**Propionibacterium infection associated with bovine pericardium dural allograft**

**Case report**

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Propionibacteria are known to play a part in postneurosurgical infections, primarily those involving ventricular shunts. Nevertheless, little is known about the association between dural allografts and propionibacterium infections. Two patients underwent craniotomy for supratentorial meningiomas and each received a dural allograft. Both patients subsequently presented with delayed epidural fluid collections several weeks after surgery. Propionibacterium species was cultured in samples from both patients. The allografts were removed and the patients were treated with appropriate antibiotic agents; one patient underwent an interval craniectomy. Both patients demonstrated neuroimaging and clinical improvement after surgery and antibiotic therapy. These cases demonstrate the association of propionibacterium infections with dural allografts. Furthermore, in patients with latent and indolent infections, *Propionibacterium* spp. should be suspected and treated appropriately.

**Key Words** • bovine pericardium • dural allograft • intracranial empyema • postoperative infection • *Propionibacterium* species

**Propionibacterium** spp. are Gram-positive, anaerobic, rod-shaped bacteria (bacillus) that colonize the skin and intestinal tract in humans. Clinically, they are known to cause acne vulgaris, endocarditis, soft-tissue infections, and various central nervous system infections. These infections usually present late in their course, are indolent in nature, and are difficult to eradicate. Propionibacterium involvement is familiar in postneurosurgical infections, primarily in ventricular shunt infections. Recently, propionibacterium-related empyemas have been associated with the use of dural allografts. We report two cases of propionibacterium-related empyemas associated with bovine pericardium dural allografts.

**Case Reports**

**Case 1**

*History and Examination.* This 51-year-old woman experienced worsening headaches for 6 months, which were associated with dizziness, diplopia on downward gaze, and short-term memory loss. The results of her neurological examination were nonspecific. An MR image revealed a large frontal midline lesion with heterogeneous enhancement that was consistent with malignant meningioma (Fig. 1).

*Initial Operation and Postoperative Course.* A frontal craniotomy and resection of the tumor was performed. The dura mater was patched with bovine pericardium (Dura-Guard Product No. DG-0608SN; Synovis Surgical Innovations, St. Paul, MN). The patient’s early postoperative course was uncomplicated. On postoperative Day 18, the patient presented with severe headaches. Both computerized tomography and MR images demonstrated pneumocephalus and an epidural fluid collection over the dural allograft (Fig. 2 left). The patient was treated with steroid medications and a 2-week course of clindamycin, resulting in a dramatic improvement. The patient received a course of radiation therapy applied to the residual tumor 3 months postoperatively. To date, there has been no detectable tumor recurrence.

*Second Operation.* The extradural fluid collection demonstrated mild improvement on imaging for 4 years after surgery, at which time the patient’s headaches recurred. Surgical reexploration was performed to confirm the suspicion of infection and to implement drainage and graft replacement. Epidural tissue consistent with chronic inflammatory disease was noted. The dural allograft and scar tissue were excised. The wound was irrigated copiously with antibiotic agents and a collagen matrix graft made from bovine Achilles tendon (DuraGen, Integra NeuroSciences, Plainsboro, NJ) was placed over the dural defect to reduce the risk of a subsequent cerebrospinal fluid leak.

*Pathological Findings and Postoperative Course.* Cultures of scar tissue revealed a *Propionibacterium* sp. infection. A
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4-week course of vancomycin was accompanied by partial resolution of the patient’s headaches. The patient no longer displays any sign of infection; however, she continues to report headaches despite MR imaging confirmation of significant reductions in the volume of the epidural fluid collections (Fig. 2 right).

Case 2

History and Examination. This 65-year-old man was found to have an elevated level of prostate-specific antigen during a screening examination. A bone scan revealed increased uptake of tracer at the left parietal region. A small homogeneous extraaxial mass was visible on MR imaging and appeared to be consistent with a convexity meningioma or a metastasis with hyperostotic changes. Biopsy findings confirmed that the lesion was a meningioma. Three months later, the patient began to experience simple partial seizures. An MR image demonstrated enlargement of the meningioma (Fig. 3).

Initial Operation and Postoperative Course. A left frontoparietal craniotomy was performed and a gross-total resection of the meningioma was obtained. The dural defect was repaired with a bovine pericardium dural allograft (DuraGuard, Product No. DG-0608SN). The patient experienced mild right-sided weakness postoperatively; this improved before he was discharged from the hospital. A subgaleal fluid accumulation was noted on MR images 2 weeks postoperatively; it resolved spontaneously. The patient received radiation therapy, which was applied to the residual tumor at 3 months postoperatively. Five months postoperatively, increased right-sided weakness suddenly developed in the patient. An MR image demonstrated elevated white-matter signal changes that were consistent with vasogenic edema, but no sign of tumor recurrence.

Four months later, an MR image revealed an epidural fluid collection abutting the dural allograft (Fig. 4 left). On clinical examination, we found that the patient’s condition had worsened and the fluid collection had increased with signs of bone involvement.

