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BIOCOMPUTATIONAL MODEL FOR URODYNAMICS ANALYSIS

<u>Hypothesis / aims of study</u>
Pelvic floor injuries during vaginal delivery are considered a significant risk factor for development of pelvic floor dysfunction (PFD), which may lead to consequences such as Urinary Incontinence (UI), Faecal Incontinence (FI), Pelvic Organ Prolapse (POP) and sexual problems. These problems can result in the need of complex surgical procedures, with high ratings of reoperation. Urodynamics is a powerful tool to characterize normal and abnormal function of the bladder and urethra and, allied to biocomputational methods, it will allow the identification and measurement of the mechanical variables that govern these organs and to propose effective treatments to repair disorders effectively.

<u>Study design, materials and methods</u>
The numerical model of the bladder and urethra was implemented with the Finite Element Model (FEM) based on MRI data of a nulliparous 24-year female without PFD complaints. The structure was characterized with hyperelastic constitutive models to be capable of accurately represent the mechanics of filling and voiding of the bladder, considering the low pressure storage of urine. The dynamics of the bladder wall and urine was described with fluid-structure analysis.
Computational analysis with fluid-structure interaction will be performed, simulating both filling of the bladder at different rates, and voiding of the bladder.
Experimental data will be used to calibrate and validate the computational model developed.

<u>Results</u>
Pressure-flow curves can be predicted by numerical analysis and several urodynamic variables can be evaluated to understand the mechanical response of the bladder and urethra and to define the functional status of the lower urinary tract.

<u>Interpretation of results</u>
The numerical model may be useful to simulate dysfunctional systems such as stress urinary incontinence and provide diagnostic tools to detect such problems and also to enable recommendation of more efficient guidelines to treat lower urinary tract dysfunction, reducing the reoperation ratings, which is not possible nowadays based only in urodynamic analysis.

<u>Concluding message</u>
Biocomputational models contribute to improve the actual understanding of lower urinary tract biomechanics.

<u>Disclosures</u>
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