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IMAGE BASED RENAL STONE TRACKING TO IMPROVE EFFICACY IN EXTRACORPOREAL LITHOTRIPSY

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ABSTRACT

Purpose: We describe a method to reduce the number of shocks necessary to fragment renal stones during extracorporeal shock wave lithotripsy by automatically taking into account stone movements.

Materials and Methods: Echotrack computer software was developed and implemented on a lithotriptor. One software module uses image processing to detect instantaneous stone location based on ultrasound images generated by the lithotriptor. A second module uses the detected location to control the shock wave generator position, and automatically adjusts it to improve coincidence between the focal volume and stone. The reliability of the tracking algorithm was clinically tested in 65 patients with renal stones. These in vivo tests were qualitative and the goal was to assess software ability to track stones during actual treatments. A quantitative evaluation of the reduction in shocks necessary for fragmentation was performed in vitro. Artificial stones were moved according to computer generated trajectories. Each trajectory was applied once with and once without automatic adjustment of the generator position.

Results: The in vivo tests demonstrated software ability to track stones as far as they were visible in the images. During in vitro tests automatic adjustments of the generator position reduced the number of shocks necessary to fragment stones completely by a factor of 1.64.

Conclusions: Image based renal stone tracking software that automatically adjusts the shock wave generator position according to the displacement of renal stones is useful during extracorporeal shock wave lithotripsy. Treatment time was significantly shorter with this software.

KEY WORDS: lithotripsy; image processing, computer-assisted; kidney calculi; ureteral calculi