

## STONE DISEASE

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### **Ureteroscopic ultrasound technology to size kidney stone fragments: proof of principle using a miniaturized probe in a porcine model**

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**Purpose:** A prototype ultrasound-based probe for use in ureteroscopy was used for in vitro measurements of stone fragments in a porcine kidney.

**Methods:** Fifteen human stones consisting of three different compositions were placed deep in the collecting system of a porcine kidney. A 2 MHz, 1.2 mm (3.6F) needle hydrophone was used to send and receive ultrasound pulses for stone sizing. Calculated stone thicknesses were compared with caliper measurements.

**Results:** Correlation between ultrasound-determined thickness and caliper measurements was excellent in all three stone types ( $r(2) = 0.90$ ,  $p < 0.0001$ ). All 15 ultrasound measurements were accurate to within 1 mm, and 10 measurements were accurate within 0.5 mm.

**Conclusion:** A 3.6F ultrasound probe can be used to accurately size stone fragments to within 1 mm in a porcine kidney.

#### **Editorial Comment**

The authors report a good correlation with stone-size to within 1mm. As a 0.5mm discrepancy represents a 1.5F difference for stone extraction through a 12F inner diameter ureteral access sheath, one could argue that the limit for error be placed at 0.5mm - in which case the probe is accurate in only 2/3 of cases. Though the authors tested stones 3-7mm in size, the critical clinical question is posed by those stones 4-5mm in size - a report to the operator that the stone is less than or greater than 4.5 mm in size is required with a high level of accuracy.

The authors utilized a rigid probe - they do not state what length probe was utilized, or if it would be easy to modify to the typical 42cm length of a rigid ureteroscope, or preferably to a flexible configuration for a flexible ureteroscope. One limitation of the device is that it provides unidimensional sizing capabilities - if the largest dimension of the stone was not captured, then the risk of engaging a stone too large to extract would not be mitigated. Often air bubbles are transmitted to the collecting system through the irrigation fluid; one might anticipate that interference with the stone-fluid interface may pose a challenge in these cases for stone sizing.

The technology provides the potential sizing stones prior to engaging them in a basket - thereby decreasing the risk of ureteral injury - this would be particularly appealing for stones that are impacted or partially embedded. In addition, this technology may aid in the identification of submucosal calculi and calculi in a calyceal diverticulum, and facilitate unroofing with the holmium laser.

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