Podium Session 5: Stones/MIS
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POD-05.01

Factors Influencing the Successful Shock Wave Lithotripsy (SWL) Treatment of Renal and Ureteric Stones: Towards a Clinical Nomogram

Wiesenthal J, Ghiculete D, Ray A, Pace S, Honey R, Pace K
St. Michael's Hospital, University of Toronto, Toronto, ON

ntroduction and Objective: Shock wave lithotripsy (SWL) is considered the first-line treatment for the majority of patients with renal and ureteric calculi, with success rates for contemporary series varying from 60-90%. Although success is dependent on patient and stone-related factors there are few reliable algorithms predictive of SWL success. We conducted a retrospective analysis of patient and stone-related factors to determine their influence on the success of SWL and develop a comprehensive nomogram to predict SWL outcomes.

Materials and Methods: Data from patients treated at the St. Michael's Hospital Lithotripsy Unit from May 2004 to June 2009 were reviewed. Analysis was restricted to those patients with a pre-treatment non-contrast CT scan conducted at our centre demonstrating a solitary renal or ureteric calculus ≤ 20 mm in maximal diameter. Successful treatment of renal stones was defined as those patients who were stone free or had asymptomatic, clinically insignificant residual fragments <4 mm in diameter three months after a single SWL treatment. Successful treatment of ureteric stones was defined as stone free 2-week post-SWL. Demographic, stone, patient, treatment and follow-up data were collected from a prospective database and review of CT and KUB imaging by two independent urologists and one radiologist. Data was analyzed with logistic regression, Chi square analysis and ANOVA where appropriate.

Results: There were 422 patients (69.7% male) with a mean age of 51.4 years (SD 12.9) and mean BMI 27.0 kg/m^2 (SD 4.9) analyzed. Mean stone size was 78.9 mm^2 (SD 77.3) for ureteral stones and 66.1 mm^2 (SD 63.2) for renal stones, with 95 (43.6%) of the renal stones located in the lower pole. The single treatment success rates for ureteral and renal stones were 62.3% and 68.8%, respectively. On univariate analysis, predictors of SWL success, regardless of stone location, were age ($p = 0.01$), BMI ($p = 0.01$), stone size ($p < 0.001$), skin-to-stone distance (SSD; $p < 0.001$), and CT attenuation (CTHU, $p = 0.003$). On multivariate analysis, age > 60 (OR=0.60, $p = 0.011$), stone size >45 mm^2 (OR=0.35, $p < 0.001$), and SSD >110 mm (OR=.49, $p < 0.001$) remained significant predictors of outcome.

Conclusions: We have identified patient and stone parameters that can reliably predict SWL outcomes for both ureteral and renal stones. This data can be used by clinicians to facilitate optimal treatment-based decisions and provide patients with more accurate single-treatment success rates for SWL that are tailored to patient-specific situations.

POD-05.02

Holmium:YAG Lithotripsy Efficiency, Fragment Size, and Retropulsion Vary with Pulse Energy

Jonat L, Chew B, Teichman J
University of British Columbia, Vancouver, BC

Introduction and Objective: The holmium:YAG laser fragments stones by photothermal mechanism. Increased pulse energy produces larger ablation craters, implying faster lithotripsy. However, increased pulse energy produces more retropulsion, implying slower lithotripsy. We studied optimal power settings for holmium:YAG lithotripsy.

Methods: Stone phantoms of uniform shape and mass were ablated in water with 500 J total energy (n = 10 per cohort). Six power settings were tested: 0.2 J at 10 Hz, 0.2 J at 50 Hz, 0.5 J at 10 Hz, 0.5 J at 40 Hz, 1.0 J at 10 Hz, 2.0 J at 10 Hz. Two conditions were tested: no stabilization device vs. a PercSys Accordion stabilization device placed behind the stone. After lithotripsy, fragments were dried and passed through sequential geological

