544: DEVELOPMENT OF A NON-INVASIVE EXTERNAL COMPRESSION PROTOCOL TO QUANTIFY DYNAMIC ELASTICITY IN AN ISOLATED WORKING PIG BLADDER

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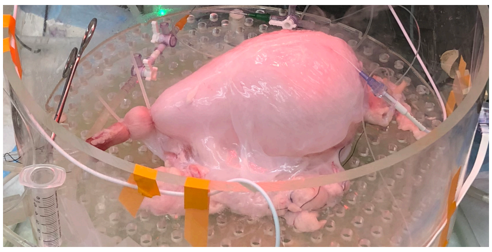
Study Aims & Hypothesis

Urodynamic studies have demonstrated repeat passive filling-emptying results in a reduction of intravesical pressure (p_{ves}), strain softening. Active voiding reverses strain softening (dynamic elasticity). Passive emptying requires invasive catheter placement. The aim of this study was to determine if strain softening produced by passive filling-emptying is equivalent to strain softening produced by repeated external compression-release in an isolated working pig bladder. Thus, taking an essential step in developing a novel, non-invasive means to reduce intravesical filling phase pressure.

Study Design, Materials & Methods

Porcine bladders after slaughter were perfused and maintained at physiologic temperature using a previously designed *ex vivo* functional model. The effect of passive filling-emptying was compared to compression-release protocol. **1 – passive fill-empty**: The bladder was filled to 250 ml and allowed 5 minutes to reach equilibrium pressure (P_{1f}). An equilibration period was allowed after each step. Intravesical volume was increased to 500 ml to measure peak pressure (P_{ref}). Next, it was passively emptied via syringe aspiration to 250 ml and intravesical pressure was noted (P_{2f}). Active voiding was induced with a potassium enriched solution to reset strain softening. **2 – compression-release**: The bladder was filled to 250 ml and pressure was allowed to equilibrate (P_{1c}). The bladder was isovolumetrically compressed to P_{ref} (part 1) by applying external pressure for 15s and releasing for 15s for 5 cycles. The peak pressure during compression (P_{cmax}) and the 5 minute equilibrium pressure after release (P_{2c}) were noted. The protocol was repeated for two cycles. P_{1f} and P_{2f} were compared to P_{1c} and P_{2c}, respectively, and P_{1c} and P_{1f} were compared.



Porcine bladder ex vivo model

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Results

Ten bladders were studied. Strain softening was present during passive filling-emptying phases ($P_{2f} < P_{1f}$, t-test, $p < 0.05$) [Fig. 1A] as well as during isovolumetric compression with external pressure ($P_{2c} < P_{1c}$, t-test, $p < 0.05$) [Fig. 1B], suggesting that significant strain softening had occurred. The pressures after passive filling-emptying and compression-release were not statistically different (P_{2cf} vs P_{2f}, t-test, $p > 0.05$) [Fig. 2], suggesting a similar degree of strain softening was induced by each method.

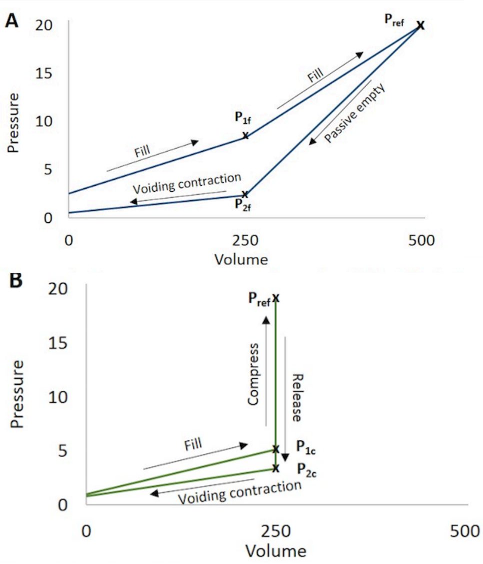

Figure 1: Average pressure values (n = 10) for part 1 (A) and part 2 (B).

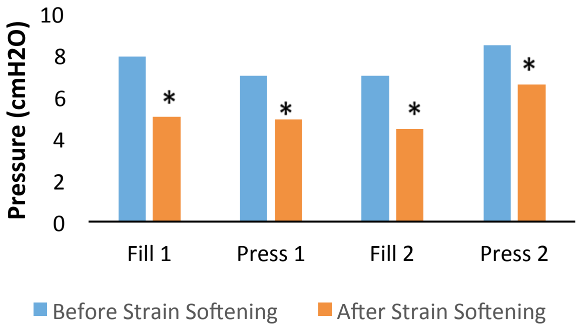

Figure 2: A similar degree of strain softening was induced.
* Indicates a significant difference from initial pressure

Interpretation Of Results & Conclusion

Bladders undergoing compression-release showed a similar decrease in intravesical pressure compared to passive filling-emptying, indicating strain softening occurs via isovolumetric compression. Increasing P_{ves} through both filling and compression results in measureable strain softening. Repeated external bladder compression represents a potential means to lower intravesical pressure via strain softening. This novel, non-invasive technique may represent a potential diagnostic test to identify sub-types of overactive bladder and may treat urinary urgency.