Augmentation Cystoplasty of Diseased Porcine Bladders with Bi-Layer Silk Fibroin Grafts

Joshua R. Mauney

Associate Professor of Urology and Biomedical Engineering; Jerry D. Choate Presidential Chair in Urology Tissue Engineering; University of California, Irvine, Irvine, CA

Abstract

Partial bladder outlet obstruction (pBOO) commonly results from neurogenic bladder and posterior urethral valves. pBOO causes fibroproliferative remodeling of the detrusor, which results in diminished bladder capacity, poor compliance, and incomplete emptying. Enterocystoplasty presents the primary surgical procedure utilized to increase bladder capacity, reduce urinary storage pressures, preserve renal function, and achieve urinary continence. Unfortunately, the transposition of gastrointestinal (GI) segments into the urinary tract is associated with significant complications, including chronic urinary tract infection (UTI), mucus production, and metabolic abnormalities. Therefore, there is a significant need to develop alternative approaches for bladder reconstruction. The search for an ideal "off-the-shelf" biomaterial for augmentation cystoplasty remains elusive and current scaffold configurations are hampered by mechanical and biocompatibility restrictions. In addition, preclinical evaluations of potential scaffold designs for bladder repair are limited by the lack of tractable large animal models of obstructive bladder disease that can mimic clinical pathology. The results of this study describe a novel, minimally invasive, porcine model of pBOO that simulates clinically relevant phenotypes. Utilizing this model, we demonstrate that acellular, bi-layer silk fibroin grafts can support the formation of vascularized, innervated bladder tissues with functional properties.

Biography

Dr. Joshua Mauney is a tenured Associate Professor in the Departments of Urology and Biomedical Engineering at the University of California, Irvine. He holds the Jerry D. Choate Presidential Endowed Chair in Urology Tissue Engineering. He received his B.Sc. in Chemical Engineering and Ph.D. in Biotechnology Engineering from Tufts University. Dr. Mauney's laboratory focuses on the development and evaluation of silk fibroin grafts for the repair of visceral hollow organs including the bladder, urethra, esophagus, and trachea. He also specializes in the creation of novel large animal models of urinary tract and gastrointestinal disease for preclinical medical device testing. Dr. Mauney has been continuously funded from the National Institutes of Health since 2011 and currently serves as the principal investigator on 2 R01 grants from NIDDK. Dr. Mauney has authored >40 international peer-reviewed journal publications.