Table 1. POD-05.02. TF, % mass of fragments > 1 mm, and retropulsion

	0.2 J 10 Hz	0.2 J 40 Hz	0.5J 10 Hz	0.5J 40 Hz	1.0 J	2.0 J	*p*-value
TF no device (g)	0.01 ± 0.00	0.02 ± 0.01	0.04 ± 0.01	0.02 ± 0.01	0.05 ± 0.01	0.05 ± 0.01	<0.0001
% >1 mm, no device	0	0	22	5	4	1	0.06
Retropulsion (mm), no device	26 ± 6	22 ± 5	58 ± 15	63 ± 9	98 ± 15	152 ± 38	<0.0001
TF + device (g)	0.01 ± 0.01	0.03 ± 0.01	0.05 ± 0.01	0.05 ± 0.01	0.09 ± 0.03	0.14 ± 0.03	<0.0001
% >1 mm, + device	0	0	10	15	37	36	<0.0001

TF = total fragmentation.

sieves. To quantify fragment size distribution, we reported the % fragments >1 mm of the top 10%ile largest fragments per cohort. Total fragmentation (TF) was defined as initial mass minus the dominant remaining mass. In the "no device" cohorts, retropulsion was measured. ANOVA, Kruskal-Wallis, Mann-Whitney and t-tests were used for statistics.
Results: Comparing no stabilization vs. stabilization for each power cohort, TF increases with stabilization devices, except for 0.2 J 10 Hz and 0.5 J 10 Hz cohorts, $p < 0.01$; fragment size increased with stabilization for 1.0 J and 2.0 J cohorts, $p < 0.0001$ (Table 1).
Conclusions: When retropulsion is constrained by a stabilization device, increasing pulse energies produce more lithotripsy but also larger fragments. With no stabilization device, increasing pulse energies produce more retropulsion with less efficient lithotripsy. At low pulse energy, fragments are small but lithotripsy is less efficient. The optimal power settings appear to be low pulse energy (0.2 – 0.5 J) at high frequency (40 Hz). The findings are consistent with photothermal effects at low pulse energy and increased photomechanical effects at higher pulse energies.

POD-05.03
Documentation of Fluoroscopy Times During Ureteroscopy May Lead to Significant Reduction in Radiation Exposure

Violette P, Szymanski K, Anidjar M, Andonian S
McGill University Health Centre, Montréal, QC

Introduction and Objective: Ureteroscopy is associated with significant radiation exposure to patients, urologists and operating room personnel. The most effective method of reducing occupational radiation exposure is to shorten the fluoroscopy time. The aim of the present study was to assess prospectively the impact of recording fluoroscopy time in the operative report on the use of fluoroscopy during ureteroscopy.
Methods: Sixty-four ureteroscopies for consecutive patients presenting for stone disease at the McGill University Health Centre were included in the study. These patients were divided into 2 groups based on the attending endourologist. Group I did not have fluoroscopy times recorded, whereas in group II, the attending endourologist recorded intra-operative fluoroscopy times in the operative report. Seven procedures were excluded (3 ureteroscopies did not have fluoroscopy time documented by either the radiologist or the urologist and 4 ureteroscopies were for staghorn calculi). Therefore, there were 24 ureteroscopies in group I and 33 ureteroscopies in group II. Patient and stone characteristics were obtained from hospital and office charts and both groups were compared using the Mann–Whitney–Wilcoxon test. Kruskal-Willis tests were used to compare fluoroscopy times between the 2 groups after correcting for stone size, location, and sidedness.
Results: There were no significant differences between group I and group II in terms of average age (55 vs. 53 years, $p > 0.4$), percentage female (42% vs. 24%, $p > 0.1$), and percentage renal stones (58% vs. 63%, $p > 0.6$). Similarly, there were no significant differences between the two groups in terms of mean stone size (11 vs. 9 mm, $p > 0.1$), and mean stone volume (1039 vs. 648 mm^3, $p > 0.2$). Intra-operative average fluoroscopy time was significantly higher in group I when compared with group II (277 vs.169 seconds, $p < 0.01$). This statistical significance remained even when both groups were corrected for stone size ($p < 0.02$), stone location ($p < 0.02$), and sidedness ($p < 0.03$).
Conclusions: Documentation of fluoroscopy times in ureteroscopy reports makes the urologist cognizant of radiation exposure and may lead to significant reductions in the use of fluoroscopy during ureteroscopy. Although these differences may be due to different intra-operative practices of urologists, surgeon behaviour remains the most significant modifiable factor in fluoroscopy use during ureteroscopy.

