Stone Disease: Surgical Therapy VII

Moderated Poster 69

Sunday, May 17, 2020 **3:30 PM-5:30 PM**

MP69-01

"VAPORTUNNEL" URETEROSCOPIC HOLMIUM LASER LITHOTRIPSY: INTRAOPERATIVE AND EARLY POSTOPERATIVE OUTCOMES

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INTRODUCTION AND OBJECTIVE: "VaporTunnel" technique is a result in pulse modulation during holmium laser lithotripsy in which the laser emits part of the energy to create an initial bubble, and the remaining energy is discharged once the bubble is formed so that it can pass through the already formed vapor channel. The aim of this study is to outline the outcomes of the Vapor Tunnel technology in ureteral stones

METHODS: A prospective trial was conducted for patients undergoing holmium laser lithotripsy for ureteral stones. Patients were randomly assigned to have holmium laser lithotripsy with or without Vapor Tunnel technology. All procedures were performed by four experienced urologists. Quanta Cyber Ho 100W generator with 365 μ fiber was used for all cases. Demographic data, stone parameters, perioperative complications and success rates were compared. The degree of stone retropulsion was graded on a Likert scale from zero-no retropulsion to 3-maximum retropulsion

RESULTS: A total of 80 patients were included in the study (40 per each group). Both groups were comparable in terms of age, and pre-operative stone size (1.2 vs. 1.1 cm, $p>0.05$). When compared with the Regular mode, Vapor Tunnel Technology was associated with significantly lower fragmentation time (20.4 vs. 16.1 min, $p<0.05$) and total procedural time (49 vs. 35.7 min, $p<0.05$). However, there were no significant differences in terms of total energy applied to the stones (9.9 vs. 10.7 KJ, $p>0.05$). Vapor Tunnel technology was associated with significantly less retropulsion. There was no significant difference between both modes in terms of intraoperative complications. The success rate at the end of 1 month was comparable between both groups (92.3 vs. 88.3%, $p> 0.05$)

CONCLUSIONS: Vapor Tunnel technology is associated with significantly lower fragmentation and procedural times. The reduced fragmentation time is a result of the significantly lower retropulsion of the stones during laser lithotripsy; thus improving stone fragmentation efficiency

Source of Funding: No

MP69-02

MOSES LASER TECHNOLOGY FOR FRAGMENTATION IS NOT ASSOCIATED WITH SUBJECTIVE OR OBJECTIVE OUTCOMES IN URETEROSCOPIC LASER LITHOTRIPSY WITH BASKET EXTRACTION

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WITHDRAWN

MP69-03

THE EFFECTS OF LASER PULSE DURATION ON ENERGY DELIVERY AND STONE DAMAGE DURING LASER LITHOTRIPSY

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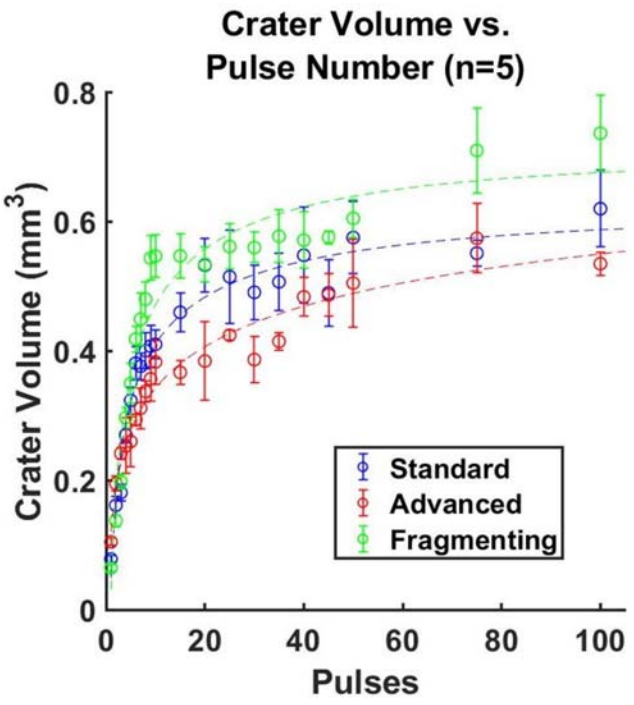
INTRODUCTION AND OBJECTIVE: Although modern laser lithotripsy (LL) systems offer pulse duration (PD) modulation during treatment, its effect on both the underlying mechanisms of stone damage and treatment efficiency are unclear. We investigate the effects of varying laser PD on the energy delivery to the stone and surrounding fluid and its resultant effects on bubble geometry and stone crater formation.

