

INVESTIGATION OF THE CONTRACTILE DYNAMICS OF THE EX VIVO URINARY BLADDER OF THE PIG AND RABBIT DURING FILLING, USING SPATIOTEMPORAL MAPPING TECHNIQUES.

Aims of study

This study aimed to investigate the spontaneous contractile activity in the ex-vivo urinary bladder of the pig and rabbit during filling, using spatiotemporal mapping techniques. The study also aimed to investigate the relationship between this contractile activity and ambient intravesical pressure (p_{ves}), and the effects of various pharmacological agents on both in order to increase our understanding of the genesis and role of spontaneous detrusor activity in accommodating incoming urine.

Study design, materials and methods

Spatiotemporal mapping techniques have previously been used to investigate gastrointestinal motility (1). We used image analysis to quantify the areas and movements of discrete propagating patches of contraction (PPCs) on the anterior, anterolateral and posterior surfaces of the urinary bladders of pigs and of rabbits maintained *ex vivo* during incremental bladder filling. We then correlated the magnitude of p_{ves} and cyclic changes in p_{ves} with parameters derived from spatiotemporal maps. The effects of certain pharmacological agents on the various parameters of spontaneous muscular activity were also investigated.

Results

Contractile movements in the filling/storing bladder consisted only of propagating patches of contraction (PPCs) involving about 1/5th of the surface of the bladder at any one time. These PPCs commenced at various sites, propagated at around 6 mm/s mainly across the anterior and lateral surfaces of the bladder by various, sometimes circular, routes in a quasi-stable rhythm, and did not traverse the trigone. The frequencies of these rhythms were low (3.15 cpm) and broadly similar to those of cyclic changes in p_{ves} (3.55 cpm). Each PPC was associated with a region of stretching (positive strain rate) and these events occurred in a background of more constant strain. The amplitudes of cycles in p_{ves} and the areas undergoing PPCs increased following a sudden increase in p_{ves} but the frequency of cycles of p_{ves} and of origin of PPCs did not change. Peaks in p_{ves} cycles occurred when PPCs were traversing the upper half of the bladder, which was more compliant. The velocity of propagation of PPCs was similar to that of transverse propagation of action potentials in bladder myocytes and significantly greater than that reported in interstitial cells. The size of PPCs, their frequency and their rate of propagation were not affected by intra-arterial dosage with tetrodotoxin or lidocaine, hence they were entirely myogenic in origin and unmodified by any intrinsic nervous activity in the *ex vivo* preparation.

Interpretation of results

Autonomous bladder muscular activity is characterized by propagating rather than stationary areas of contraction (PPCs). The origin and duration of these PPCs influences both p_{ves} and cyclic variation in p_{ves} . PPCs appear to be myogenic, and may contribute to overall tone and to variation in p_{ves} .

Concluding message

Autonomous bladder activity is myogenic and comprises frequent ongoing propagating contractions of inconstant genesis and path. Similar autonomous activity has been observed in the isolated bladder of other species (2) and has been linked to bladder overactivity and sensory urge (3). The parameters that can be derived from spatiotemporal mapping of PPCs i.e. the amplitude, frequency and rate of propagation of PPCs may provide a basis for evaluating such disorders as well as contributing to our understanding of bladder compliance and the generation of tone. The finding that cyclic variations in p_{ves} reflect inconstant summations of the effects of PPCs at various sites of varying compliance indicates that cystometric evaluation does not provide a reliable basis for quantifying of contractile activity in the resting bladder

References

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Disclosures

Funding: This work was supported by the Massey University Research Fund. **Clinical Trial:** No **Subjects:** ANIMAL **Species:** Pig **Ethics Committee:** Massey University Animal Ethics Committee