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Craggs M, Ballaro A
Institute of Urology and Nephrology

ELECTROMYOGRAPHIC DETECTION OF PURINERGIC DETRUSOR ACTIVITY USING AN INTRAVESICAL ELECTRODE IN THE GUINEA-PIG

Aims of Study

An artefact free electromyographic (EMG) signal has recently been recorded from the serosal aspect of a whole guinea-pig bladder preparation using suction electrodes [J Urol 2001; 166:1957-61]. The signal has subsequently been recorded from mucosa-free detrusor strips, and shown to originate from a purinergic but not a cholinergic mechanism [Eur Urol Suppl. 2002; 1(1): 85P]. This novel technique may enable clinical electromyographic detection of pathological purinergic excitatory neuromuscular transmission in the overactive bladder. However, no unequivocal EMG has yet been recorded intravesically using a *per urethram* device. The aim of this study was to determine whether an artefact free real EMG could be recorded from inside the guinea-pig bladder using an intravesical suction electrode.

Methods

Whole bladders, excised from male guinea-pigs sacrificed with ethical committee approval were mounted in a 50ml organ bath that enabled their superfusion with gassed Tyrode's solution and pharmacological agents. A specially developed bi-polar reversible (Pt/PtCl) suction recording electrode was attached to a standard Foley urinary catheter (10F) which incorporated nerve-stimulating electrodes, and was passed intravesically through the bladder neck so that the suction electrode was applied to the dome urothelium and the stimulation electrodes was in contact with the bladder neck. The bladder was filled with Tyrode's solution to a limit determined by competency of the suction seal. Tetrodotoxin (1μM) sensitive bladder contractions were evoked by 10-50ms trains of electrical pulses of 0.1ms duration at various frequencies. Electrically evoked electromyographic responses from the suction electrode were recorded in real time with the associated intavesical pressure changes. The morphology and parameters of the electromyographic signal was compared with those recorded from the serosa under similar conditions.

Results

Nerve-mediated, visible, generalised bladder contractions were readily evoked by electrical stimulation of the bladder neck. A predominantly bi-phasic electromyographic signal of (mean ± SD): amplitude 359 ± 430μV, duration 254 ± 22 ms, and time to depolarisation 46 ± 6 ms was consistently recorded from the suction electrode in association with contractions. The signal preceded intravesical pressure changes, was separate from stimulus artefact, and abolished during desensitisation to ATP (using α,β-meATP 30μM). There was no significant difference in the aforementioned signal parameters (P=0.21, 0.24, 0.27 respectively, Student's t-test), or visually obvious difference in morphology, of the signals recorded from the bladders mucosal (n=6) or serosal (n=6) surfaces.

Conclusions

Generalised contraction of the whole, excised guinea-pig bladder can be evoked by electrical stimulation of the bladder neck area using catheter mounted electrodes. A real, evoked EMG associated with these contractions can be recorded through the urothelium using a transurethral suction electrode, and is not detectably different from the purinergic signal recorded directly from the detrusor itself. Although extracellular electrical activity has yet to be recorded from human detrusor, and obvious anatomical differences between human and small animal urothelium exist, this study, in combination with previous work supports the development of a *per urethram* catheter-mounted suction electrode for the *in situ* electromyographic evaluation of pathological purinergic mechanisms in the overactive bladder.