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MP-3.01

Evaluating nutraceutical products for their effectiveness in kidney stone disease

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Introduction and Objective: Nutraceuticals are food extracts that claim to have medicinal effects. There are many nutraceutical products commercially available for the treatment of kidney stones. Previously, nutraceuticals for erectile dysfunction have been found to contain known pharmaceuticals (*J Urol* 174:636,2005). We sought to determine if known pharmaceuticals used for the treatment/prevention of stone disease are present in nutraceuticals advertised for kidney stones.

Materials and Methods: Thirteen nutraceuticals (Kidney Liquescence, Kidney Restore II, Kidney Stone Formula, Kidney Stone Out, Rencare, Renal Complex, Renal Sarcode, UNDA 2, UNDA 7, UNDA 258, Uripril, Vitamin C Liquescence and Yidan) were obtained and analyzed using high-performance liquid chromatography (HPLC) and mass spectrometry to determine if they contained hydrochlorothiazide, chlorthalidone, allopurinol, tamsulosin or nifedipine. Their effect on urine pH and their ability to dissolve calcium oxalate crystals over 10 days were also tested.

Results: Low levels of the α-blocker tamsulosin were present in the nutraceutical product Yidan as determined by HPLC and mass spectrometry, while none of the other pharmaceuticals were found in any of the products tested. Yidan decreased urine pH to 3 and Kidney Restore II raised the pH to 8.0. Yidan also slightly decreased calcium oxalate crystal weight suggesting it may be able to dissolve stones. Quadrupole-time of flight mass spectrometry analysis is currently being employed to identify the compounds found in each of the products.

Conclusion: Nutraceuticals are often used instead of conventional pharmaceuticals and there is very little scientific data evaluating their effectiveness and mechanisms of action. Two of the products tested affected urine pH while one contained low levels of a known pharmaceutical and showed activity in dissolving calcium oxalate crystals. In vivo studies are required to determine the effectiveness of nutraceuticals in treating kidney stone disease.

MP-3.02

Interim analysis of the Canadian StoneBreaker Trial: a randomized, multicentre trial comparing the LMA StoneBreaker and the Swiss LithoClast during percutaneous nephrolithotomy

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Introduction and Objective: Percutaneous nephrolithotripsy (PNL) is the preferred treatment modality for renal stones greater than 2 cm in diameter. Pneumatic lithotriptors are powered by compressed air. The StoneBreaker, a novel hand-held pneumatic lithotriptor, is powered by a compressed carbon dioxide cartridge. The purpose of this study is to compare the LMA StoneBreaker to the current standard of pneumatic lithotripsy, the Swiss LithoClast, during PNL. This study is ongoing and these data are an interim analysis.

Materials and Methods: From September 2007 to November 2008, we prospectively randomized 33 patients undergoing PNL to either the LMA StoneBreaker or the Swiss LithoClast. The primary outcomes were the time to 1) fragment the stone intracorporeally, 2) pluck the fragments and 3) time spent using ultrasonic (US) lithotripsy to remove debris at the end of the case. Secondary end points included stone-free rate, time to set up each device, ease of use, endoscopic visualization, damage to mucosa and device-related complications.

Results: Of the 33 patients, 16 were randomized to StoneBreaker and 17 to the Swiss LithoClast arm. The StoneBreaker was significantly faster at fragmenting stones than the LithoClast. Overall, there was a nonstatistically significant trend in the total lithotripsy time in favour of the StoneBreaker. The StoneBreaker was significantly faster to set up than the LithoClast ($p = 0.025$). Visualization, ease of use, operator fatigue and epithelial damage were not significantly different. The stone-free rates were almost identical as well as the stone composition in both groups. There were no device-related complications in either group (Table 1).

