

### **3<sup>RD</sup> PLACE WINNER – MILEY B. WESSON / OLYMPUS RESIDENT ESSAY CONTEST**

#### **TRENDS IN UROLOGY RESIDENT EXPOSURE TO OPEN SURGERY FOR INDEX PROCEDURES: A TALE OF TWO COUNTRIES**

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(Presentation to be made by Dr. Hoag)

**Purpose:** Urologic surgery has trended towards an emphasis on minimally invasive surgery (MIS) in the last decade. The impact of this trend on the ultimate surgical competence of graduating residents is unknown. Our objective was to interrogate case-log data for American and Canadian urology residents to define trends in MIS and open surgery and compare operative experiences between these two groups.

**Materials and Methods:** Accreditation Council for Graduate Medical Education case-log data from 2004-2009 was extracted for American urology residents and compared to Canadian resident case-logs for 8 index cases which are routinely performed in both an open and MIS approach. These included nephrectomy (donor, radical, simple, partial), prostatectomy (radical), adrenalectomy, pyeloplasty, and nephroureterectomy. Case-logs were evaluated for percentage of cases performed by MIS.

**Results:** Linear regression analysis demonstrated a statistically significant increase in the percentage of MIS radical prostatectomies performed by American residents (11.2% to 52%), compared to Canadian residents (0.74% to 11.2%) over the study period. There was also a significant increase in the percentage of MIS donor nephrectomies by Canadian residents (5.6% to 68.7%), compared to American residents (70.1% to 89.1%). For Canadian residents, exposure to the following 3 MIS procedures increased significantly over traditional open approaches in the last 5 yrs: Adrenalectomy, radical prostatectomy and donor nephrectomy. For American residents, all index procedures with the exception of adrenalectomy underwent a significant increasing trend over the same period (all  $p < 0.05$ ).

**Conclusions:** Trends for 8 index procedures confirm a continuing shift towards MIS for the majority of procedures that residents are exposed to in both countries. Differences between American and Canadian trends may be only temporal and relate to dissimilar health-care delivery models with a resultant lag in the adoption of laparoscopy and robotics in Canada. The impact of these trends upon ultimate surgical competence of our graduates remains to be seen.

**Source of Funding:** None

## **SURGICAL TREATMENT OF METASTATIC RENAL CELL CARCINOMA TO THE PANCREAS**

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(Presentation to be made by Dr. Grimsby)

**Introduction:** Despite the emergence of new systemic therapies for renal cell carcinoma (RCC), surgical resection remains the primary therapeutic intervention for achieving long term disease control. Even with known metastatic RCC, metastasectomy is often considered as improved patient survival has been documented with resection of all identified disease. Common metastatic sites for resection include the liver, lung, and bone. The pancreas, however, is a rare site of metastatic RCC and some providers may be hesitant about resection as pancreatic surgery can be fraught with complications. We describe the presentation, treatment, complications, and survival of patients treated with surgical resection of metastatic RCC to the pancreas at a single institution.

**Methods:** A retrospective chart review was performed of patients who had undergone a pancreatic resection for metastatic renal cell carcinoma at either the Mayo Clinic in Rochester, MN or the Mayo Clinic in Phoenix, AZ from 1992 to the present. The patients were identified by searching the Mayo Clinic Data Discovery and Query Builder (DDQB) database for pathology reports containing the words "pancreas" and "renal cell carcinoma". The database queries the existing electronic medical record from 1992 to the present. Patients were included only if he or she underwent a resection of a metastatic lesion of RCC from the pancreas at the Mayo Clinic. Patients were excluded if this was done at an outside facility or if the pathology report was a fine needle aspiration specimen for diagnostic purposes only. The patients' demographic information, previous renal cell carcinoma history, surgical treatment, pathology, complications of treatment, and future treatment of renal cell carcinoma was recorded. Survival after the resection of the metastatic RCC was calculated as time from the surgical resection to the date of death or the date of last follow up documented in the electronic medical record.

**Results:** A total of 54 patients were included for review. The mean age was 68 years old with a range of 49-90 years old at the time of the pancreatic resection. The mean time from original treatment of RCC to resection of the pancreatic metastasis was 11 years, ranging from resection of a pancreatic lesion at the time of nephrectomy to resection 34 years after the original nephrectomy. The original treatment included left radical nephrectomy in 26 patients, right radical nephrectomy in 23, right partial nephrectomy in 2, left partial in 1, unknown site in 1, and bilateral nephrectomies in 1 patient. All patients in whom the subtype of RCC could be confirmed revealed clear cell RCC. A majority of patients had the pancreatic lesions found incidentally on surveillance CT scan for RCC. Others had the lesions discovered via a CT done for another reason (such as a hernia or back pain), or during the work up of a gastrointestinal complaint such as GI bleeding, abdominal pain, or dyspepsia. Surgical resection for the metastatic RCC included distal pancreatectomy with or without splenectomy in 29 patients, whipple procedure in 11, total pancreatectomy in 9, enucleation of the metastasis in 1 patient, and 4 patients underwent 2 separate pancreatic resections of metastatic RCC at separate dates. The patients had a range of 1 to 12 metastatic nodules of RCC resected with a size ranging from 0.1 cm to 14 cm. Sixteen patients (30%) had significant peri-operative complications including intra-abdominal abscess and/or fistula (4), pancreatic leak (3), GI bleed (2), small bowel obstruction requiring re-operation (2), pancreatic pseudocyst (2), colonic injury requiring re-operation (1), chylous leak (1) or biliary stricture requiring stenting (1). Twenty four (44%) had another site of RCC metastasis resected before or at the time of the pancreatic resection. Five patients (9%) had adjuvant treatment with sunitinib and 4 patients (7%) had adjuvant radiotherapy. The mean survival from the time of pancreatic resection to either the date of death or date of last follow up documented in the electronic record was 1382 days (range of 9 days to 6169 days). Twenty eight patients had at least 5 years of follow up and 17 of those (60%) were alive at the five year mark.

**Conclusions:** A metastatic deposit of renal cell carcinoma may appear in the pancreas many years after the original treatment for RCC and is often asymptomatic. In the properly selected patient, resection of a metastasis of RCC to the pancreas should be considered with 60% of our patients alive 5 years after resection. As with all types of pancreatic surgery, however, complications do exist and the risks and benefits should be considered before proceeding with surgical intervention.

## **COMPARISON OF PARTIAL AND RADICAL NEPHRECTOMY IN STAGE II OR GREATER RENAL TUMORS**

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(Presentation to be made by Dr. Kopp)

**OBJECTIVES:** Partial nephrectomy (PN) has emerged as a preferred treatment option for stage cT1 renal masses, comparing favorably with radical nephrectomy (RN) from the standpoint of oncologic efficacy and conferring superior renal functional preservation. Further data is needed to show equivalence of PN to RN for higher stage tumors. We compared outcomes of patients who underwent PN and RN for stage II or higher tumors.

**METHODS:** Retrospective review of 105 patients (61 RN/44 PN, mean age 55 years, median follow-up 21.5 months) who underwent RN or PN for stage  $\geq$ cT2 or  $\geq$ pT2 renal tumors at two institutions from 3/2003 to 5/2010. Patient and disease characteristics, RENAL nephrometry score, renal function, and oncologic outcomes were recorded and analyzed within subgroups based on treatment. Kaplan-Meier analysis compared development of metastases, disease specific (DSS) and overall survival (OS).