POD-05.04
Renal Colic and Urolithiasis Practice Patterns in Canada: A Survey of CUA Members

Satkunasivam R, Keays M, Pace K
Division of Urology, Department of Surgery and St. Michael's Hospital, University of Toronto, Toronto, ON

Introduction and Objective: A wide range of therapeutic options are available for the management of urolithiasis. We sought to describe the practice variability of CUA members and factors which predict these patterns for common stone scenarios.
Methods: Three hundred and eight English and 52 French-speaking CUA members were asked to complete online surveys in their respective languages. Demographic information on practice location, endourology fellowship training, Extracorporeal Shock Wave Lithotripsy (ESWL) access, "academic" vs. "community" practice, and whether at a hospital with regionalized surgical services, was collected. Respondents were asked

Table 1. POD-05.04. Actual and ideal treatment patterns for renal colic due to distal ureteric stones (% in parenthesis)

Stone size (mm)		Open ureterolithotomy	PCNL	Ureteroscopy and intra-corporeal lithotripsy / stone retrieval	ESWL	Cystoscopy and ureteric stent insertion under general anesthetic	Cystoscopy and ureteric stent insertion under local anesthetic	Analgesia, medical expulsive therapy, and close follow-up	Analgesia and close follow-up	Total
4	Actual	0 (0)	0 (0)	7 (5.1)	2 (1.4)	0 (0)	0 (0)	105 (76.6)	23 (16.8)	137
	Ideal	0 (0)	0 (0)	34 (17.4)	3 (1.5)	1 (0.5)	1 (0.5)	108 (55.4)	48 (24.6)	195
8	Actual	0 (0)	0 (0)	77 (57.5)	10 (7.5)	3 (2.2)	3 (2.2)	37 (27.6)	4 (3.0)	134
	Ideal	0 (0)	0 (0)	108 (54.3)	29 (14.6)	3 (1.5)	4 (2.0)	44 (22.1)	11 (5.5)	199
14	Actual	0 (0)	1 (0.8)	106 (80.3)	8 (6.1)	5 (3.8)	7 (5.3)	4 (3.0)	1 (0.8)	132
	Ideal	0 (0)	1 (0.5)	120 (65.9)	36 (19.8)	10 (5.5)	6 (3.3)	8 (4.4)	1 (0.5)	182

PCNL = percutaneous nephrolithotomy; ESWL = Extra-corporeal shock wave lithotripsy.

to indicate actual as well as ideal treatment for scenarios of renal, proximal and distal ureteric calculi.

Results: There were 131 urologists who responded (36 % response rate), all of whom treat urolithiasis. Of these: 38% practiced in Ontario, 17% in Quebec, 12% in BC and 12% in Alberta; 17% had endourology fellowship training; 76% had access to ESWL; 42% were at an academic institution and 66% at institutions with regionalized surgical services. Actual and ideal treatment modalities selected for symptomatic, distal and proximal ureteric stones (4, 8, 14 mm) were consistent with published guidelines. There were discrepancies between the use of ureteroscopy and ESWL in actual versus ideal scenarios (Table 1). Actual and ideal practices were congruent for proximal ureteric stones and asymptomatic renal calculi. In multivariable analysis, respondents were less likely to perform ureteroscopy on proximal 4 and 8 mm stones if they were at a hospital with regionalized surgical services (OR: 0.097; 95% CI: 0.01-0.76, $p =$ 0.03 and OR: 0.330; 95% CI: 0.13-0.83, $p =$ 0.02). Academic respondents were more likely to choose ESWL for proximal stones (OR: 4.12; 95% CI: 1.70-9.98, $p = 0.002$ for 8mm and OR: 3.87; 95% CI: 1.59-9.44, $p = 0.003$ for 14 mm). Endourology training was the only predictor for use of PCNL (OR 4.02; 95%CI: 1.1-14.8, $p =$ 0.04 for 22 mm renal pelvic stone and OR 3.395; 95% CI: 1.21-9.51, p = 0.02 for 15 mm lower calyceal stone).

Conclusions: There is a range of clinical variability in the management of urolithiasis in Canada, however, management approaches fall within published guidelines.