Table 1. MP-3.02

Parameter	StoneBreaker	Swiss LithoClast	*t* test
No. of patients	16 (11M, 5F)	17 (7M, 10 F)	NS
Age (SD), yr	48 (12.8)	55.5 (3.6)	0.12
BMI (SD), kg/m^2	31.69 (6.52)	30.79 (9.16)	0.98
Stone size (SD), mm^2	436.9 (353)	404.5 (212.9)	0.6877
Rate of stone fragmentation (SD), s/mm^2	0.23 (0.24)	0.54 (0.49)	0.0316
Lithotriptor set-up time (SD), min	3.09 (0.30)	5.58 (0.82)	0.025
Total lithotripsy time (SD), s	672.8 (434)	1027.2 (604.8)	0.0985
Ease of use (SD) (1–10, 10 = simple)	8.5 (2.23)	7.75 (3.22)	0.47
Visibility (SD) (1–10, 10 = adequate)	8.42 (2.23)	8.00 (2.21)	0.53
Damage to renal epithelium (SD) (1–10, 10 = no damage)	7.83 (3.10)	7.58 (3.31)	0.78
Operator fatigue (SD) (1–10, 10 = none)	9.42 (1.44)	7.92 (2.15)	0.11
Stone free, no. (%)	9 (56.3)	8 (47.1)	$p = 1.00$
Residual fragments > 4 mm, no. (%)	2 (12.5)	4 (23.5)	$p = 1.00$
Residual fragments < 4 mm, no. (%)	5 (31.3)	3 (17.7)	$p = 1.00$
Stone composition	Ca Oxalate: 43.8%, Ca Phosphate 18.8%, mixed Ca Phosphate and Ca Oxalate: 3%, other (struvite or mixes)	Ca Oxalate: 52.95%, mixed Ca Phosphate and Ca Oxalate: 11.8%, uric acid: 11.8%, other (Ca Phosphate)	

Conclusion: The new StoneBreaker pneumatic lithotriptor provides faster set-up and significantly faster stone fragmentation. The StoneBreaker produces an equivalent stone-free rate with no complications.

MP-3.03

Degradation times of a second and third generation biodegradable ureteral stent in a porcine model

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Introduction and Objective: We previously published preclinical results on a novel ureteral stent that degraded between 7 and 10 weeks in a porcine model. This Uriprene stent (Poly-Med Inc.) has now been modified to degrade faster and here we report on its properties regarding degradation time, drainage and safety in a Yucatan porcine model.

Materials and Methods: Fully grown Yucatan pigs (n = 32) were randomized to receive either a standard plastic stent (n = 16) or a degradable second generation Uriprene stent (n = 16) inserted via cystoscopy. Intravenous pyelograms, renal ultrasounds, urine and bloodwork were obtained on day 0, and weeks 2, 4, 7 and 10. All animals were sacrificed after 10 weeks and evaluated for histolopathological changes. Lastly, a third generation of degradable stent was developed to degrade even faster and was inserted in another set of 4 animals (8 ureters) to test degradation time.

Results: The second generation Uriprene stents started to partially degrade at 2 weeks and 80% were fully gone by 7 weeks and 100% by 10 weeks. There was significantly less hydroureteronephrosis in the degradable stent group as compared with biostable stents at all time points following insertion. There was significantly more ureteral dilation in the proximal ureter in the control stented group compared with the degradable stent group. Histopathology showed a robust trend toward less inflammation in degradable stented kidneys and ureters. Fifty percent of third generation Uriprene stents were completely degraded by 2 weeks, 80% by 3 weeks and 100% by 4 weeks. These stents produced even less hydronephrosis than the previous generation stent and controls. There were no differences in blood work, body weight or urine results in all animals tested.

Conclusion: Uriprene ureteral stents are biocompatible and their latest generation degrades in a timely fashion within 2 to 4 weeks. The amount of inflammation and hydronephrosis was considerably less than in controls suggesting that the material might be advantageous compared with regular biostable plastic stents. The third generation degradable ureteral stent will be used in a clinical trial in the near future.

MP-3.04

Subcapsular hematoma as a complication of extracorporeal shock wave lithotripsy: experience with the Storz Slx-F2 lithotripter

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Introduction and Objective: Subcapsular and perinephric hematomas are a frequent and potentially serious complications of extracorporeal shock wave lithotripsy (SWL). Their incidence ranges between 0.2% and 25%, depending on the type of SWL energy source and the imaging technique used to detect the hematomas. We determined the incidence of and evaluated the risk factors for the development of clinically apparent post-SWL renal hematomas

Materials and Methods: From April 2004 to June 2006, 3623 SWL treatments were performed using the Storz Modulith SLX-F2. Thirty-six percent of the patients were female and 64% male, with a mean age of 53 (range 5–94) years. Data was analyzed retrospectively for patient age, body mass index (BMI), gender, stone size, stone location, number of shockwaves, energy level, shock frequency, medications and the existence of hypertension.