**RESULTS:** Patient characteristics, including preoperative eGFR, were similar except for hypertension (RN 49% vs. PN 73%,  $p=0.017$ ). Mean tumor size (cm) was larger ( $p<0.001$ ) in RN (10.3) vs. PN (7.3). Mean nephrometry sum was higher ( $p<0.001$ ) in RN (10.7) vs. PN (9.5). PN had 6 (13%) urine leaks. De novo GFR $<60$  was significantly greater in the RN cohort (32% vs. 10%,  $p=0.023$ ). AJCC stage distribution between RN (II 30%, III 26%, IV 44%) and PN (II 43%, III 46%, IV 11%) groups was significant ( $p=0.002$ ). Survival curves demonstrated OS was less for RN ( $p<0.001$ ), but not within stage III ( $p=0.440$ ). DSS was less for RN ( $p<0.001$ ) except in stage III ( $p=0.259$ ).

**CONCLUSIONS:** Patients undergoing PN for higher stage tumors may have equivalent oncologic benefits and superior renal functional outcomes compared to RN for  $>$ Stage I RCC. Larger populations with further follow-up are needed to investigate effects on renal function and overall survival. PN may be an effective treatment for select patients with advanced RCC.

**SOURCE OF FUNDING:** None

## **ONCOLYTIC REOVIRUS THERAPY FOR RENAL CELL CARCINOMA**

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(Presentation to be made by Keith A. Lawson)

**Purpose:** Oncolytic viruses are potential novel agents for a variety of cancers and recently a number of these viruses have been shown to display potent anti-tumour activity in renal cell carcinoma (RCC). Metastatic RCC is an excellent target for oncolytic virotherapy, as this type of cancer responds to immunotherapy and displays upregulated survival signalling, which is a hallmark of oncolytic virus sensitivity. Recently, we have demonstrated the clinical potential of the reovirus, a novel oncolytic virus, against prostate cancer. In this study, we sought to characterize the response of RCC to reovirus as a monotherapy and in combination with sunitinib, a first line agent currently used to treat metastatic RCC.

**Materials and Methods:** A panel of RCC cell lines (786-O, A498, ACHN, Caki-1, Caki-2, RENCA) and *ex vivo* specimens were treated with escalating doses of reovirus, sunitinib or a combination of these agents. Cytotoxicity and viral progeny release were assessed via the WST-1 assay and plaque titration assay, respectively. Additive effect, synergism and antagonism resulting from combination therapy was determined via the Chou and Talalay method. *In vivo*, 6-8 week BALB-c mice were implanted with s.c. RENCA tumours and treated with reovirus [ $1.0 \times 10^8$  pfu/ml], sunitinib [10 mg/kg] or a combination of these agents. Mice will be followed for 60 days and assessed for tumour growth and overall survival. Moreover, tumour infiltrating immune cells and tumour vasculature will be assessed via flow cytometric and immunohistochemical analysis.

**Results:** Our preliminary data shows reovirus induces a cytotoxic response at 40 multiplicity of infection (MOI) following 48hrs in all tested cell lines and *ex vivo* specimens tested. All of the cell lines tested displayed greater than 70% cytotoxicity, suggesting that RCC is highly sensitive to reovirus oncolysis. The ability of reovirus to replicate and produce a lytic infection in RCC was confirmed via viral progeny assays in the A498, RENCA and 786-O cell lines. Interestingly, the combination of reovirus with the multi-tyrosine kinase inhibitor, sunitinib, resulted in an antagonistic cytotoxic effect in A498, ACHN, RENCA and 786-O cells *in vitro*. The mechanism of this is currently being investigated. *In vivo* experimentation in an immunocompetent murine model is ongoing and updated results will be presented.

**Conclusion:** These preclinical results suggest that RCC is highly sensitive to reovirus oncolysis. To our knowledge, this has not been previously reported. These findings warrant additional laboratory and clinical investigations into the use of reovirus as a potential novel therapeutic strategy for RCC. These preclinical results will be used to initiate a phase I/II clinical trial for the use of reovirus in RCC.

**Source of Funding:** Alberta Cancer Foundation

## **HIGH GRADE RENAL INJURIES: APPLICATION OF PARKLAND HOSPITAL'S PREDICTORS OF INTERVENTION FOR RENAL BLEEDING TO A LARGE SERIES OF PATIENTS WITH BLUNT RENAL TRAUMA**

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**PURPOSE:** Currently, the American Association Surgery of Trauma (AAST) grading scale remains the standard for assessment of renal injury. Researchers from Parkland Hospital have proposed further substratification of AAST grading to provide better prognostic information and guide management of these injuries. Substratification of injuries into grade 4a and 4b was based upon having 2 or more of 3 risk factors, which included active vascular extravasation, medial laceration, and a perinephric hematoma  $\geq$  3.5cm. The purpose of this study was to evaluate high-grade (AAST grade 3-5) renal injuries using these characteristics to determine if they serve as reliable predictors for intervention for renal bleeding in a large series of patients with high-grade blunt renal trauma.

**METHODS:** We conducted a retrospective review of renal trauma from 2005 to 2011 at all level 1 adult trauma centers in Utah. In patients with high-grade injury (AAST 3-5), images were re-graded and injuries further characterized based upon CT scans according to the presence of active bleeding, medial located laceration, and the presence of a perinephric hematoma  $>$  3.5cm. One point was assigned for each of these risk factors. We also recorded patient age, sex, mechanism of injury, and required interventions. Our primary outcome of interest was the need for an invasive intervention to control renal bleeding (selective embolization or renal exploration). We used simple logistic regression to evaluate the impact of each of the 3 risk factors on the primary outcome.

**RESULTS:** From 2005 to 2011, 147 high-grade injuries were identified. We excluded patients with penetrating trauma, those taken emergently for exploration without imaging, patients whose films were no longer available for review, and bilateral renal injuries. In the excluded patients, 7 nephrectomies and 4 renorrhaphies were performed. Of the 120 patients meeting study inclusion criteria, 69% were male. The mean age was 33 years. There were 62 (52%) grade 3, 41 (34%) grade 4, and 16 (13%) grade 5 renal injuries. For renal bleeding, 8 (7%) patients underwent intervention. The presence of active vascular extravasation (p-value=0.001) and a perinephric hematoma of  $>$  3.5cm (p-value=0.006) were predictive of need for intervention, while having a medial laceration was not (p-value=0.175). Patients with 1 or less risk factors had a 2% need for intervention, whereas 30% of patients with 2 or more risk factors required intervention.

**CONCLUSION:** Unlike previous studies, we found only active vascular extravasation and the presence of a perinephric hematoma  $>$ 3.5cm to be predictive of intervention for bleeding. Our study is limited by the small number of interventions and the numerous patients that underwent immediate operative exploration without pre-operative staging of their renal injury. However, we did find patients with 2 or more characteristics to be at increased risk for life threatening bleeding requiring intervention. This was the basis of designating patients into 4a and 4b in the Parkland Hospital study and helps to validate their findings. These imaging features have potential to serve as useful prognostic indicators in assessing renal trauma, and should be applied to a larger multi-institutional population for evaluation.

## CLINICOPATHOLOGIC FEATURES AND OUTCOMES OF A CHROMOPHOBE RENAL CELL CARCINOMA SERIES FROM A SINGLE INSTITUTION

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(Presentation to be made by Dr. Thong)

**Purpose:** Chromophobe RCC (cRCC) is a rare histological subtype of renal cell carcinoma (RCC) representing 3-5% of all RCCs. Cancer specific survival of cRCC appears to be favorable compared to that of conventional RCC. A novel pathologic grading system for cRCC has been proposed due to the controversial prognostic value of Fuhrman grade in cRCC (Paner et al, Am J Surg Pathol, 2010). Clinicopathologic outcomes with this novel grading system have not been evaluated in the literature.

