Three Separate Collagen-based Biomatrices in Pig Bladder
Aiming for Bladder Augmentation

Paul J. Geutjes¹*, Luc A.J. Roelofs¹, Barbara B.M. Kortmann¹, Robert P.E. de Gier¹, Dorien M. Tiemessen¹, Willeke F. Daamen², Toin H. van Kuppevelt², Wouter F.J. Feitz¹

¹Dept. of Urology, Radboud University Nijmegen Medical Centre, Nijmegen, The Netherlands ²Dept. of Biochemistry, Radboud University Nijmegen Medical Centre, Nijmegen, The Netherlands

(*p.geutjes@uro.umcn.nl)

Introduction

Tissue engineering may be an useful tool to generate alternatives for bladder augmentation. The use of large acellular constructs lack in the ingrowth of blood vessels and cells, resulting in necrotic and fibrotic tissue. The aim of this study was to assess the possibility to augment the bladder with three smaller collagen-based biomatrices, and study the effect of heparin and growth factors on bladder regeneration. This may be an useful alternative approach to replace the current used technique for bladder augmentation, which is implantation of intestinal tissue.

Materials and Methods

Different collagen-based biomatrices (Ø 3 cm) were prepared using freezing, lyophilization and crosslinking techniques: plain collagen (COL), collagen-heparin (COL-HEP), and collagen-heparin with VEGF, FGF-2 and EGF (COL-HEP-GF). The constructs were characterized by means of scanning electron microscopy (SEM), TNBS assay (degree of crosslinking), and immunofluorescent staining (IF).

In 13 pigs three collagen biomatrices were separately implanted in the bladder: COL (n=3), COL-HEP (n=3), COL-HEP-GF (n=4). Non-absorbable Prolene sutures were used to mark the implantation site. Pigs were evaluated 3 months after surgery using urodynamic assessment, standard histology (H&E) and immunofluorescent staining (IF). As a control, three separate defects were made and primarily closed (n=3).

Results

Survival after bladder augmentation was 90%.

Pigs recovered well and complications in relation to the bladder surgery was not observed. Within 2 months normal voiding was observed. Macroscopical evaluation in the bladder revealed no stone formation or infectious tissue. The original biomatrix structure made way for new bladder-like tissue. The results are promising, but remain to be confirmed by histological evaluation. In depth evaluation are now being performed (including immunohistochemistry; cytokeratin, αSMA, vimentin, desmin), which will be presented at the conference.

Discussion and Conclusions

In this study, we show that it is possible to close bladder defects using highly porous molecularly-defined biomatrices. We expect that the addition of heparin and growth factors will induce cellular ingrowth.

This technique could be an alternative approach for bladder augmentation. It may also be an promising model to study three separate bladder constructs in one animal model, and therefore reducing the number of animals.

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