Results: Following SWL treatment, 12 Patients developed clinically apparent renal hematomas (severe flank pain, acute drop of hemoglobin level or acute raise in serum creatinine which prompted tomography or ultrasound) with an overall incidence of 0.3%. All patients were male. Eight (66%) of the affected patients had hypertension before the treatment. Six (50%) of the patients had a stone in the lower calyx, 2 (17%) in upper calyx, 2 (17%) in the renal pelvis, 1 (8%) in midcalyx and 1 (8%) in the upper ureter. The mean energy level 6.0 (5.0–8.0) of the patients with hematomas was significantly higher (p = 0.0379) compared with that of the control cohort, which was 5.4 (0.5–9.0). Age, BMI, number of shockwaves, shockwave frequency or stone size had no significant impact on the formation of the renal hematomas at the 0.05 level. All patients with hematomas were treated conservatively. One patient received a blood transfusion (4 units). The hematomas resolved in all patients without further complication.

Conclusion: The incidence of a clinical apparent hematoma following SWL with the SLX-F2 was 0.3%. A mean energy level of 6 had a statistically significant impact on the formation of renal hematomas. Other factors such as male gender (100%) lower calyx stone (50%) and hypertension (66%) seem to be correlated with the onset of the subcapsular or perinephric hematomas after SWL treatment. With regard to our data a combination of those given risk factors seem to be relevant to the formation of the renal hematomas. However, controlled studies are needed to validate that.

MP-3.05

Comparison of urinary stone-risk parameters between obese and nonobese subjects

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Introduction and Objective: Obesity has been a steadily growing and common health problem in both developed and developing countries. Obesity has been associated with a number of health related conditions, including cardiovascular disease, diabetes, depression, hypertension, and osteoarthritis. There are also some reports showing that obesity might also be associated with an increased risk of urinary stone formation. Therefore, we aimed to evaluate the urinary risk parameters responsible for calcium oxalate and uric acid stone formation as well as to compare the differences of these parameters between obese and nonobese men and women.

Materials and Methods: A 24-hour urine sample was collected from each of the 126 volunteers [48 men (age: 49.26, standard deviation [SD] 6.95, yr) and 78 women (age: 49.15, SD 7.40, yr)] who participated in a dietary intervention study (named "Chample Study") in Okinawa, Japan. Demographic data were also recorded from all subjects. Based on the body mass index, all subjects were divided into obese and nonobese groups. Urine volume, pH, urinary excretions of oxalate, glycolate, citrate, uric acid, sulfate, phosphate, calcium, magnesium, sodium and potassium were determined. Relative supersaturation of calcium oxalate [$SS_{(CaOx)}$] and uric acid [$SS_{(UricAcid)}$] in urine was calculated using EQUIL 2 computer program. All data were compared between the obese and nonobese groups.

Results: In the present study, obese subjects (BMI > 25 kg/m^2) had lower pH (mean: 6.1 v. 6.4; obese v. nonobese), higher oxalate (mean: 262.9 µmol v. 212.1 µmol), higher calcium (mean: 5.1 mmol v. 4.7 mmol), higher uric acid (mean: 3.7 mmol v. 2.9 mmol), higher $SS_{(CaOx)}$ (mean: 3.3 v. 2.7), and higher $SS_{(UricAcid)}$ (mean: 3.5 v. 2.2) than the nonobese subjects (BMI < 25 kg/m^2).

Conclusion: The present study demonstrated that obese subjects showed lower pH, higher oxalate level, higher calcium level and higher uric acid level as well as higher urinary supersatuation of calcium oxalate and uric acid, suggesting that the obese subject has higher risk of calcium oxalate and uric acid stone formation.

MP-3.06

Dietary depletion of vitamin B1 and/or B6 increases the risk of urinary calcium oxalate and uric acid stone formation

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Introduction and Objective: Urolithiasis is a multifactorial and highly recurrent disease. Hyperoxaluria, hypercalciuria, hyperuricosuria, hypocitraturia, and hypomagnesiuria are among the important risk factors of urinary stone formation. Vitamin B1 and B6 are essential vitamins and play important role in human health. It has previously been reported that vitamin B1 and B6 deficiency increases oxalate metabolism. However, studies about the effects of the deficiency of these vitamins on the risk of uric acid stone formation are limited. Therefore, we investigated the effects of vitamin B1 depletion with or without vitamin B6 depletion on various urinary stone-risk parameters, as well as on the relative supersaturation indices of calcium oxalate and uric acid.
Materials and Methods: Twenty-four male Wistar rats were divided into 4 groups of 6 rats each. All rats were acclimatized at the University Animal Center for several days and then they were fed a standard diet (control group), or a vitamin B1–deficient diet (vit-B1-def group), or a vitamin B6–deficient diet (vit-B6-def group), or a combination of vitamin B1– and B6–deficient diet (vit-B1&B6-def group) for 3 weeks, respectively. Twenty-four-hour urine samples were collected before and after feeding respective diets. Urine volume, pH, creatinine, urinary excretions of oxalate, citrate, uric acid, magnesium, potassium, calcium and phosphorus were determined. Relative supersaturation indices of calcium oxalate and uric acid were calculated by EQUIL 2 computer program.
Results: Urinary pH, citrate, magnesium and potassium were lower than baseline, while urinary uric acid excretion as well as relative supersaturation indices of calcium oxalate and uric acid was higher than baseline after feeding respective diets for 3 weeks in vit-B1-def, vit-B6-def, and vit-B1&B6-def groups.
Conclusion: The present study demonstrated that dietary depletion of vitamin B1 and/or vitamin B6 increases the relative supersaturation indices of calcium oxalate and uric acid, and thereby, may increase the risk of urinary calcium oxalate and uric acid stone formation.

