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URINARY INCONTINENCE

Propagating contractions influence urinary bladder tone

New research investigating the underlying contractile dynamics of urinary bladder smooth muscle in a porcine model has shown that discrete, propagating patches of contraction contribute to overall tone and variations in vesicular pressure. "We were particularly interested in the smooth muscle of the bladder, as, at rest, its principal function is achieved solely by adjustment of tone" explains lead author Roger Lentle from Massey University, New Zealand.

Isolated *ex vivo* pig bladders were attached to a pressure transducer under constant vascular perfusion with physiological saline solution. A video camera was used to monitor patterns of motility within the bladder during contractions.

"We developed a video spatiotemporal mapping algorithm that allowed us to determine amplitude, duration and propagation velocity," explains Lentle. "This technique allows the direction of propagation of a contraction and its progression across the surface of the structure in a single muscle layer to be mapped in two dimensions."

Using this technique, propagating patch contractions (PPCs) were detected, which travelled across the anterior surface of the bladder at a similar frequency to that of cyclic changes in vesicular pressure.

> "...temporary 'pacemaker' sites are active within the smooth muscle of a resting bladder..."

Importantly, introduction of tetrodotoxin had no detectable effect on PPCs, implying that these contractions are entirely myogenic in origin. Furthermore, PPCs obeyed no long-term, specific patterns of propagation, despite intermittently entering quasi-stable cycles of re-entrant propagation that exhibited uniform patterns of propagation. The speed of PPC propagation was similar to that reported for the spread of action potentials in urinary bladder smooth muscle.

Taken together, these findings suggest that the tone, and contractile state of the resting urinary bladder are controlled by myogenic factors, and that several competing temporary 'pacemaker' sites are active within the smooth muscle of a resting bladder at different times.

"We are currently investigating whether the size, frequency and speed, or pattern of propagation of patch contractions in persons with overactive bladder differ significantly from those observed in the healthy bladder," Lentle explains when asked about future directions of this work. He adds that, if PPCs are indeed altered in overactive bladder or other urological diseases, such as painful bladder syndrome, two-dimensional spatiotemporal mapping might prove to be an excellent tool for diagnosis or treatment selection in these patients.

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Original article Lentle, R. G. *et al.* Characterisation of the contractile dynamics of the resting *ex vivo* urinary bladder of the pig. *BJU Int.* doi:10.1111/bju.13132