Urethroplasty using autologous urethral tissue-embedded acellular porcine bladder submucosa matrix grafts for the management of long-segment urethral stricture in a rabbit model

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Objectives
- Numerous urethral reconstruction materials have been described, but completely satisfactory ones remain to be found.
- Previous research has demonstrated that collagen-based materials, such as the small intestine, have potential regenerative capability, but have not achieved complete success owing to insufficient incorporation with the host urethra.
- We developed a tissue-embedded BSM graft. This method can avoid cell culture procedures, be used for direct in vivo placement, and increase incorporation between the graft and host tissue sufficiently.
- We conducted this study to evaluate the combined effect of acellular bladder submucosa matrix (BSM) and autologous urethral tissue for the treatment of long segment urethral stricture in a rabbit model.

Materials and Methods
- Preparation of acellular matrix
  - porcine bladder submucosa was processed, decellularized, configured into a sheet-like shape, and sterilized
- In 15 male New Zealand rabbits, urethral stricture was generated by excising a 5×20 mm²-sized distal and ventral portion. One month after the procedure, 10 rabbits were randomized to receive either nontransected ventral onlay-augmented urethroplasty using BSM (5×20 mm²) only or BSM/autologous urethral tissue (n=5 per group). Stricture only and sham-operated rabbits served as control groups (n=5 per group).
- Generation of a urethral stricture model and urethroplasty

Conclusions
- Nontransected ventral onlay-augmented urethroplasty using an acellular BSM scaffold combined with an autologous urethral tissue graft represents a feasible procedure for urethral reconstruction.

Results
- Retrograde urethrography
  - Retrograde urethrography (representative images of week 12) showed complete tubularization of both grafted urethras similar to the control group throughout the study period. The stricture group showed stenosis.

Histologic and immunohistochemical analysis
- The histopathologic study revealed that the BSM/autologous urethral tissue graft had a normal area of urethral lumen, compact muscular layers, complete epithelialization, and progressive infiltration by vessels in the regenerated urethra. In contrast, the BSM grafts revealed keratinized epithelium, abundant collagenized fibrous connective tissue, and were devoid of bundles of circular smooth muscle.