MP-3.07

Extracorporeal shock wave lithotripsy in patients with horseshoe kidney: experience of a single centre

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Introduction and Objective: Horseshoe kidney is the most common renal fusion anomaly, with a prevalence of about 1 in 400 and an incidence of urolithiasis between 20%–60%. For patients with congenital anomalies of the urinary tract, including horseshoe kidney, treatment poses a particular challenge. Extracorporeal shock wave lithotripsy (SWL) is considered the first-line treatment for the majority of patients with success rates of 60%–90%; however, SWL remains poorly studied in patients with horseshoe kidneys.
Materials and Methods: Data from all patients treated at the St. Michael's Hospital Lithotripsy Unit since Jan. 1, 1994, with a known horseshoe kidney were reviewed (65 patients, 106 calculi). Treatment was conducted with one of 2 lithotriptors, the Dornier MFL-5000 or the Philips LithoTron. Patient and follow-up data were extracted from a prospective database and review of imaging. Analysis was restricted to patients with a minimum 2-week follow-up after SWL. As our unit is a provincial resource requiring patients to travel long distances, limited 3-month data was available. Success was defined as patients who were stone-free or had asymptomatic, clinically insignificant residual fragments 4 mm or less after a single treatment.
Results: Data from 46 patients with horseshoe kidney were analyzed (73 calculi). Mean stone size was 86.8 (standard deviation [SD] 74.1) mm^2, mean body mass index (BMI) was 26.5 (SD 5.5) and 46.6% of stones were in the lower calyx. Overall single-treatment success rate at 2 weeks was 49.3% and stone-free rate was 30.1%. Two-week success and stone-free rates with the Dornier MFL-5000 lithotriptor were 54.2% and 33.3%, respectively. For the Philips LithoTron, 2-week success and stone-free rates were 46.9% and 28.6%. The lithotriptor used did not affect either treatment success ($p = 0.562$) or stone-free rate ($p = 0.610$). In total, 35 calculi (47.9%) underwent an additional treatment at our centre (SWL 34 and PCNL 1).
Conclusion: Patients with horseshoe kidney appear to have lower single-treatment success and stone-free rates following SWL than patients with normal kidneys. Since our analysis included only cases followed at our centre, the success rate may be underestimated. SWL may be offered to patients with horseshoe kidney once limitations in stone clearance have been considered and discussed with the patient.

MP-3.08

Robot-assisted magnetic resonance imaging–guided prostatic interventions

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Introduction and Objective: To develop a robotic system capable of automated prostate interventions in a closed bore magnetic resonance imaging device (MRI). These interventions include image-guided stereotactic biopsy, photothermal therapy, and radioactive seed implantation.
Materials and Methods: A robotic system was designed and manufactured to penetrate the perineum and deliver a tool accurately to a target within the prostate under real-time MRI guidance. The robot is built of MRI compatible materials, it is activated by ultrasonic motors, and operates under personal computer-based supervisory controller and human control located outside the high magnetic strength area. The robot has 4 degrees of freedom (DOF). The surgical tool is mounted on a 2 DOF modular transfer device capable of biopsying tissue, transferring photothermal energy and placing radioactive seeds. We conducted in vitro experiments to establish compatibility, accuracy, and ease of use.
Results: The robot is fully operational within a closed bore MRI system. The ultrasonic motors lend to compact design that allows for transperineal prostatic procedures within the closed bore MRI device. Using the MRI imaging sequence 3-dimensional fast spoiled gradient-echo (FSPGR) and spin echo gives minimal or no artifacts with the robot in place; Balanced Gradient Echo (FIESTA) is also suitable but gives some banding artifacts. Using ultrafast gradient echo and FIESTA sequence we managed to achieve excellent needle and target visualization. Given a defined target, in a prostate phantom, the therapeutic trocar automatically navigates and achieves reproducible 0.9 mm accuracy from penetration to target. Furthermore, using 2D FSPGR sequence we were able to accurately monitor and control photothermal destruction of areas of the gel. Magnetic resonance–generated temperature maps compared within 1 degree centigrade to multiple thermal sensors within the gel.
Conclusion: The robotic system is MRI compatible. The technology allows for automated and accurate transperineal procedures of the prostate within a closed bore MRI unit while maintaining the high resolution MRI imaging quality necessary to adequately visualize prostate tissue. It also allows for accurate thermal mapping. In vivo testing is now being planned. We believe that this system may prove to be a useful tool in image-guided prostate interventions.

