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Urinary Reflux[1] KOUROSH KALEYAH, J. BRIAN FOWLKES, WILLIAM SCHULTZ, BRYAN SACK, University of Michigan (Ann Arbor, MI, US) — Urinary reflux refers to urine flow backward in the ureter from the bladder toward the kidneys. Using nonlinear, large deformation finite element simulations, the deformation of the bladder wall during urine storage is modeled in this study. The bladder wall is assumed to be a homogeneous, isotropic, hyperelastic spherical shell with a finite thickness. A straight elliptical cylindrical hole through the bladder wall at the reference configuration before inflation is the extension or the ureter through the wall. A simple fluid analysis of the tunnel flow resistance compares different bladder inner surface stretch ratios. Our model shows that the hole deformation depends on its orientation with respect to the bladder wall radial direction. As the orientation angle increases, its cross section decreases and its length increases during urine storage causing the hole closure and a rise in its flow resistance. The modeling results indicate that this closure could be explained by bladder wall deformation rather than the local differential pressure. Our findings are consistent with the accepted primary anti-reflux mechanism of minimum hole length-to-diameter ratio and consequently its insertion angle.

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William Schultz
University of Michigan

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