METHODS: Three pulse modes of varying PD (Fragmenting $\approx$ 75 μs, Standard $\approx$ 150 μs, Advanced $\approx$ 200 μs) from a clinical LL system (H Solvo 35-watt laser, Dornier MedTech) were used to treat fixed Begostone samples. A 400 μm laser fiber was placed in contact with the stone surface and delivered varying number of pulses (1 – 100) for each pulse mode ($n = 5$). Crater volume (CV) was quantified using optical coherence tomography (OQ Labscope, Lumedica) following LL. The effects of PD on cavitation during treatment and power delivery to the stone were quantified with high-speed imaging and photodetector measurements, respectively.

RESULTS: We observed a rapid increase in CV over the first 5-10 pulses in all three pulse modes before a plateau after 20-30 pulses, accompanied by a characteristic transition in bubble geometry from a small, flat bubble to a large hemispherical bubble. Longer PDs resulted in higher energy delivery efficiency, but lower mean CV (0.737 mm^3, 0.602 mm^3, and 0.535 mm^3 for fragmentation, standard, and advanced mode after 100 pulses, respectively; $p < 0.05$). High-speed imaging synced with photodetector measurements correlated higher energy delivery with the expansion of the vapor bubble.

CONCLUSIONS: As CV enlarged, more laser energy was absorbed by the intermediate fluid, leading to a large bubble formation with a concomitant reduction in stone damage at increasing pulse numbers. This important observation demonstrates that fiber-stone distance is a critical parameter in treatment efficiency regardless of PD. Significantly, this is the first experimental validation of improved energy delivery to the stone with longer PDs with more pulse energy delivered following the formation of a vapor bubble. However, the reduced CV for longer PD suggests that other factors, such as cavitation erosion and stress, may play a significant role in stone damage.



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MP69-04

URETERAL ACCESS SHEATH SIZE AND FORCED IRRIGATION EFFECTS IRRIGATION FLUID TEMPERATURE WHEN HOLMIUM: YAG LASER IS USED ON FLEXIBLE URETEROSCOPY

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INTRODUCTION AND OBJECTIVE: The latest developed laser energy modalities provide higher amounts of energy promising better results for urinary stone treatment. Higher amounts of energy can lead to a higher irrigation fluid temperature which may cause tissue damage. In this study, irrigation fluid temperature during laser lithotripsy; its relation with ureteral access sheath (UAS) and irrigation force was studied. Objective was to find the most appropriate settings for high energy laser treatment.

METHODS: In vivo porcine model was used in this study. Kidney ureter units were divided into 4 groups: 14/16Fr UAS, 12/14Fr UAS, 10/12Fr UAS group and non-UAS group. Thermocouple (TC08, Pico Technologies, UK) was used to measure temperature via 22Fr nephrostomy tract which was placed in upper calyces of kidney units. A flex-X2 ureteroscope (Karl Storz GMBH, Germany) was used with continuous irrigation pump (Endoflow II, Rocamed SAM, Monaco). Holmium: YAG laser (Moses Pulse 120H, Lumenis Ltd. Israel) was fired at 20W, 40W or 60W for 60 seconds. Maximum temperature was recorded in each group with either passive or active/forced irrigation (table 1). The experiment was interrupted if temperature rates were above 65 C°.