**Materials and Methods:** An institutional kidney cancer database was retrospectively queried for those patients who had undergone radical or partial nephrectomy and had final pathology showing cRCC. Each case was then re-reviewed by a genitourinary pathologist to confirm the diagnosis and re-graded according to the novel chromophobe tumor grade (CTG). Preoperative symptoms, sex, age, date of surgery, medical co-morbidities, tumor size, stage, CTG, and sarcomatoid features were modeled against recurrence and cancer specific mortality using Fisher's exact and Wilcoxon rank-sum tests.

**Results:** From 1989 to 2010, a total of 76 patients had pathology consistent with cRCC. Median age was 62.1 years (IQR 51.1-69.7). 16 patients (21%) had some clinical symptoms at time of diagnosis. Average tumor size was 6.5 cm (IQR 3.2-8.4). Only one case had distant metastasis at diagnosis. 17 patients (22%) underwent partial nephrectomy. 47 (62%) tumors were CTG 1, 27 (36%) were CTG 2, and 2 (2.6%) were CTG 3. Stage was T1a in 25 patients (32.9%), T1b in 21 (28%), T2 in 19 (25%), T3 in 10 (13%), and T1 in 1 (1.3%). One patient had N1 disease. Median length of follow-up was 32.5 months (IQR 12.9-68.7). Three patients (3.9%) had recurrence of disease and 2 (2.6%) of these patients died of their disease during this follow-up period. All three patients who had recurrence were  $\geq$  stage T3 and had either sarcomatoid features or nodal disease. Only two patients in this series had sarcomatoid features and both patients were deceased. CTG 3 encompasses sarcomatoid features and was associated with both mortality ( $p < 0.0011$ ) and recurrence ( $p < 0.0021$ ). Greater tumor size was also linearly associated with the risk of recurrence ( $p < 0.0129$ ). The remaining clinicopathologic features were not associated with adverse outcome.

**Conclusions:** cRCC patients in this cohort demonstrated favorable prognosis. Recurrence and disease specific death were associated with sarcomatoid features. Longer clinical follow-up and larger multi-institutional cohorts are needed for adequate assessment of the utility of the novel CTG system.

**Source of funding:** None

## **REDUCED PORT ROBOTIC PYELOPLASTY: REVIEW OF TECHNIQUE AND INITIAL RESULTS**

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(Presentation to be made by Dr Santomauro)

**Introduction and Objectives:** Much has been written, recently, about single site surgery. The application of this technique can be technically quite difficult. Attempts at single port robotics are limited due to the size of the 8mm instruments, 12 mm lens, and collisions/locking that occurs when the arms are in close proximity. We report on our initial experience with reduced-port robotic surgery (RPRS) using the DaVinci robot, in performing dismembered pyeloplasty.

**Material and methods:** Between June, 2010 to April, 2011 a single surgeon performed all pyeloplasties using RPRS . All patients met standard indications for primary dismembered pyeloplasty. Two incisions were made. One periumbilical 3-4 cm incision for the applied medical gelPOINT system, which incorporated one robotic arm, the 12mm robotic scope and a 5mm assistant port. The other, upper quadrant 8mm incision was made for other robotic arm with approximately 8-10 cm y-axis separation (i.e. this arm was at least 8 cm more lateral and superior. The scope was placed in a 30 degree up configuration so that it put traction on the medial portion of the fascial incision, providing adequate room for the robotic working arm and the 5mm assistant port. Standard dismembered pyeloplasty with antegrade stent placement was then performed. JP drain was placed through the upper quadrant port site.

**Results:** A total of five patients underwent RPR pyeloplasty. Average age of the patient was 28.3 years with an average BMI of 26.7. Average operating room time was 235 minutes (range 210 to 265 minutes) with an average estimated blood loss of 56cc (range 25 to 100cc) . Average hospital stay was 2.25 days, with an average total use of 124 mg morphine equivalents. After the initial learning curve, access was streamlined and the procedures were performed with near seamless robotic technique. The 30 degree up scope made anatomical visualization sub-optimal at times, but did not hinder successful completion. In one case, there was a need to change to a zero degree lens as a result of excessive bowel obstructing the visual field. There was no noticeable increase of instrument collisions in that case. Cosmesis was excellent, with the umbilical port being nearly invisible, with only one upper quadrant scar remaining.

**Conclusions:** Robotic assisted reduced-port-pyeloplasty is a safe and effective modification for dismembered pyeloplasty in adults, resulting in a near seamless robotic surgical environment and excellent cosmesis. It is reasonable alternative to pure single-site surgery, which is technically very challenging and limiting. Further study is warranted both in pyeloplasty as well as in other urologic procedures.

## **NATIONWIDE PRACTICE PATTERNS FOR THE MANAGEMENT OF SMALL RENAL MASSES**

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(Presentation to be made by Dr. Yang)

**Purpose:** The diagnosis of small renal masses is increasingly common, and the use of surveillance, ablation, and partial nephrectomy have increased as familiarity with new technology and operative technique becomes more pervasive. We describe the changing national practice patterns in the management of small renal masses.

**Methods:** All patients in the SEER registry treated for renal masses up to 7 cm in diameter from 1998 through 2007 were included for analysis. Annual trends in the use of surveillance, ablation, partial nephrectomy, and radical nephrectomy were calculated. Multinomial logistic regression was used to determine the association of demographic and clinical characteristics with treatment modality.

**Results:** A total of 41,595 patients from 17 registry sites with a mean age of 62.6 years were included for analysis. Between 1998 and 2007, for masses < 2cm and 2-4 cm, a dramatic increase was observed in the proportion of patients undergoing partial nephrectomy (31% vs. 52%, 16% vs. 31%) and ablation (1% vs. 9%, 2% vs. 8%). In multivariable analysis, year of diagnosis, younger age, and smaller tumor size were associated with increased use of partial versus radical nephrectomy. Older age, smaller tumor size, and the presence of bilateral masses were associated with increased use of ablation and surveillance versus radical nephrectomy.

**Conclusions:** While partial nephrectomy is now employed in a slight majority of patients with the smallest renal masses, it is still likely underutilized. Ablation and surveillance are less common overall, but increased usage is observed in older patients and those with small or bilateral tumors.

# COSMETIC IMPACT OF NEEDLESCOPIC PORTS AND PLACEMENT TECHNIQUES UPON SCARLESS SURGERY IN A PORCINE MODEL

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(Presentation to be made by Dr. Smith)

**Objectives:** LESS and NOTES procedures aim to provide scarless cosmesis. In an attempt to simplify these technically challenging procedures, surgeons may employ accessory needlescopic ports. The cosmetic impact of these additional ports, however, has not been determined. The purpose of this study was to characterize the cosmetic impact of a 2 mm needlescopic port and to evaluate 4 different methods for creating these incisions.

**Methods:** In the porcine model, 45 2x2 cm boxes were tattooed onto the abdominal wall. These boxes were randomized to 4 different incisional techniques, including an incision with a #11 blade, a no-scalpel vasectomy tool, a veress needle, or electrocautery. A fifth group with no incision acted as a control. All ports were left in place for 2 hours and mobilized in a uniform manner in all dimensions to mimic the forces experienced during laparoscopic surgery. Incisions were closed with adhesive skin glue and assessed 4 weeks post-operatively by a blinded plastic surgeon using the Vancouver Scar Scale (VSS). Results were analyzed using Fisher's exact test and an independent-samples Kruskal-Wallis test ( $\alpha=0.05$ ).