Discussion

Propionibacterium species is a common inhabitant of human skin, found primarily around hair follicles and sebaceous glands. Propionibacterium acnes has been found in various clinical infections, including bacterial endocarditis, orthopedic implants, and ventricular shunts, and is a com-

Second Operation. During surgical evacuation of the fluid collection we observed milky-brown purulent fluid emerging from beneath the bone plate, which was not attached to the adjacent bone. The bone plate was removed, the empyema was drained, and the granulation tissue abutting the dural allograft was vigorously debrided and left in place.

Pathological Findings and Postoperative Course. A fluid culture demonstrated Gram-positive rods with growth of Propionibacterium sp. on anaerobic medium. The patient was placed on an 8-week course of intravenous vancomycin, ceftriaxone, and metronidazole. The cranial defect was repaired 14 months after craniectomy by performing acrylic–titanium cranioplasty. The patient was placed on an antibiotic prophylaxis course of clindamycin (450 mg twice daily) and remains neurologically stable on this medication with no recurrence of epidural fluid collection (Fig. 4 right).

Fig. 1. Case 1. Contrast-enhanced axial T₁-weighted MR image revealing a partially homogeneous area of enhancement consistent with a meningioma. The irregular margins and the marked adjacent white matter edema are consistent with the malignant variant of the disease later found on pathological examination.

Fig. 2. Case 1. Left: Contrast-enhanced axial T₁-weighted MR image obtained on postoperative Day 18, demonstrating a fluid collection at the site of the resected tumor with dural allograft involvement. Right: Nonenhanced axial T₁-weighted MR image depicting the decreased fluid collection after antibiotic therapy.

Fig. 3. Case 2. Contrast-enhanced coronal T₁-weighted MR image revealing a large homogeneous mass, consistent with a meningioma, discovered at the 3-month follow-up examination after a biopsy of a small lesion had been performed.

Fig. 4. Case 2. Left: Contrast-enhanced axial T₁-weighted MR image revealing a partially homogeneous area of enhancement consistent with a meningioma. Right: Nonenhanced axial T₁-weighted MR image depicting the decreased fluid collection after antibiotic therapy.
mon contaminant of blood cultures. Additionally, P. acnes is a known cause of intracranial infections including epidural and subdural abscesses (Table 1).

We describe two patients with intracranial propionibacterium infections that were associated with bovine pericardial allografts. Bovine pericardium is a widely used agent for dural allografts and is associated with few complications. A theoretical risk with bovine xenografts is the transmission of prion diseases such as Creutzfeldt-Jakob disease associated with the use of human cadaveric dural allografts, to our knowledge there have been no reported cases of prion disease, including bovine spongiform encephalopathy, associated with bovine pericardium allografts. Both of our patients had undergone meningioma resection and in both epidural fluid collections developed. In the first patient, the allograft was replaced with a fresh DuraGen allograft, whereas in the second patient only the infected bone flap was removed leaving the dural allograft in place. Both received intravenous antibiotics and radiation therapy for remnant tumor obliteration; however, only the second patient received therapy before abscess formation. Note that the first patient, who received a relatively short antibiotic course after graft replacement, had symmetric recurrence of the epidural fluid collection, whereas the patient who received continuous prophylactic antibiotics did not experience a recurrence. This observation brings to mind the indolent nature of Propionibacterium sp. and may reflect the bacteriostatic nature of the administered antibiotics.

At present, little is known about the association between propionibacterium infections and dural allografts. Recently, Jallo, et al., reported three cases of P. acnes infection associated with dural allografts. Their patients presented with indolent infections associated with headache, erythema, and swelling, or subgaleal fluid collections 5 to 10 weeks after allograft placement. Computerized tomography scans of the head demonstrated epidural or subdural collections of fluid. Each patient was treated with surgical evacuation of the abscess followed by 4 to 8 weeks of levofloxacin therapy. In each patient the fluid collection resolved within 2 weeks. Two of their patients had acellular dermal allografts (AlloDerm; LifeCell Corp., Branchburg, NJ) and one patient had a bovine pericardium allograft (Dura-Guard).

To date, there is no determined duration of antibiotic administration for intracranial propionibacterium abscesses. Current treatment recommendations for propionibacterium infections are surgical evacuation of the abscess and a prolonged antibiotic course. Most antibiotics with anaerobic coverage, such as clindamycin or levofloxacin, are effective for propionibacterium-related brain abscesses. Metronidazole is not effective in this setting. The duration of treatment should always correlate with the clinical situation but can vary from 6 weeks to several years.

**Conclusions**

Propionibacterium species should be considered a potential pathogen in latent infection after placement of a bovine pericardium dural allograft, and prolonged antibiotic coverage for indolent propionibacterium infections is essential.

**References**


G. Barkhoudarian, et al.

**Fig. 4.** Case 2. Contrast-enhanced coronal T1-weighted MR images. Left: Image revealing a large extraaxial fluid collection at the site of the resected tumor with enhancement of the dural allograft. Right: Image demonstrating a nonenhancing isointense signal at the site of the previous fluid collection. There is no evidence of recurrence of the empyema.
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