Poster Presentation
Track 20: Biomechanics of Organs

Abstract: 4499

Citation: Journal of Biomechanics 2006; Vol. 39 Suppl. 1, page S635

Variation in noise recorded distally to a urethral obstruction related to cross-sectional area and flow pattern

T. Idzenga, J.J.M. Pel, R. van Mastrigt

ErasmusMC, Dept. of Urology, Rotterdam, The Netherlands

Elderly men often have trouble voiding due to bladder outlet obstruction (BOO), caused by an enlarged prostate. For diagnosing BOO we are developing a non-invasive method, based on recording of noise at the perineum during voiding. In a biophysical model of the male urethra made from PolyVinyl Alcohol we found that recorded noise varied with the distance from the obstruction (Neurourol Urodyn, 24: 381).
In the present study we analysed flow through an unobstructed and obstructed model. One side of the model was connected to a water column, representing bladder pressure (obstructed: 145 cm H_2O, unobstructed: 40 cm H_2O). A water-filled cuff was placed around the model, representing the prostate. Both obstructed and unobstructed cases had a flow rate of 8 ml/s. We recorded flow pattern and cross-sectional area at regular intervals from the obstruction by means of Doppler imaging equipment. Pressure during flow was recorded by retracting a fluid-perfused catheter through the model. In the obstructed model we found that the cross-sectional area and pressure increased with distance and that the flow pattern changed from turbulent to laminar. In the unobstructed model there was no significant variation in cross-sectional area and flow pattern. In earlier measurements in the obstructed model (Abstract ICS 2005, Montreal) we found that with increasing distance from the obstruction the noise amplitude increased to a maximum followed by a decrease to an approximately constant level. A similar relation between pressure-variations at the wall and distance to the orifice was found in another model (J. Acoust. Soc. Am. 83(1): 318). From the present study two effects can be deduced. Increasing pressure in the model suggests increasing interaction between turbulence and the model wall causing increased noise amplitude. However, conversion of the flow pattern to laminar diminishes the source of pressure-variations and implies decreasing noise amplitude. The combination of these counteracting effects explains the location dependence of the noise amplitude in the obstructed urethral model.