MP-3.09

Select patients with small glands to improve outcomes during the learning curve in robot assisted laparoscopic radical prostatectomy

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Introduction and Objective: Widespread introduction of robotic assisted laparoscopic radical prostatectomy (RALRP) has led to multiple surgeons going through the learning curve globally. The number of cases estimated for this learning curve has varied widely, with no clear consensus. Recent studies have shown an inverse relationship between prostate size and positive margin rates in RALRP. We evaluated our learning curve to determine whether or not prostate gland size influenced intraoperative outcomes and margin rates during the learning curve.
Materials and Methods: Data were obtained after institutional review board approval from a prospectively collected database for the first 150 cases of RALRP performed by a single surgeon. Patients were divided into 3 groups

based on prostate size: less than 40 mL (group 1), 40–60 mL (group 2), or greater than 60 mL (group 3). Perioperative outcomes evaluated included total operative time, times for individual steps and estimated blood loss. Immediate postoperative outcomes evaluated included pathological stage and margin status.
Results: There were 75 patients in group 1, 50 patients in group 2 and 25 patients in group 3. Five patients in each group had median lobes. A statistically significant difference in total operative times between the groups (mean operative times were 206 min for glands < 40 mL, 201 min for glands 40–60 mL, and 233 min for glands > 60 mL) was noted. With regard to individual intraoperative steps, there were no statistically significant differences noted except for the bladder neck reconstruction and anastomosis time, which was longer in group 3. We noted no statistically significant differences in estimated blood loss, length of stay, pathological stage or positive margin rates between the 3 groups.
Conclusion: Prostate gland size influenced total operative times, the bladder neck reconstruction and anastomosis time. Our data support recommendations for surgeons starting on their learning curve to choose glands less than 60 mL, in order to avoid prolonged operative times during the learning curve.

MP-3.10

Prospective assessment of risk factors affecting unit-specific renal function after laparoscopic partial nephrectomy

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Introduction and Objective: Few prospective studies have rigorously assessed risk factors affecting renal function postlaparoscopic partial nephrectomy (LPN). Herein we prospectively assessed the impact of multiple factors affecting early and chronic renal function after LPN.
Materials and Methods: Fifty-three consecutive patients with 2 functioning renal units undergoing LPN were prospectively included for analysis. Cockcroft–Gault-calculated glomerular filtration rates (GFR) as well as MAG-3 renograms with GFR and differential function were obtained 1) preoperatively and 2) immediately postoperation (< 3 d) and 3) > 6 weeks postoperation. The impact of patient demographics, tumour size, tumour location/depth, baseline GFR and clamp time on functional renal outcomes were assessed. Mean follow-up was 26 (range 2 to 72) months.
Results: Preoperative GFR less than 60 mL/min was associated with significant impairment in function (% decline GFR > 25%) immediately postoperation ($p < 0.011$ for GFR and $p = 0.026$ for altered split function), but not at 6 weeks ($p = 0.12$ and $p = 0.32$). However, 2 patients with severely compromised baseline renal function required permanent renal replacement. Clamp time longer than 30 minutes was also associated with a decline in function of the affected side immediately postoperation ($p = 0.032$), as well as longer than 6 weeks ($p = 0.047$). Age greater than 60 years, hypertension and diabetes were all associated with impaired function of the affected renal unit immediately postoperation (all $p < 0.05$), but this perioperative decline in split and global renal function did not persist longer than 6 weeks (all p = NS). Gender, tumour size and location/depth had no impact on functional renal outcomes anytime postoperatively.
Conclusion: This prospective study supports the need to minimize clamp time less than 30 minutes following LPN. Although age, GFR, hypertension and diabetes were shown to impact acute tubular necrosis risk, effect on chronic function will require further study in larger numbers of patients.