**Results:** In total, only 50% of all incisions were identified. A comparison of the 4 techniques is found in Table 1. Scars from the no-scalpel technique were noticed significantly less often (33%;  $p=0.02$ ) than scalpel (44%), veress needle puncture (44%), and electrocautery (78%). VSS scores from veress needle punctures were significantly lower than from electrocautery (0.8 vs 2.6,  $p=0.01$ ).

Table 1.

	Scalpel	No Scalpel	Veress Needle	Electro-cautery	p
Identification Rate	44%	33%	44%	78%	<b>0.02</b>
VSS Score	2.3	2.3	0.8	2.6	0.06
Baseline Incision Length	4.9	3.6	3.1	6.6	0.58
Healed Incision Length	3.8	2.5	2	3	n/a
Change in Length	-22%	-31%	-35%	-55%	<b>0.03</b>

**Conclusions:** A 2 mm needlescopic port has minimal impact upon overall cosmesis, as only 50% of incisions could be identified. The technique used to make the needlescopic incisions significantly impacts post-operative cosmesis, with the no-scalpel technique being least likely to leave an identifiable scar.

**MICROSCOPICALLY POSITIVE VEIN MARGINS ARE ASSOCIATED WITH INCREASED LOCAL RECURRENCE AND METASTATIC PROGRESSION IN PT3N0M0 RENAL CELL CARCINOMA PATIENTS AFTER NEPHRECTOMY WITH THROMBECTOMY**

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(Presentation to be made by Dr. Chan)

**INTRODUCTION AND OBJECTIVES:** Renal cell carcinoma (RCC) is known to invade vascular structures and thrombi. Radical nephrectomy with thrombectomy requires clamping major blood vessels and intraoperative pathologic assessment is not possible. Despite the surgeon's attempt to remove all tumor by excising visibly involved venous tissue, positive vein margins are not uncommon. The purpose of this study was to evaluate how microscopically positive vein margins after thrombectomy affects the risk of local recurrence (LR), metastatic progression (MP) and overall survival (OS) in non-metastatic RCC patients.

**METHODS:** After IRB approval, an institutional database identified pT3N0M0 RCC patients who underwent radical nephrectomy and thrombectomy. Clinical and pathologic data were collected for each patient. LR was defined as tumor within surgical bed or recurrent thrombus. A Kaplan Meier survival analysis was performed and the log rank test was used to evaluate differences between groups in LR, MP and OS.

**RESULTS:** There were 270 patients who fit the inclusion criteria with a median age of 62 years (28-90) and median tumor size of 9 cm (3-28). Median follow-up was 36.7 months. Tumor was present in the renal vein or smaller branch veins, sub-diaphragmatic IVC, and supra-diaphragmatic IVC in 144, 105, and 21 patients respectively. In 51 (19%) patients with tumor present at the vein margin of resection, 27 (46%) had MP, 2 (4%) had LR, and 3 (6%) had both LR and MP. In 219 patients without tumor at vein margin, 84 (38%) had MP and 10 (3.7%) had both LR and MP. No patients with negative vein margins had isolated LR. Patients with positive margins were statistically more likely to have LR ( $p=0.02$ ) and metastatic progression ( $p=0.01$ ). There was no statistical difference in OS between the two groups ( $p=0.54$ ). Positive margins were more likely in patients with higher level of thrombus.

**CONCLUSIONS:** Positive vein margins in non-metastatic RCC patients are associated with higher rates of local recurrence and metastatic progression. Risk is increased in patients with increased height of thrombus. Preoperative identification of thrombus and liberal resection of vein margins is suggested whenever feasible.

## **HYPERURICEMIA AS A PREOPERATIVE PREDICTOR OF DECLINE IN RENAL FUNCTION AFTER NEPHRECTOMY**

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(Presentation to be made by Dr. Cohen)

**Introduction:** Hyperuricemia has been determined to be a risk factor for renal insufficiency. It remains unclear how pre-existing hyperuricemia affects the post-operative recovery of renal function in patients who have undergone partial or radical nephrectomy. This study examines the use of preoperative hyperuricemia, as a potential predictor of decline in renal function in this patient population.

**Methods:** A prospective observational study of 65 patients who underwent partial and/or radical nephrectomy were analyzed in this study. 18 of these patients were found to have preoperative hyperuricemia (serum uric acid level > 7.0 mg/dL in males and > 5.7 mg/dL in females). Hyperuricosemic and non-hyperuricosemic cohorts were analyzed with respect to demographics, disease characteristics, surgical management outcomes, and renal functional outcomes. Multivariate analysis was carried out to elucidate factors associated with postoperative development of chronic kidney disease (de novo CKD, defined by eGFR<60)

**Results:** Patients in the hyperuricosemic and non-hyperuricosemic groups had comparable demographics (mean age 58 vs 57 p=0.821; males 38.9% vs 59.6% p=0.17) and comorbidities (DM p=0.74, HTN p=0.165 and CAD p=0.175), with the exception that hyperuricosemic patients had a higher BMI (31.4 vs 27.3 p=0.012). Hyperuricosemic patients were more likely to undergo radical nephrectomy than patients with normal uric acid levels (61.1% vs 87.2% p=0.034). Median follow-up was 13.5 and 9 months (p=0.124) for hyperuricosemic and non-hyperuricosemic patients. Higher pre-operative uric acid levels were correlated with higher creatinine levels on last FU (Rho= 0.251, p=0.044). When adjusting for age and gender, hyperuricemia remained a significant predictor of the development of post-operative de novo creatinine >1.2 (OR 5.3, 95% CI 1.3-22.8, p=0.025).

**Conclusion:** In this preliminary analysis of prospective radical and partial nephrectomy cohorts, hyperuricemia was an independent predictor of postoperative CKD. Further investigation is requisite to confirm these findings and to determine whether aggressive treatment of hyperuricemia preoperatively in this patient population may attenuate postoperative renal functional decline.

**Source of Funding:** None

## **SINGLE ACADEMIC INSTITUTION EXPERIENCE IN APPLICATION OF LAPAROENDOSCOPIC SINGLE-SITE SURGERY IN ADULT AND PEDIATRIC UROLOGIC SURGERY**

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(Presentation to be made by Dr. Cohen)

**Introduction:** Adoption of Laparoendoscopic Single-site surgery (LESS) into pediatric surgical practice represents a further development of the minimally invasive surgical armamentarium for pediatric urology. The extension of LESS has been undertaken in partnership between the adult and pediatric urologic surgeons at the University of California, San Diego.

**Methods:** Adult LESS (A-LESS) commenced in 1/2009, followed by initiation of Pediatric LESS (P-LESS) in 11/2009. Prior to initiation of P-LESS, pediatric urology faculty (GS, MD) proceeded with LESS-modified Society of American Gastrointestinal and Endoscopic Surgeons/Fundamentals of Laparoscopic Surgery curriculum emphasizing didactics, dry simulation drills, and preclinical live experience in partnership with the adult urologic surgeon (IHD). A-LESS were performed by transperitoneal (40) and retroperitoneal approach (20). Most (52) were performed by a single site approach with multiple trocars. All P-LESS were performed by transperitoneal SILS port (Covidien, Mansfield, MA, USA). Patient demographics, intraoperative parameters, outcomes, and complications were recorded.