RESULTS: Maximum temperature measured with passive irrigation and without use of UAS were higher than other groups; results for 20, 40 and 60 W were 60 °C, > 65 °C and > 65 °C respectively. Lowest temperature rates were achieved with 14/16 Fr group with active/forced irrigation; results for 20, 40 and 60 W were 28.5 °C, 37 °C and 37.5 °C respectively. Even with smaller size of UAS forced irrigation helped lowering maximum temperatures (figure 1).

CONCLUSIONS: Use of forced irrigation and larger UAS helps to reduce high irrigation fluid temperatures caused by laser lithotripsy. Higher irrigation fluid temperatures were seen with passive irrigation and without use of ureteral access sheath which may result in tissue damage. Gravity irrigation seems to be not safe when high power settings are used.

Table 1. Maximum temperature rates of groups

	20 W		40 W		60 W	
	forced irrigation	passive irrigation	forced irrigation	passive irrigation	forced irrigation	passive irrigation
Without UAS	35.5 °C	60 °C	40.5 °C	>65 °C	42.5 °C	>65 °C
10/12 Fr	33.5 °C	57.5 °C	40 °C	>65 °C	41.5 °C	>65 °C
12/14 Fr	33.5 °C	45 °C	36.5 °C	61.5 °C	44.5 °C	>65 °C
14/16 Fr	28.5 °C	49 °C	37 °C	>65 °C	37.5 °C	>65 °C

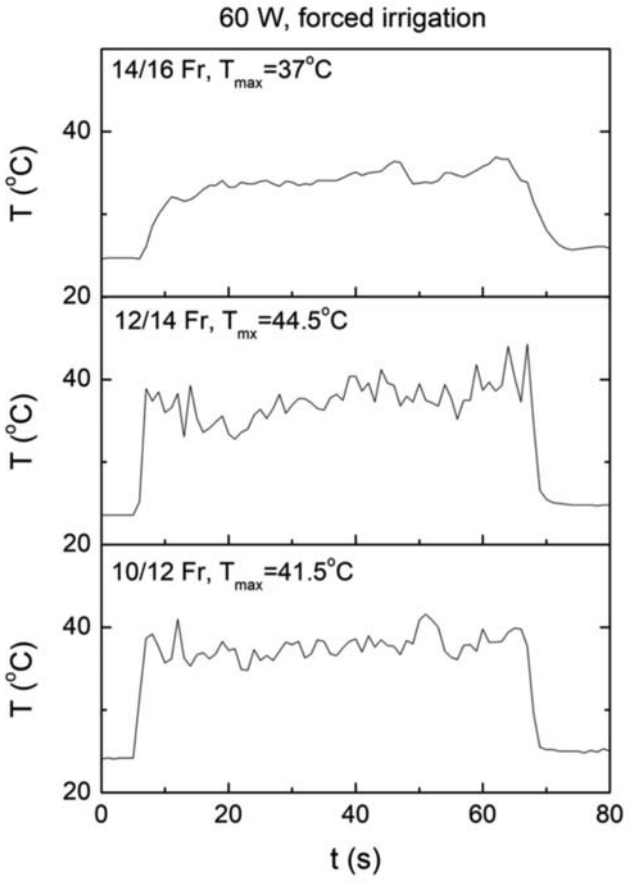

Figure 1. Temperatures 60 W energy, with forced irrigation

Source of Funding: This study is independent and was not funded by any external organization.

MP69-05

LEAN: INTRODUCTION OF A QUALITY IMPROVEMENT CONCEPT TO IMPROVE EFFICIENCY WHILE MAINTAINING SAFETY IN PERCUTANEOUS NEPHROLITHOTOMY

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INTRODUCTION AND OBJECTIVE: There has been increasing interest in quality care while maintaining good clinical outcomes efficiently. One of the more technically challenging procedures in endourology is percutaneous nephrolithotomy (PCNL). PCNL