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PREVENTING MOVEMENT ARTEFACT DURING URETHRAL PRESSURE MEASUREMENT: RESULTS WITH AN OIL-CELL TRANSDUCER.

Hypothesis / aims of study

The techniques most commonly used to measure urethral pressure over time in women are notoriously prone to movement artefact. The small sensing area of microtip catheters combined with the narrow band of maximal urethral pressure (MUP) in the urethra means that relatively small movements of the catheter can produce artefactual pressure decreases.
The aim of this study was to test and validate a new technique for urethral pressure assessment, using an oil-cell sensor designed to remove this susceptibility to artefact.

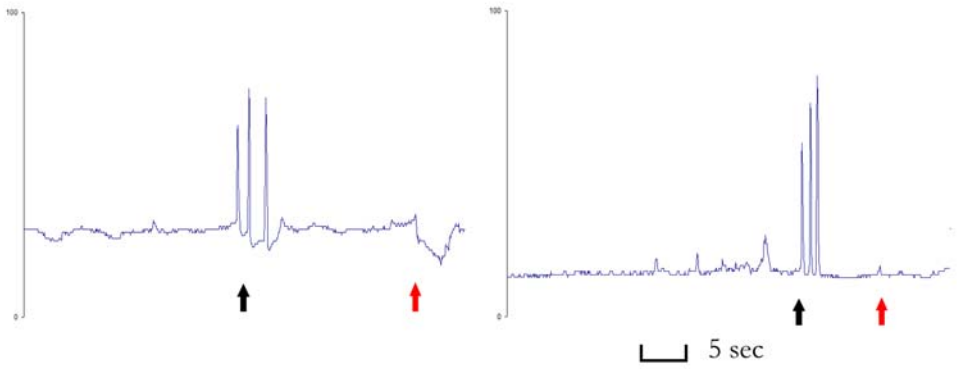
Study design, materials and methods

We used a standard microtransducer, contained within an oil-cell, and mounted on a 7F catheter (Gaeltec). The oil cell was 5cm long, and sensitive through 360 degrees. When positioned in the urethra it records the mean pressure in the whole urethra. As the MUP is the most significant contributor to the mean pressure, it will not change significantly as long as part of the sensor remains at the MUP. This means that precise orientation is not required, and it should be inherently less sensitive to movement. We compared this system to a standard microtip catheter (Gaeltec CTU-2).
Women with symptoms of detrusor overactivity were recruited into the study. Routine filling and voiding cystometry was performed initially. The bladder was then refilled to 250mls for urethral pressure measurement. The standard microtip catheter was used first, using the general accepted technique. The sensor was pulled through the urethra in the 9 o'clock position to identify the MUP point, and then returned to this point to record the pressure for ten minutes. During this time the patient was asked to give coughs, and change position from supine to standing. The catheter was also deliberately manipulated to try and create movement artefact. Some patients were also asked to perform rapid pelvic floor contractions. This procedure was then repeated using the oil-cell catheter. The traces produced by each sensor type were compared qualitatively.

Results

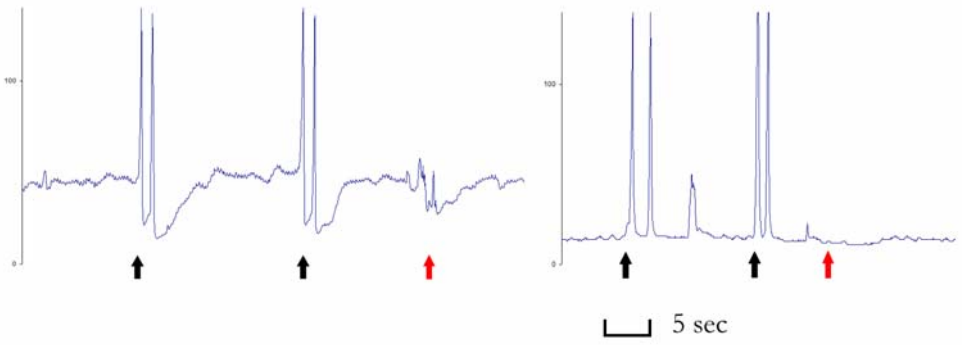
As expected, pressures recorded by the oil-cell sensor were lower, with the MUCP typically 30-45% of that seen with the standard catheter when supine. This is less marked when standing, with pressures recorded by the oil-cell being around 70% of the standard catheter values. Coughing produced pressure spikes of similar magnitude and duration with both catheter types. The pressure increase seen with rapid pelvic floor contractions was smaller with the oil-cell sensor, but the proportional increase from baseline was similar for both sensor types.
Deliberate movement of the standard catheter by as little as 5mm produced marked variations in recorded pressure for all patients. These were at least 10cmH_2O, and represented falls in the MUCP of between 30% and 100%. In contrast, pressure changes on manipulation of the oil-cell catheter were only 1-2 cmH_2O.
During monitoring with the standard catheter two patients demonstrated transient falls in pressure after coughing. This was not seen when using the oil cell catheter (Figures 1 and 2).

Figure 1: Comparison of cough response and catheter manipulation in patient A.
(Black arrow: cough. Red arrow: catheter manipulation.)



a) Standard catheter b) Oil-cell catheter

Figure 2: Comparison of cough response and catheter manipulation in patient B.
(Black arrow: cough. Red arrow: catheter manipulation.)



a) Standard catheter b) Oil-cell catheter

Interpretation of results

Our results confirm that even small movements of standard microtip catheters can produce significant artefact on urethral pressure recordings. In contrast, the oil-cell sensor shows very little change in recorded pressure when manipulated. Urethral pressure falls following coughing have been described by a number of authors. We were able to demonstrate similar changes whilst using the standard catheter, but not the oil-cell catheter. This suggests that this phenomenon is probably movement-related artefact rather than a true relaxation.

The trade-off for having a larger sensor area is the averaging of the pressure over that sensor area, raising the possibility that pressure changes may be damped out. We did not find this to be the case. The oil-cell sensor performed similarly to the standard sensor during coughing and rapid pelvic floor contractions, indicating it is sensitive enough to demonstrate true pressure changes.

Concluding message

The oil-cell sensor appears to perform better than standard microtransducers in terms of movement artefact, without any significant loss of sensitivity to true pressure variations.