**Results:** 60 A-LESS and 15 P-LESS have been performed. A-LESS included 29 radical and 17 partial nephrectomies, 6 nephrectomies with renal vein thrombectomies, and 7 adrenalectomies. P-LESS included 7 unilateral and 4 bilateral nephrectomies, 1 ureteral reimplant, 1 varicocelectomy, and 2 orchidopexies. One adult case each required conversion to open, multiport laparoscopy, or placement of second trocar at separate site. One P-LESS converted to open surgery. Median age (years, range) for A-LESS was 62.5 (24-85.6), and for P-LESS was 6 (1.2-17.9 years). Median hospital stay (hours) for A-LESS was 60, and for P-LESS was 51.6. Median operative times (minutes, range) for A- and P-LESS were 154 (35-220) and 183 (58-564). Median estimated blood loss (mL, range) for A-LESS was 100 (5-500) and for P-LESS was 10 (0-100). Median discharge pain score for A-LESS (visual analog scale, range) was 1 (0-4); median pain score (Faces, Legs, Activity, Cry Consolability scale, range) on post-operative day 1 for P-LESS was 2.2 (0-4.4). Complications were noted in 4 (6.7%) A-LESS and 0 P-LESS.

**Conclusion:** Adaptation of LESS technique with excellent, reproducible and comparable outcomes was achieved by collaboration between adult and pediatric urologic surgeons. Further investigation is requisite to determine ultimate utility of LESS in adult and pediatric urology.

## **EVALUATION OF THE APPROPRIATE UTILIZATION OF IMAGING IN THE DIAGNOSIS AND MANAGEMENT OF HIGH GRADE RENAL INJURIES**

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(Presentation to be made by Dr. Hardee)

**PURPOSE:** The appropriate utilization of imaging in renal trauma is necessary to minimize delayed intervention for unrecognized injuries. Missed injuries may include the renal collecting system. Current recommendations for imaging renal trauma include first obtaining an abdominal and pelvis CT with intravenous contrast, followed by delayed images of the kidney to identify injury to the collecting system when there is either high grade injury or perinephric fluid. The purpose of this study was to evaluate the compliance with this recommendation among adult level 1 trauma centers in Utah, as well as an assessment of the incidence of missed injuries and need for intervention when delayed films were not obtained.

**METHODS:** A retrospective review was performed on all renal trauma patients evaluated at level 1 adult trauma centers in Utah from January 2005 to January 2011. For all American Association for Surgery of Trauma (AAST) grade 3-5 renal injuries, images were reviewed from date of injury through one month after injury. Type of imaging used, injury characteristics including presence and size of perinephric fluid collection, injury grade, management, and outcomes were recorded for analysis. We defined appropriate compliance with imaging recommendations as delayed images of the kidney obtained for grade 3 injuries with perinephric fluid, or any grade 4 and 5 injuries.

**RESULTS:** A total of 147 patients were identified with renal injuries of grade 3 or higher at level 1 trauma centers in the state of Utah. After excluding patients who did not have images available for review, 126 underwent analysis. Blunt trauma was the mechanism of injury in 97% of patients. Grade 4-5 injuries or a perinephric fluid collection was identified in 84 (66.6%) of patients. Delayed images were obtained in 73% of these patients. In patients who underwent delayed imaging, 20% were found to have an injury to the collecting system. Only one patient was found to have a collecting system injury without a perinephric fluid collection. This patient did have a medial laceration and urine extravasation from the proximal ureter. In the 23 patients in which delayed images were not obtained, 7 were later identified to have an injury to the collecting system. Intervention was required in 3 (43%) for persistent urine leak. A total of 19 collecting system injuries were identified in our study. However, 36% of injuries to the collecting system were not diagnosed on initial imaging due to lack of compliance with obtaining delayed imaging. Using chi-square test for statistical analysis, the association between perinephric fluid collection and collecting system injury was statistically significant ( $p$ -value=0.007). Delayed images were appropriately obtained by referral centers 65% and by level 1 trauma centers 75% of the time. This difference was not statistically significant ( $p$ -value=0.6).

**CONCLUSION:** Our findings support obtaining delayed kidney imaging in patients with grade 4 or 5 injuries or those with a perinephric fluid collection. Poor compliance with these recommendations led to delayed diagnosis and persistent urinary leak that required intervention in patients with grade 4 renal injuries. We have implemented imaging guidelines for renal trauma within our hospital system, which seek to minimize these diagnostic and management problems.

## **PREVALENCE OF INJURY PROGRESSION ON REPEAT IMAGING IN AAST GRADE IV COLLECTING SYSTEM INJURIES**

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Bryan B. Voelzke, M.D.: Seattle, WA  
(Presentation to be made by: Dr. Leddy)

**Purpose:** Repeat abdominal CT scan 48-72 hours following initial diagnosis of high-grade renal injury is commonly performed to evaluate for renal injury progression. CT-IVP with an initial non-contrast phase is the imaging modality most commonly used. Recent reports have questioned the need for repeat imaging after 48 hours in high grade blunt renal trauma. We hypothesize that repeat CT scan with 10 minute delayed pyelogram images is necessary after blunt grade IV collecting system renal injuries due to an increased rate of subsequent procedural intervention. As a secondary endpoint we assessed the need for the non-contrast phase traditionally performed during repeat CT imaging to assess for retained contrast from the initial CT. Elimination of this phase would decrease unnecessary total radiation exposure.

**Methods:** A retrospective review was performed of all patients with grade IV renal collecting system injuries secondary to blunt trauma from 2003-2007 at a level I trauma center. Patients included for review underwent conservative management after initial injury detection and had repeat renal imaging during their index hospitalization. Patients were excluded if they did not receive intravenous contrast during their initial CT scan or underwent operative intervention prior to repeat imaging. Time to repeat CT scan, progression of renal injury, presence of contrast in the renal parenchyma or retroperitoneum on non-contrast phase and need for procedural intervention after repeat imaging were recorded.

**Results:** 45 patients with a blunt grade IV collecting system injury were identified. Mean time to follow up CT scan was 58 hours (range 8-279 hours). 13 patients (28.9%) had progression of their renal injury on follow up imaging, with 24% requiring active management. Of the 13 patients who had radiographic progression, the following interventions were performed: ureteral stent placement (6), ureteral stent placement with subsequent peri-nephric drain (4), and partial nephrectomy (1). 2/13 patients were successfully managed with continued conservative management.

31/45 patients underwent a preliminary non-contrast phase during repeat CT imaging during their index hospitalization. Only one of 31 patients had evidence of residual contrast in the renal parenchyma from the initial CT scan. This patient underwent repeat CT eight hours after the initial CT, rather than the recommended 48-72 hours. No contrast was present in the retroperitoneum on any repeat imaging.

**Conclusions:** Blunt grade IV collecting system injuries are at risk for injury progression. As such, we advocate a repeat CT scan with 10 minute delayed pyelogram images 48-72 hours after the index CT scan. Patient radiation exposure during repeat CT imaging could be minimized by eliminating the non-contrast phase of the follow up CT scan as it does not appear to impact clinical decision making.

**Source of Funding:** None

**ADVERSE PATIENT SAFETY EVENTS:  
A COMPARISON OF LAPAROSCOPIC AND OPEN PARTIAL  
NEPHRECTOMY FROM  
1998-2008**

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(Presentation to be made by Dr. Stroup)

**OBJECTIVE:** Associations of the diffusion of laparoscopic partial nephrectomy with patient safety remain uncharacterized. We compared the frequency of adverse patient safety events occurring in laparoscopic versus open partial nephrectomy over a 10-year period.

**METHODS:** We utilized the Nationwide Inpatient Sample (NIS), a 20% sample of inpatient discharges in the U.S., from 1998 to 2008. All raw data was weighted to produce national estimates. We identified discharges with a principal diagnosis of kidney surgery by ICD-9CM codes. The primary outcome was occurrence of any Patient Safety Indicator (PSIs)—validated measures developed by the Agency for Healthcare Research and Quality to describe adverse outcomes related to patient safety. We used multivariate logistic regression to compare PSIs occurring in laparoscopic and open partial nephrectomy.

