Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

A cumulative shear mechanism for tissue injury initiation in shock-wave lithotripsy JONATHAN FREUND, University of Illinois at Urbana-Champaign — Considerable injury to renal tissue often accompanies treatment when shocks waves are delivered to break up kidney stones. The most severe injuries seem to involve cavitation damage, driven by the expansive portion of the lithotripor's wave. However, data from animal studies indicate that inverted shock waves, which should preclude cavitation, still cause local injury near the tip of the renal papilla, which seems particularly susceptible to injury in general. We develop a model of papilla tissue, which consists mostly of parallel fluid filled elastic 10 to 30μm diameter tubules, to assess whether or not the shear of repeated shocks can accumulate to cause injury. Material properties are estimated from reported measurements of renal basement membranes. A Stokes-flow boundary integral algorithm is used to estimate the net viscoelastic properties of the tissue. It is predicted that the particular microstructure of the tissue near the tip of the papilla is indeed susceptible to shear accumulation as consistent with several observations.

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Date submitted: 03 Aug 2007 Electronic form version 1.4