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INDEPENDENT EVALUATION OF THE LITHOGOLD LG-380 LITHOTRIPTER: IN VITRO ACOUSTIC CHARACTERISTICS AND ASSESSMENT OF RENAL INJURY IN THE PIG MODEL

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INTRODUCTION AND OBJECTIVES: Different lithotripters can differ considerably in their acoustic output (pressures they generate, acoustic energy delivered, dimensions of the focal volume), stone breakage efficiency, and potential to induce injury. As such it is important to critically evaluate new machines to identify their advantages and limitations, and build experience in how to use these devices safely and effectively. We undertook such a laboratory assessment of TRT (Tissue Regeneration Technologies) LG-380 lithotripsy system.

METHODS: The LG-380 was coupled (defect-free) to the Mylar window of an acrylic test tank. The target point was found by x-ray then marked by crossed lasers. A fiber-optic probe hydrophone (FOPH-500) was used to map the acoustic field (in x-y-z) at various power levels (PL 1-9). Stone breakage was determined using U30 gypsum stones. Acute renal injury (4 hr post-tx) was assessed in four young adult (70 kg) pigs treated with 3,000 SWs, 60 SW/min using an uninterrupted multi-stage power ramping protocol (PL 1-8 @ 50 SW, PL-9 2600 SW) as recommended by TRT for treatment of patients.

RESULTS: Focal width (-6dB zone) at the target plane depended on electrode age; when the electrode was new the focal width measured ~20 mm, but narrowed to 10-12 mm after ~5000 SWs. This change did not affect breakage of stones even for stones positioned 10 mm lateral to target point ($p>0.59$). With a new electrode, FOPH scans along the acoustic axis localized the acoustic maximum (~30 MPa) nearly 35 mm distal to target point. As the electrode aged the acoustic maximum reduced in size and moved toward target point; that is, there was a proximal shift of the acoustic field with wear on the electrode, possibly due to change in position of the spark gap. Injury to the kidney parenchyma, as determined by quantitative histo-morphometry, was either absent or measured <0.1% functional renal volume.

CONCLUSIONS: The LithoGold LG-380 is a low-pressure, wide-focal-zone lithotripter that employs a self-adjusting electrode. Electrode wear leads to a proximal shift in the acoustic field, but this does not affect stone breakage in the target plane. When SWs were delivered by progressive power ramping at moderate SW-rate (60 SW/min), renal injury was very low with this lithotripter. (Supported by NIH DK43881)

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