**RESULTS:** The prevalence of both open and laparoscopic partial nephrectomy increased steadily during the study period (Figure 1). Compared to open, patients undergoing laparoscopic partial nephrectomy had lower Charlson Index morbidity scores ( $p < 0.001$ ) and were more likely to undergo surgery at urban ( $p < .001$ ) and teaching ( $p < 0.001$ ) hospitals. Among the 62,853 open partial nephrectomies and 5,828 laparoscopic partial nephrectomies performed, PSIs occurred in 4,084 (6.5%) and 270 (4.6%) ( $p = 0.019$ ) cases, respectively. On multivariate analysis, there were no significant differences in the probability of at least one PSI between open and laparoscopic partial nephrectomy [Odds Ratio (OR) 0.778, 95%CI 0.579-1.046,  $p < 0.096$ ]. The probability of any PSI was 38% higher for Charlson  $\geq 3$  compared to  $< 3$  (OR 1.38, 95% CI 1.2 to 1.6,  $p < 0.001$ ).

**CONCLUSIONS:** Laparoscopic and open partial nephrectomy demonstrated similar risks of adverse patient safety events as defined by PSIs. These data suggest that, as it has diffused into clinical practice, laparoscopy has remained a relatively safe technique for performing partial nephrectomy.

## INTRAPERICARDIAL CONTROL FOR INFERIOR VENA CAVAL THROMBUS

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(Presentation to be made by Dr. Patil)

**Purpose:** Inferior vena cava (IVC) tumor thrombectomy is an advanced urologic procedure that requires an experienced surgical and anesthesia team due to complex hemodynamic considerations. This is especially true for tumor thrombi that extend into the intrahepatic portion of the IVC and above the diaphragm. Cardiopulmonary bypass and cardioplegia are often utilized adjunctively by a second surgical team, but introduce additional risk to the patient. Vascular control of the inferior vena is possible within the pericardium, and obviates the need for cardiopulmonary bypass for intrahepatic (Level II) and supradiaphragmatic (Level III) tumor thrombi. We present our experience with intrapericardial control of the inferior vena cava for patients undergoing extirpative surgery for Level II and Level III IVC tumor thrombi.

**Materials and Methods:** Between January 2005 and December 2010, 24 patients underwent extirpative surgery with intrapericardial IVC control by a single surgeon (SD). This method of vascular control was performed in cases of intrahepatic and supradiaphragmatic thrombi without intra-atrial involvement. All surgeries, regardless of tumor laterality, were performed through a right thoracoabdominal incision, which allows access to the pleural cavity and to the pericardium. Continuous transesophageal echocardiography was utilized to monitor cardiac function and to monitor for embolic events. Intrapericardial control was obtained with a Rumel tourniquet, and test occlusion was performed to confirm hemodynamic stability. Splanchnic blood supply (superior mesenteric artery and inferior mesenteric artery), contralateral renal vein, and infrarenal IVC are controlled similarly prior to occlusion of the porta hepatis (Pringle Maneuver). IVC tumor thrombectomy was then performed, followed by additional procedures when indicated (vena cavoscopy, IVC filter placement, caval resection or caval interruption).

**Results:** Of 24 patients undergoing surgery, none had a positive vascular margin. No operative mortality or complications occurred, nor did complications related to obtaining intrapericardial control or clamping of the porta hepatis. There were no intraoperative embolic events. Median pringle maneuver time was 14 minutes (8-20). IVC filter placement was performed in 3 patients. Vena cavoscopy was performed in 12 patients. Cavoscopy permitted visualization of tumor thrombus that was not identified during manual extraction; this finding altered surgical management and allowed retrieval of additional tumor thrombus in 3 patients. IVC resection or interruption was performed in 4 patients. Median length of intensive care monitoring was two days, and median length of stay (entire hospitalization) was 9 days. Pathology revealed renal cell carcinoma in 22 patients, adrenocortical carcinoma in one patient and urothelial carcinoma in one patient. Extensive retroperitoneal lymphadenectomy was performed in all patients and revealed nodal metastasis in 4 of 22 patients with renal cell carcinoma and the patient with urothelial carcinoma. Eighteen patients (75%) were alive at an average of 15.1 months (ranging 3 months to 44 months post-operatively).

**Conclusion:** Intrapericardial control of the inferior vena cava allows a single surgical team to safely perform tumor thrombectomy for intrahepatic and supradiaphragmatic thrombi. This approach obviates the need for cardiopulmonary bypass and eliminates associated morbidity.

## RELATIVE RENAL FUNCTION DOES NOT IMPROVE AFTER RELIEVING CHRONIC RENAL OBSTRUCTION

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(Presentation to be made by Dr. Wu)

**Objectives:** The primary goals in the treatment of chronic renal obstruction are to treat symptoms, reduce the risk of infection, and prevent further renal damage. Whether renal function improves after relief of chronic unilateral obstruction is controversial. We sought to determine the change in relative renal function (RRF) following relief of chronic obstruction.

**Methods:** We retrospectively identified 85 adult patients who underwent (99m)Tc-MAG-3 lasix nuclear renography before and after surgery to relieve unilateral renal obstruction from 2000-2011. Seventy-eight percent of these patients had congenital ureteropelvic junction obstruction. We stratified patients into groups of low (<20% RRF), medium (20-40% RRF), and high (>40% RRF) preoperative RRF for the obstructed kidney. We then evaluated each group for change in RRF after relief of obstruction. Given that change in RRF may be better represented by an inverse exponential equation, we also performed analysis on log transformed data. Multivariable logistic regression was also performed to see if age and preoperative RRF predicted for improvement in RRF over 7%, controlling for hypertension, diabetes mellitus, smoking history, and whether the primary etiology was ureteropelvic junction obstruction.

**Results:** The average preoperative RRF ( $37.6 \pm 12.3\%$ ) and postoperative RRF ( $38.4 \pm 13.6\%$ ) were not significantly different ( $p=0.31$ ). When stratified by preoperative function, patients with low, medium and high preoperative function saw no significant changes in postoperative RRF ( $p=0.53$ ,  $0.39$ , and  $0.77$ , respectively). Log transformation of the relative renal function did not correlate linearly ( $r^2 = 0.515$ ) and did not show significant change postoperatively ( $0.76$ ). In multivariable logistic regression analysis, decreased age (OR 0.90, 95% CI 0.83 to 0.98) and lower pre-operative RRF (OR 0.90, 95% CI 0.83 to 0.97) predicted for an improvement in RRF of greater than 7%, after adjustment.

**Conclusions:** There is significant variability in how procedures to relieve obstruction will affect the change in RRF. RRF does not change significantly after relief of obstruction.

# **SELECTIVE RENAL ISCHEMIA DURING LAPAROSCOPIC ROBOTIC PARTIAL NEPHRECTOMY: EARLY EXPERIENCE WITH A PARENCHYMAL CLAMP**

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(Presentation to be made by Dr. Harper)

**Purpose:** Laparoscopic and robotic partial nephrectomy (PN) most often require renal hilar clamping and total renal ischemia. Ways to reduce warm renal ischemia continue to evolve including simpler reconstructive techniques and early unclamping. The purpose of this paper is to describe our initial experience with a laparoscopic parenchymal clamp that avoids complete renal ischemia during robotic PN.

**Materials and Methods:** Patients undergoing robotic PN were assessed during surgery for applicability of a laparoscopic parenchymal pole clamp depending on tumor location beginning in January 2011. Mobilization of the kidney, identification of the mass with laparoscopic ultrasound, and defatting the kidney to expose the mass was performed in a routine fashion. The clamp was placed proximal to the mass while the tumor was excised. The clamp was either left in place for partial or total reconstruction, or removed following excision.

