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Research paper

Porcine extracellular matrix scaffolds in reconstructive urology: An *ex vivo* comparative study of their biomechanical properties

N.F. Davis[a,b], *A. Callanan*[b], *B.B. McGuire*[a], *R. Mooney*[b], *H.D. Flood*[a], *T.M. McGloughlin*[b,*]

[a] *Department of Urology, Mid-Western Regional Hospital, Limerick, Ireland*
[b] *Centre for Applied Biomedical Engineering Research, Department of Mechanical and Aeronautical Engineering, Materials and Science and Surface Science Institute, University of Limerick, Ireland*

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ABSTRACT

Functional reconstruction of the human urinary bladder has been attempted by replacing defective bladder tissue with tissue-engineered xenogenic extracellular matrix (ECM) scaffolds. However, experimental studies that demonstrate the effects of implanted ECMs on important biomechanical properties such as total bladder capacity (TBC) and compliance (*C*) are lacking. In the current study, the effects of ECM scaffold surface area (SA) on TBC and *C* was assessed, *ex vivo*, in an ovine model ($n = 5$). TBC and *C* were measured at pressures (*P*) of 5, 10, 15 and 20 mm Hg prior to performing a 3 × 3 cm (9 cm^2) partial cystectomy defect. Equal-sized 3 × 3 cm (9 cm^2) and larger 6 × 6 cm (36 cm^2) urinary bladder matrix (UBM) scaffolds of porcine origin replaced the 3 × 3 cm cystectomy defect, and TBC and *C* were re-recorded for comparative analysis. The results showed that TBC decreased by 39.6%±0.005% (122.9 ml ± 15 ml, $p < 0.05$) and *C* by 38.9% ± 0.51%, ($\Delta P = 0$–5 mm Hg, $p < 0.05$) in ovine bladders reconstructed with 3 × 3 cm UBM scaffolds compared to their native values. It was also found that TBC increased by 25.6 ± 0.64% (64.2 ml ± 8.8 ml, $p > 0.05$) and *C* by 24.5 ± 0.43% ($\Delta P = 0$–5 mm Hg, $p > 0.05$) in the 6 × 6 cm UBM scaffold group compared to the 3 × 3 cm UBM scaffold group; however, these values were not statistically significant. The present work demonstrates that a fourfold increase in ECM scaffold SA relative to its intended defect does not lead to a significant improvement in TBC and *C* values.

1. Introduction

The urinary bladder can be affected by multiple pathological processes in which autogenous donor gastrointestinal tissue may be applicable for treatment purposes. However, the presence of mucus-secreting epithelium is associated with long-term complications such as recurrent calculus formation, resistant urinary tract infections and metabolic abnormalities (Flood et al., 1995). These persistent and debilitating complications have led researchers to seek an alternative donor material that may be more suitable for reconstructive purposes. Synthetic materials such as

* *Corresponding address:* Centre for Applied Biomedical Engineering Research, University of Limerick, Co. Limerick, Ireland.
E-mail address: tim.mcgloughlin@ul.ie (T.M. McGloughlin).

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