Podium Session 3: Endourology/Stones
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POD-03.01
A Prospective Study Examining the Incidence of Bacteriuria and Urinary Tract Infection Post-shockwave Lithotripsy: The Case against Universal Antibiotic Prophylaxis

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Introduction and Objective: Controversy exists over the need for antibiotic prophylaxis prior to shockwave lithotripsy (SWL). The AUA's Best Practice Policy Statement on Urologic Surgery Antimicrobial Prophylaxis uses level 1A evidence to indicate universal antibiotic prophylaxis, whereas the EAU's Guidelines on Urological Infections cites level 1A evidence to indicate prophylaxis only for patients with urinary drainage tubes, ureteral stents or infected stones. This prospective, single-centre quality assurance study evaluates the use of targeted antibiotic prophylaxis in patients undergoing SWL.

Methods: Over a three-month period, patients undergoing SWL for renal and ureteral calculi were enrolled. All patients underwent urine dipstick, microscopy and culture prior to SWL. At our centre antibiotic prophylaxis was provided to patients with nephrostomy tubes, history of infected stones or urine dipsticks with both nitrites and leukocytes. The presence of ureteral stents was not an indication for prophylaxis. All patients had a urine culture performed 3 days post-SWL if they did not undergo antibiotic prophylaxis, or 2 days after finishing their course of antibiotic prophylaxis. All patients completed a survey documenting fevers or urinary symptoms up to one-week post-treatment.

Results: 526 patients (63.7% male, 36.3% female) with a mean age of 54.17 years and BMI of 28.05 kg/m^2 were enrolled. 78 (15.1%) patients underwent SWL with previously placed ureteral stents. Only 3 (13.0%) of the positive urine cultures taken prior to SWL were both leukocyte and nitrite positive on urine dipstick, whereas 17 (54.8%) of the positive urine cultures were both leukocyte and nitrite negative on dipstick. 10 (2.2%) patients were administered antibiotic prophylaxis (6 of which had ureteral stents), and 14 (2.7%) were given antibiotics post-treatment. Post-SWL, only 1 (0.2%) patient developed a urinary tract infection (UTI) and 4 (0.8%) patients developed asymptomatic bacteriuria.

Conclusions: The rates of UTI and asymptomatic bacteriuria following SWL are extremely low (<1%) with targeted antibiotic prophylaxis. This prospective case series questions the need for universal antibiotic prophylaxis prior to SWL, as well as the need for antibiotic prophylaxis in patients undergoing SWL with indwelling ureteral stents.

POD-03.02
Factors Determining Stone Free Rate in Shock-Wave Lithotripsy Using the Storz Modulith SLX-F2 Lithotripter

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Introduction and Objectives: Although shock wave lithotripsy (SWL) has been around since 1982, wide variations of Efficiency Quotients (EQ) have been reported for the third and fourth generation electromagnetic lithotripters. Therefore, the aim of our present study was to calculate the EQ of the latest mobile Storz Modulith SLX-F2 lithotripter and to identify factors determining stone-free rate.

Methods: A retrospective review of a prospectively collected database of the first consecutive 533 patients undergoing SWL between June 2009 and February 2010. A total of 16 patients with radiolucent stones and 46 patients with incomplete follow-up were excluded. Patients were followed with plain radiography to assess stone-free status. Univariate and multivariate analysis were performed to identify factors determining stone-free rates.

Results: Follow-up was complete for 474 patients with a mean age of 54.2 ± 14.5 years. Success rate after a single SWL session was 82.7% (renal 82.2% and ureteral 83.3%; p=0.81). Retreatment rate was 14.7% (renal 15.2% and ureteral 14.2%; p=0.79). Stone-free rate was 77% (renal 74.1% and ureteral 80.9%; p=0.10). Forty-three patients had pre-SWL ureteral stents, whereas 13 patients required post-SWL ureteral stenting. Thirty-five patients required post-SWL curative procedures. The EQ was 0.66 and the modified EQ was 0.62. On multivariate analysis, stone-free patients were associated with significantly smaller stone size (9.5 vs 10.3 mm, p=0.02), younger age (53.1 vs 58.0 yrs, p=0.002), right-sided stones (83.6% vs 71.0% p=0.001) and absence of a ureteral stent (78.7% vs 64.3%; p=0.001).

Conclusions: The mobile Storz Modulith SLX-F2 lithotripter has acceptable EQ of 0.66. In the present study, smaller stones (<10 mm), younger age, right-sided stones and absence of ureteral stents were associated with significantly higher stone-free rates.

POD-03.03
Holmium:Yag Lithotripsy: Optimal Power Settings to Increase Fragmentation and Decrease Retropulsion

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Introduction and Objectives: We studied the relationship between holmium:YAG lithotripsy power settings and fragmentation, fragment size, and retropulsion, with and without anti-retropulsion devices.