**Results:** Three patients underwent robotic PN with selective ischemia only. Parenchymal clamping ranged from 4-15 minutes. Mean EBL was 115ml (70-200ml) and there were no perioperative complications. Mean tumor size was 1.7cm. Tumor characteristics included predominantly endophytic (2) and exophytic (1) while tumor location was lower pole (1) and lateral interpolar (2). Pathology revealed AML, clear cell, and papillary type 2 renal cell carcinoma. All margins were negative. There was no change in preoperative to postoperative day 1 and 2 creatinine in two patients while one patient had an increase of 0.1.

**Conclusions:** Selective renal ischemia via a laparoscopic parenchymal clamp can be used to eliminate total renal ischemia during robotic PN in select tumors. This technique could result in better preservation of renal function.

**Source of Funding:** none

## **RENAL FUNCTION FOLLOWING LAPAROSCOPIC RADICAL VS PARTIAL NEPHRECTOMY: A SINGLE INSTITUTION EXPERIENCE**

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(Presentation to be made by Dr. Melnyk)

**Purpose:** Nephron-sparing surgery (NSS) for renal cell carcinoma has become the standard of care for small renal masses. Although NSS reduces the risk of chronic renal failure and is becoming more popular for the treatment of small renal masses, data suggests that these masses are being treated too often with radical nephrectomy. Our objective was to determine the rates of laparoscopic radical nephrectomy (LRN) and laparoscopic partial nephrectomy (LPN) at our institution over time, and to compare renal function in these patients, with the hypothesis that NSS would improve renal outcomes.

**Materials and Methods:** Demographics, tumor characteristics, changes in serum creatinine, hemoglobin and perioperative complications were collected. The number of LRNs and LPNs performed each year were recorded. Serum creatinine was repeated at 3 to 6 months following surgery. Statistics were carried out using paired t-tests with a Bonferroni correction with significance set at  $p < 0.05$ . Complications, changes in hemoglobin and tumor characteristics were recorded. We also evaluated the number of LRNs versus LPNs performed each year. Complications were recorded according to the Clavien Classification.

**Results:** From 2003 to 2010, the percentage of cases treated with LRN declined (86% to 52%), while the number of LPN increased (14% to 48%) at our institution. Follow-up data was available for 56 LPN and 61 LRN patients. The mean difference between serum creatinine after LPN was an increase of 6.54  $\mu\text{mol/L}$  (CI 95% 5.97-19.05,  $p > 0.05$ , ns) and after LRN was 35.00  $\mu\text{mol/L}$  (CI 95% 23.01-46.99,  $p < 0.001$ ). Blood loss was significantly higher in the LPN group, however no patient in either group required blood transfusion. Other complication rates were similar between groups. There were no cancer recurrences.

**Conclusions:** LPN preserves renal function better than LRN with the same cancer control. LPN is associated with a slightly higher blood loss and longer OR time, but no transfusions were required. Our centre is now performing LPN more commonly rather than LRN, which is in keeping with the current standard of care. Longer follow-up is necessary to determine if these changes in serum creatinine will result in differences in renal failure and renal replacement therapy in the future.

**Source of finding:** None

## **THE USE OF NEAR INFRARED FLUORESCENCE IMAGING DURING ROBOTIC-ASSISTED LAPAROSCOPIC PARTIAL NEPHRECTOMY: THE INITIAL EXPERIENCE AT CITY OF HOPE CANCER CENTER**

David Josephson, MD, Robert Torrey, MD, Bertram Yuh, MD, Jennifer Linehan, MD, Jonathon Yamzon, MD, Clayton Lau, MD, Timothy Wilson, MD  
(Presentation to be made by Dr. Torrey)

**Purpose:** Intuitive surgical has developed a new camera for use with the daVinci Si<sup>®</sup> robotic surgical system which has near infrared capabilities that can detect the fluorescence of intravascular Indocyanine Green (ICG) dye. This technology has been FDA approved for renal perfusion and vessel identification during partial nephrectomy. We describe our initial experience with this new technology.

**Materials and Methods:** Five patients underwent robotic-assisted laparoscopic partial nephrectomy. At appropriate times during the surgery, ICG dye was injected intravascularly through the patient's intravenous access by the anesthesiologist. Injections were given to evaluate the patient's renal vascularity, renal perfusion, differentiation of normal versus abnormal parenchyma, and to potentially assist in evaluation of margin status. Patients were reviewed regarding demographics, preoperative, perioperative, and postoperative outcomes.

**Results:** Six lesions were removed from 5 patients. One patient had two lesions. There were 2 males and 3 females with a median age of 67 (49-79) and a median ASA of 2 (2-4). The median overall operative time, median EBL, and median length of stay were 193minutes (140-223), 50cc (20-400), and 3days (2-3), respectively. Selective arterial clamping of inferior pole arterial branches was possible in 3 patients. One of the patients who had selective arterial clamping had two lesions. Selective clamping was used to remove one of the lesions while complete arterial clamping was needed for the second lesion. For those who underwent selective arterial clamping, the median clamp time was 14minutes (8-17). For those who required complete arterial clamping the median warm ischemia time was 19.5minutes (10-24). The median lesion size was 2.9cm (1.4-3.4) and all margins were negative. The median total dose of Indocyanine green was 9mg (5-13.75), but was given in fractions at strategic times during the procedure. Two of the lesions were clear cell carcinoma and did not fluoresce in comparison to normal healthy renal parenchyma. One of the lesions was chromophobe carcinoma and similarly did not fluoresce. The remaining lesions were oncocytoma x2 (both on one kidney) and papillary cell carcinoma. Oncocytomas and papillary cell carcinomas actually fluoresced to the same degree or more so than the normal healthy parenchyma. Fluorescent imaging was used at the end of the reconstruction to evaluate renal re-perfusion. The resected lesions were examined on the back table following removal with regard to margin status. Median creatinine prior to surgery was 0.73 (0.57-1.00) and after surgery was 0.71 (0.59-1.00).

**Conclusions:** Near-infrared fluorescent imaging may improve the ability to perform a robotic-assisted laparoscopic partial nephrectomy by improving the ability of the surgeon to detect the renal vascularity, by decreasing renal hypoperfusion in allowing selective arterial clamping for certain cases, by potentially improving the surgeon's ability to detect margin status during the surgery, and to allow for evaluation of renal perfusion following renal unclamping at the end of surgery.

## THE NEPHROMETRY SCORE AS A PREDICTOR OF POST-OPERATIVE RENAL FUNCTION AFTER PARTIAL NEPHRECTOMY.

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Kerrin Palazzi-Churas, MPH, Michael Santamouro, M.D., James  
L'Esperance, M.D., Ithaar H. Derweesh, M.D.: San Diego, CA  
(Presentation to be made by Dr. Colangelo)

**Introduction:** Preservation of renal function in the setting of kidney surgery has become prognostic for decreased morbidity as well as overall survival. A reliable method for predicting renal function outcomes pre-operatively would be valuable in patient counseling, operative planning, and with post-operative expectations. Factors that predict renal function after partial nephrectomy, however, have not been well defined and have included both modifiable factors such as amount of renal parenchyma preserved during surgery and ischemia time; and non-modifiable factors such as baseline renal function and tumor size. The Nephrometry score was developed as a way to standardize the surgical description of renal masses (Uzzo et al 2010). We sought to use the nephrometry score as a method for predicting renal functional outcomes after partial nephrectomy.