POD-05.05

Ambulatory Percutaneous Nephrolithotomy: Initial Series

Shahrour W, Andonian S
McGill University Health Centre, Montréal, QC

Introduction and Objective: Percutaneous nephrolithotomy (PCNL) is the gold standard for management of large renal stones. Traditionally, patients are admitted postoperatively with a large-bore nephrostomy tube, which is removed after a normal nephrostogram on postoperative day two. Although tubeless PCNL has been described previously, there have been no reports of ambulatory tubeless PCNL. The aim of the present study was to assess the safety and feasibility of ambulatory tubeless PCNL. Here the initial 10 patients are presented.

Methods: The initial series of 10 patients undergoing ambulatory tubeless PCNL was included in the present study. Patient information including age, sex, fluoroscopy time, operating room time, stone size (using largest diameter), and Hounsfield Units (HU) were collected prospectively and analyzed retrospectively. Furthermore, number of needle punctures, number of tracts, and stone free status were ascertained. Amount of narcotic administered in the recovery room (mg morphine equivalents), amount of time spent in recovery room (minutes), amount of narcotics used at home, and complications were recorded and documented. Criteria for same day discharges were: single tract, stone free status, adequate pain control, and satisfactory postoperative chest X ray and CBC. All patients had antegrade double J stents placed intra-operatively. Male patients were discharged home with Foley catheter. Follow-up office visit was done on postoperatively 2 days for trial of void and removal of the flank dressing. Double J stents were removed a week later cystoscopically.

Results: Out of the 10 patients undergoing ambulatory PCNL, 2 had established nephrostomy tracts. The rest of the 8 patients had nephrostomy tract established intra-operatively by the urologist. The median operating and fluoroscopy times were 83.5 and 4.45 minutes, respectively. The median stone diameter was 20 mm with a median of 800 HU. Patients spent a median of 240 minutes in the recovery room and received a median of 19.25 mg of morphine equivalents. There were no intra-operative complications and none of the patients required transfusions. There were two postoperative complications. The first was a deep vein thrombosis requiring anticoagulation. The second was re-admission for multiresistant E. coli UTI requiring intravenous antibiotics.

Conclusion: In highly-selected patients, ambulatory tubeless PCNL is safe and feasible. More patients are needed to verify criteria for patients undergoing ambulatory approach.

POD-05.06

Robotic vs. Laparoscopic Pyeloplasty: A Two-Centre International Study with Long Term Scintigraphic Follow-Up

Mufarrij P[1], Lebel M[2], **Boudreau L**[2], Mitchell S[1], Pouliot F[2], Audet J[2], Shah O[1], Dujardin T[2], Stifelman M[1]
[1]Department of Urology, New York University Langone Medical Center, New York, NY, USA; [2]Department of Urology, Centre Hospitalier Universitaire De Québec, Québec, QC

Introduction and Objective: Minimally invasive pyeloplasty has emerged as the standard of care for repair of UPJO. Herein, we review our international experience to evaluate outcomes of robotic and conventional laparoscopic pyeloplasty, comparing two large series with long-term scintigraphic and clinical follow-up.

Methods: Two university medical centre surgical teams have performed 107 robotic and 150 laparoscopic dismembered pyeloplasties, respectively, since 2002. An IRB-approved retrospective chart review was used to collect demographic, preoperative, operative, and postoperative data. Patients underwent a diuretic renal scan and symptom analysis pre- and post-surgery. Outcomes of laparoscopic and robotic pyeloplasty were analyzed using JMP 8.0 software.

Results: Both groups had a mean follow-up greater then 2 years. The laparoscopic group treated more UPJO with suspected intrinsic etiology ($p = 0.045$) and had decreased operative time ($p < 0.0001$). The robotic group had decreased length of stay and a slightly improved postoperative scintigraphic radiographic resolution of obstruction ($T_{1/2} \leq 20$ minutes) and symptoms. There was a trend for an increased complication rate in laparoscopic pyeloplasty group ($p = 0.08$), including an increased urinary leak rate.

Conclusions: To our knowledge, this represents the largest series comparing laparoscopic and robotic pyeloplasty with a mean follow-up of greater then 2 years. Laparoscopic pyeloplasty is associated with shorter operative times. Robotic pyeloplasty appears to have shorter lengths of stay and improved rates of postoperative radiographic resolution and symptoms. There was a trend for decreased complications in the robotic group. Overall, both techniques appear to be effective treatment with good durable outcomes for the management of UPJO.