Methods: In vitro studies quantified total fragmentation (TF) and fragment size distribution for varied Ho:YAG power settings. All stones were exposed to 500 J total energy with a 365 um fiber in water. Stones were ablated in a 8 mm diameter cylinder without and with stabilization (Accordion and BackStop devices). TF and % fragments >1 were measured. Optical computed tomography (OCT) measured ablation craters for uric acid, struvite and calcium oxalate monohydrate stones. Pressure transients were measured by needle hydrophone. Accordion and backstop devices were directly ablated with 100J total energy at various power settings to simulate operative error (surgical pass point).

Results: For non-stabilized stones, increased pulse energy produced increased retropulsion ($p<0.001$) and decreased TF ($p<0.001$). With anti-retropulsion devices, no retropulsion occurred. TF increased ($p<0.001$) and fragment size increased ($p<0.02$) as pulse energy increased. OCT showed symmetric craters with regular contours. Crater size varied proportionally to pulse energy, $p<0.01$. Pressure transients increased as pulse energy increased, with typical peak transients of <10 bars at 0.5 J and 20-30 bars at 2.0J, $p<0.01$. With direct ablation, both Accordion and BackStop showed increased damage as pulse energy increased. Even at 2.0J pulse energy, they retained shape and function.
Conclusions: When a given amount of total energy is applied, retropulsion increases as pulse energy increases. Energy is wasted and lithotripsy is compromised with retropulsion. Low pulse energy (0.2J-0.5J) produces minimal retropulsion and tiny fragments. High pulse energy (1.0J-2.0J) produces faster lithotripsy but larger fragments. Anti-retropulsion devices are useful when high pulse settings are applied. The ideal power settings depends on whether the urologist wants tiny debris or is willing to basket larger fragments; and whether an anti-retropulsion device is used. At all pulse settings, pressure transients remain low and ablation craters remain predictable consistent with photothermal mechanisms.

POD-03.04

Development of a Biodegradable Ureteral Stent in a Yorkshire Pig Model

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Introduction and Objective: Conventional polymeric (polyurethane and silicone) and metal ureteral stents often result in increased morbidity due to irritation, encrustation and obstruction. A novel stent, engineered from absorbable suture material that degrades in a retrograde fashion, may significantly reduce morbidity by mitigating fragment obstruction while maintaining adequate drainage. This study was conducted to evaluate the degradation time, physiologic and histologic responses elicited by a third generation ureteral stent in a porcine model.
Methods: In 16 female Yorkshire pigs, 10 biodegradable (Uriprene, Oceana Therapeutics, NJ) and 6 biostable (Polaris, Boston Scientific) ureteral stents were cystsoscopically inserted unilaterally. Intravenous pyleograms (IVPs) were performed on Days 0, 7, 9/10, 14/15, 17, 24 and 28. Blood and urine samples were collected on Days 0, 7, 14, 21 and 28. Polaris stents were removed on Day 21. On Day 28, animals were euthanized and necropsied for abnormalities, microscopic and histologic evaluation.

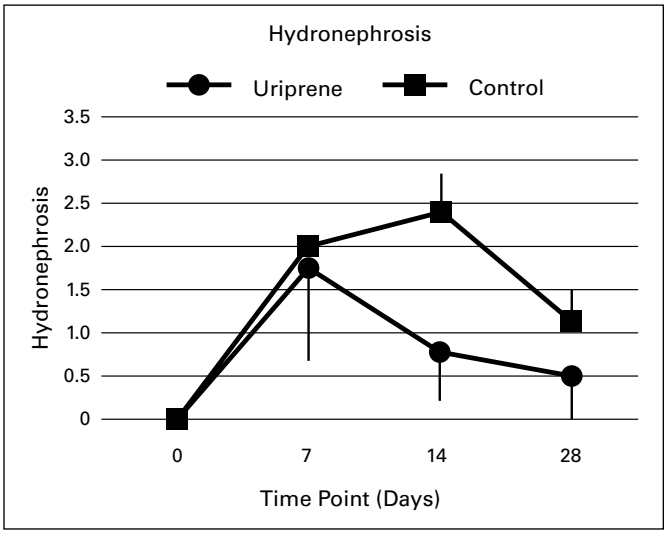

Fig. 1. POD-03.04

Results: 9/10 Uriprene stents degraded completely within the 4-week study period; the remaining stent left three small (<1.5 cm) remnants in the bladder. IVPs showed equivalent drainage throughout and significantly less hydronephrosis in Uriprene-stented kidneys on Day 14 (Figure 1). Hematology and urinalysis parameters were not affected by Uriprene or PolarisTM stent implantation. 40% of Uriprene-stented animals displayed a transient mean serum creatinine increase on Day 7, resolving by Day 10; BUN clearance was not affected. Significantly less stent-related bullous edema and bladder mucosa thickening were observed in the Uriprene-stented animals as well as less histologic inflammation.
Conclusions: This study demonstrates the safety and effectiveness of the Uriprene stent in a porcine model. The Uriprene stent degraded in retrograde fashion without distal ureter obstruction and provided equivalent drainage to the Polaris-stented group. Pathologic inspection suggested improved biocompatibility in the Uriprene group.

