thickness of the tissue. We have requested that LifeCell provide 2x4 cm strips with this 0.5mm thickness for use to line the mastoid cavities and reline external auditory canals in cases of osteoradionecrosis or mastoid obliteration.

CONCLUSIONS

AlloDerm effectively minimizes the formation of granulation tissue during the healing of a CWDM defect and creates an effective subepithelial layer preventing long term skin breakdown and drainage. The thickness of the AlloDerm graft is crucial and a thickness should be selected that approaches as close to 0.5 mm as possible for maximum “take” of the graft.