

TRANSURETHRAL ULTRASOUND GUIDED INJECTION OF CLONALLY CULTURED AUTOLOGOUS MYOBLASTS: EXPERIMENTAL RESULTS

Aims of Study

Different technologies have been developed in the past few years to generate skeletal muscle cell cultures as a potentially limitless source for tissue engineering and transplantation medicine. In the present study we wanted to explore the potential of autologous myoblast transfer into the urinary tract. The main aim of the study was to demonstrate if myoblasts that had been injected into the porcine urethra could improve the function of the urethral closure mechanism.

Methods

Skeletal muscle samples were obtained from 7 pigs. Each biopsy was enzymatically dissociated according to a modified procedure of a cell dispersion technique first described by Blau and Webster (1981). Single satellite cells in suspension were manually collected with a micropipette under microscopic control. The cells were cultured in a growth medium and maintained in a proliferating state for several weeks. Desmin was used as a marker to identify clones of myoblasts. Fluorescent labeling was used to assess integration of the injected myoblasts into the urethra and rhabdosphincter. With the help of a transurethral ultrasound probe (23 F, 11 MHz) and injection system the myoblasts were injected into the urethra under direct sonographic control. Urethral pressure profiles were measured before and after injection to determine the postoperative changes of urethral closure pressures.

Results

When cultured in differentiation medium, desmin positive mononucleated myoblasts fused into multinucleated myotubes. After one week spontaneous contractions of the myotubes were observed. Pure porcine cultures of self-renewing myoblasts could be grown for long periods. The yield of myoblasts did not decrease until passage number 15. Transurethral injection of myoblasts under direct sonographic control proved to be easy, quick and minimally invasive. The position of the inserted injection needle as well as the site and size of the injected cell depots could be visualised and documented in all pigs. Histologic examination of the specimens revealed that the injected cells survived well for at least 10 weeks. Postoperatively maximal urethral closure pressures were increased (up to 32%). Furthermore, the zone of a urethral closure ≥ 30 cm H₂O extended more cranially into the proximal urethra (up to 3,2 cm) compared to preoperative measurements.

Conclusions

Autologous skeletal muscle myoblast injection into the urethral wall under sonographic control has the potential to become a successful method for treatment of urinary stress incontinence. Self-renewing clones of myoblasts can be prepared from small skeletal muscle biopsies. The injected cells survive well. Furthermore, the injected myoblasts have the potential to strengthen the contractile force of the injured or weakened urethra, which results in a postoperative increase of urethral closure pressures.