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NERVE-FIBRE STAINING WITH METHYLEN BLUE FOR IDENTIFICATION OF SMALL PELVIC AUTONOMOUS NERVE FIBRES

Aims of Study

Maintenance and bladder function during small pelvis surgery depends on the exact intra-operative identification of the relevant nerve fibres. Substantial attention is given to the preservation of nerve structures in urological, gynaecological, and rectal surgery to maintain sexual potency, voiding function and urinary continence. For the identification of these nerve fibres we evaluated intra-operative methylen blue fibre staining in an experimental animal model.

Methods

Laminectomy was performed on four Göttinger mini-pigs and a modified Brindley electrode for sacral anterior root stimulation (SARS) was implanted at S2/S3. After abdominal midline incision, the nerve bundles forming the inferior pelvic plexus were identified. A methylen blue solution (2:10) was applied to the presumed nerve structures. The entire pelvis was then irrigated with normal saline solution to rinse the methylen blue out of the surrounding tissue. (The remaining stained structures resembled nerve fibres that innervate the urinary bladder.) To prove that the stain fibres were responsible for urinary innervation, detrusor contraction was monitored visually and by intra-vascular pressure assessment through a tranurethrally-placed six French catheter, connected to a routine urodynamic unit (Dantec®). After each stimulation trial, the bladder was emptied and refilled with 50cc normal saline. SARS-induced detrusor contraction was monitored before and after stepwise dissection of the stained post-ganglionic nerve fibres until contraction of the urinary bladder completely disappeared. Histological evaluation of the nerve structures followed.

Results

In all four animals the inferior pelvic plexus could be localized, and the autonomous nerve fibres from S2 to S4, that are responsible for bladder innervation, could be identified by methylen blue staining in very close proximity, dorsal medial to the ureterovesical junction. Initially, unilateral stimulation of sacral anterior roots did result in an intra-vesical pressure (pdet) increase to a mean of 26 cmH2O on the left, and 20 cmH2O on the right side of the detrusor. With stepwise dissection of nerve fibres that run along the ureter on the left side, intra-vesical pressure decreased until pressure response ceased to 2 cmH2O. This effect was measured in all four animals. Histomorphology of the stained structures dissected revealed multiple supra-vital autonomous nerve fibres and small vessels embedded in connective tissue.

Conclusions

Identification of minute nerves bundles is often a tedious and extremely difficult task. Results from our animal models demonstrate that, particularly in the small pelvis, supra-vital staining of autonomous nerve fibres with methylen blue is a simple, safe and reliable method of identification to prevent urinary bladder from accidental denervation. This method should be transformed and tested in further clinical settings.