POD-03.05

Randomized Controlled Trial of Virtual Reality and Hybrid Simulation for Robotic Surgical Training

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Background: The increasing utilization of robotic assisted surgery in urology has created new educational challenges regarding optimal training conditions for residents. While simulation has been incorporated into training for laparoscopy, it is unknown if simulation can play a preparatory role for the robotics platform. In a randomized fashion, we sought to investigate the optimal simulation environment for robotic surgery.
Methods: We identified two widely validated laparoscopic simulation programs, LapSim® [LSM], and the McGill Inanimate System for Training and Evaluation of Laparoscopic Skills® (MISTELS) utilizing a hybrid augmented reality trainer, ProMIS® [PM]. Four tasks were used; peg transfer, intracorporeal suturing, cannulation, precision cutting. 20 surgically naive medical students were randomized to the practice sessions with either, both or none of these simulators. Baseline performance scores, training, and a final performance measurements were completed from February-May, 2009. Statistical performance changes were characterized using SAS®. Scores were compared using the Mann-Whitney U test.
Results: All 20 medical students completed the preliminary performance analysis, five training sessions and the final performance analysis. Baseline performance characteristics amongst cohorts were statistically similar (á =0.05). On comparing mean scores differences between pre and post training sessions within each group, statistically significant performance enhancement in all four robotic tasks were identified in the groups receiving dual training (LSM and PM) [$p<0.05$]. Students trained on the PM or LSM alone did improve in cannulation alone, but did not demonstrate overall score or performance enhancement. Students without training did not illustrate performance improvement.
Conclusions: We have demonstrated that the use of ProMIS hybrid and LapSim VR simulators together leads to improvement in robotic task completion that exceeds what is seen with without simulation or with either simulator alone in novice medical students. Additionally, the use of MISTELS tasks can be adapted for the DaVinci® platform. Until pure robotic simulators are both validated and cost-effective, the utility of ProMIS and LapSim simulators for surgical readiness on the robotic platform cannot be understated.

POD-03.06

Standardized Communication and Frame of Reference Facilitates Safe and Efficient Laparoscopic Teaching: A Randomized Controlled Study

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Introduction and Objectives: During laparoscopic procedures, communication between the attending surgeon and the novice trainee is paramount. While teaching laparoscopic surgery, attending must direct the novice to certain points in the surgical field. Without standardized frames of reference (FOR) the directions can become confusing and frustrating. We designed a novel FOR overlay and standardized verbal commands to facilitate intraoperative teaching and directing. The objective of this study was to determine the impact of the FOR overlay used with a standardized language on the performance of laparoscopic tasks.

Methods: Forty-two medical students were randomized to two groups: group 1 (control) performed tasks with with no overlay, the commands were limited to simple directions such as left, right, up and down; group 2 performed tasks on a overlay with commands based on a clock and x:y triangulation (Figure 1). All subjects performed three different trials, each consisting of 6 bean transfers, while instructed with one of the two methods. Time to task completion and "error score" defined as the number of times the bean is moved to a wrong circle were recorded and analyzed using non-parameteric statistics.

Results: Group 2 was faster than the control for all three trials (63,67,51 vs 87,80,71s respectively) ($p<0.05$). The error scores were lower for group 2 compared to the control, approaching significance in trial 1 (1.33 vs 1.67, $p=0.07$) and significant in trial 3 (1.26 vs 1.74, $p=0.012$). No significant differences were seen in trial 2 (1.4 vs 1.6, $p=0.32$).

Conclusions: Using a FOR overlay and standardized communication for directing in laparoscopy improves performance and error. This proof of concept will be used to develop a video inlay FOR for endoscopy monitors. The development and validation of standardized communication and FOR will improve teaching and patient safety during laparoscopy.

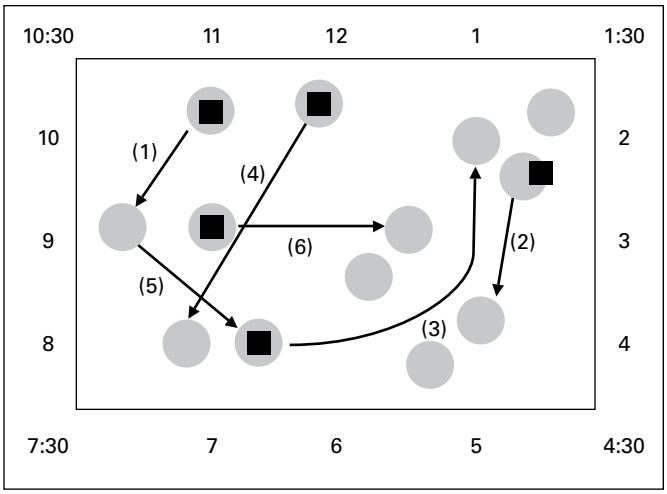

Fig. 1. Bean transfer with clock overlay (group 2). POD-03.06
Step 1: Move 11′ bean to 9′ circle
Step 2: Move 2′ bean to the (4l5) circle
Step 3: Move 7′ bean to the (1;2) circle
Step 4: Move the 12′ bean to the (7;8) circle
Step 5: Move 9′ bean to the 7′ circle
Step 6: Move (7;9) bean to the 3′ circle