Abstract: Aging pediatric cranioplasty patients with titanium implants are a population at risk for scalp breakdown and implant extrusion. Reports of complications focused on pediatric populations are sparse in the medical literature. This case series describes four examples of negative sequelae associated with titanium implant use in infant cranioplasty and outlines a treatment strategy for each case.

Introduction: Craniosynostosis is a condition wherein the sutures of the infantile skull prematurely fuse leading to growth patterns that lead to abnormal skull shape. Cranioplasty is the surgical repair of skull defects and deformities such as craniosynostosis. Indications for cranioplasty: congenital defects, hypoplasia, and traumatic injury. Materials used in cranioplasty include autologous bone grafts and alloplastic materials the include titanium implants, cadaveric grafts, and polyether ether ketone (PEEK) implants. Variables considered in the use of biomaterials include patient age, limited tissue availability at donor site, size of defect, and a history of graft resorption or site infection. While complications of cranioplasty are well documented in the adult population, they have not been well described in the pediatric population.

Representative cases:

Case 1: 6 y.o. male with craniosynostosis
- Anterior vault remodeling performed at age 2
- Presented with headache and tenderness over areas of visibly palpable hardware
- CT confirmed hardware
- Hardware was removed via prior incision.
- Patient symptoms resolved

Case 2: 5 y.o. male with impending extrusion of titanium mesh covering a frontoparietal skull defect (see A)
- A polyether ether ketone (PEEK) implant was rendered based on CT modeling
- The titanium was surgically explanted and the PEEK was placed (see B)
- Patient recovered without incident.

Case 3: 14 y.o. male with profound developmental delay presented with extruding titanium mesh.
- Explantation of only locally extruding mesh was performed due to the expansive size of the titanium implant, which spanned the entire calvarium
- The wound was irrigated and primarily closed
- The patient had no further complications

Case 4: 23 y.o. male with history of pilocytic astrocytoma and vault reconstruction presented with extrusion of titanium mesh and overlying cellulitis.
- Patient underwent local excision, debridement, and closure. He completed a course of antimicrobials as well.
- Three months later, the patient returned for explantation of titanium hardware (see C) and split cadaveric rib grafts (see D)
- Due to cadaveric graft resorption, a PEEK implant was fashioned and placed to definitively re-establish calvarial continuity
- The patient recovered fully

Discussion: Titanium is a highly biocompatible material used in cranioplasty. The pediatric population presents unique challenges to use of alloplastic materials including skull growth, limits to scalpel distensibility, and pressure injury. Titanium in this population may extrude lending to a host of complications. Treating these complications can be challenging. Explantation of hardware is recommended if extrusion is present or eminent. The use of autologous bone may not be an option to fill resultant defects. In these instances PEEK contracts may be used at the time of explantation or in a stage approach.