**Purpose:** The purpose of this study was to evaluate the feasibility and predictive potential of the nephrometry score with regards to renal function after partial nephrectomy.

**Methods:** A multi-institutional retrospective chart review of 155 partial nephrectomies between 2003-2010 was performed. The RENAL nephrometry score ([www.nephrometry.com](http://www.nephrometry.com)) for each lesion was determined by pre-operative CT scan. Serum Cr and GFR measurements were measured pre operatively, 4-12 weeks post operatively, and at most recent follow up. Main outcome measures were percent change in Cr and GFR from baseline. Statistical analysis included univariate analysis and multiple regression analysis based on low (<8) and high (≥8) nephrometry scores.

**Results:** Patients were well-matched in terms of gender, BMI, comorbidities, and pre op eGFR and Cr, when comparing those with nephrometry scores less than 8 and greater than or equal to 8. On multivariate analysis, the risk of developing GFR reduction of greater than or equal to 25% was increased for lesions with a high nephrometry score (≥8), OR=2.3 (CI 1.078-4.956); p<0.031. Similarly, the risk of developing GFR reduction ≥25% was increased for masses with nearness to the collecting system of <4mm, OR 2.7 (CI 1.153-6.443), p<0.022.

**Conclusions:** Nephrometry score >8 is predictive of post operative renal function decline. Also, nearness to collecting system (<4mm) was the strongest predictor of post operative renal function decline. The nephrometry score, therefore, may be used as a reliable predictor for post operative renal function, and can be a useful tool in predicting post operative outcomes and in counseling patients undergoing partial nephrectomy.

**Source of Funding:** None

## **PREDICTING ADVERSE EVENTS IN PATIENTS UNDERGOING PCNL**

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(Presentation to be made by Dr. Adams)

**Purpose:** To identify risk factors for operative complications following PCNL, and generate pre-operative risk assessment based on patient characteristics, stone data, and planned surgical technique.

**Materials and Methods:** The records of 531 consecutive patients undergoing PCNL by two primary surgeons at a single institution between 2007 and 2010 were retrospectively reviewed. We collected extensive pre-operative patient data including demographics, comorbidity, stone size/composition/location, and prior treatments. Operative data such as access site, EBL, and OR time was collected as well as post-operative course, complications and their management, hospital length of stay, and success of stone treatment. Logistic regression with backward stepwise selection of predictive variables was used to identify risk factors for adverse events.

**Results:** 531 patients (mean age, 51.4 +/- 50.7 years; 50.6% male) underwent PCNL during the observation period for treatment of upper tract urolithiasis with mean stone diameter of 2.7cm. 122 patients (22.9%) experienced a complication. Of these, 49 (9.23%) were chest complications while 73 (13.75%) were non-chest. On multivariate analysis, multiple risk factors for any, chest, and non-chest complications were identified. Cystine stone composition ( $P=0.001$ ) and increasing stone size ( $P=0.005$ ) were significant predictors of any complication. Supra-costal access, both supra-11 ( $P < 0.001$ ) and supra-12 ( $P=0.003$ ) was the strongest predictor of chest complications, but patients with cystine stones also had increased risk of an adverse thoracic event ( $P=0.01$ ). Increasing BMI was associated with decreased risk of chest complications ( $P=0.01$ ). Severe medical comorbidity, as assessed by ASA class 4 status ( $P=0.008$ ), and increasing stone size ( $P=0.005$ ) were predictive of non-chest complications.

**Conclusion:** Supra-costal access is the major predictor of thoracic complications, while medical comorbidity and increasing stone size were predictive of non-chest complications. Patients with cystine stones had increased complication rates compared to other stone compositions and may benefit from strategies to decrease complications such as avoidance of supra-costal access.

## TARGETED INTERVENTION VERSUS CONSERVATIVE INTERVENTION FOR THE PREVENTION OF KIDNEY STONE RECURRENCE

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(Presentation to be made by Dr. Ben Chew)

**Purpose:** Conservative advice consists of increasing fluid intake, limiting protein, sodium and oxalate, and maintaining a moderate calcium intake. Alternatively, performing two-24 hour urine tests can highlight specific metabolic abnormalities and targeted approaches such as selective dietary restriction, potassium citrate, or thiazide diuretics can be tailored. There is a paucity of literature on whether targeted or conservative approaches to metabolic stone management are more effective at preventing stone recurrences. 24-hour urine tests are cumbersome for patients to collect and can represent a large cost to the healthcare system. Conservative therapy is less costly, forgoing the need for repeat urine collections, but it is unknown if it is as effective as targeted therapy in preventing kidney stones. We sought to compare the urinary values of patients undergoing conservative versus targeted preventative therapies at our centre.

**Materials and Methods:** A retrospective chart review of patients in our stone clinic was performed involving 98 patients with recurrent metabolic stone disease, consisting of 24-hour urine collection while on a random diet and after dietary modification. Patients were treated at the Stone Centre at Vancouver General Hospital. Sex, age, body mass index (BMI), medical risk factors, anatomical risk factors, follow-up length, stone recurrences, and changes in volume, calcium, oxalate, citrate, sodium, and uric acid in the 24-hour urine samples were compared between targeted (treated by BHC and RALS) and conservative (treated by RFP) groups.

**Results:** There was no difference observed in urinary oxalate, calcium, or citrate between groups. There was significant pre and post differences for urinary sodium and volume between the targeted and conservative treatment. The results showed urinary sodium ( $p=0.014$ ) and uric acid ( $p<0.001$ ) increased for the targeted metabolic management. In the obese population, there was a significant increase in the urinary sodium ( $p=0.003$ ) and volume ( $p=0.034$ ) for the targeted treatment group. The urinary volume actually decreased in the conservatively managed obese patients. There was no difference in stone recurrence rates between groups with a mean follow-up of 6.8 months ( $p=0.391$ ).

**Conclusions:** From our results, it can be concluded that both approaches in the management of patients at our centre have equal validity. Recurrence rates were equal, but urinary sodium increased in the targeted group (both obese and non-obese), but this also resulted in higher urine volumes. More patients and further data analysis with longer follow-up are required and should specifically analyze patients with other such risk factors as obesity, diabetes, and coronary artery disease. Currently, both types of management are equally effective.

**Source of funding:** None

## **ASSESSING SUCCESS AND COMPLICATIONS OF PERCUTANEOUS NEPHROLITHOTOMY IN A DEDICATED STONE CENTRE**

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(Presentation to be made by Dr. Hamidizadeh)

**Purpose:** Percutaneous nephrolithotomy (PCNL) is a minimally invasive procedure involving placement of a tract into the kidney through which instruments are inserted to disintegrate and remove renal stones. The Vancouver General Hospital Stone Center was opened in fall of 2008, with dedicated staff and facility for performing PCNL. We compared the PCNL procedures prior to and after opening of the Stone Center.

**Methods:** 952 PCNL cases were analyzed retrospectively. Group 1 contained 750 cases from prior to Stone Center opening, between 2000-July 2008. Group 2 contained 202 cases from after Stone Center opening, between October 2008-December 2009. Different complication and stone-free rates were analyzed. Data was analyzed using the INSTAT statistical program with p values (significance:  $p < 0.05$ ), and 95% confidence intervals (CI).

**Results:** The results showed statistically significant improvements in rates of major complications (Group 1:7.7% vs Group 2:3%;  $p < 0.05$ , CI (95): 1.184-6.598), bleeding (12.9% vs 6.4%;  $p < 0.01$ , CI(95):1.184-3.940), transfusions (6.3% vs 0.5%;  $p < 0.001$ , CI(95):17.501-954.54), pulmonary complications (30.9% vs 2.5%,  $p < 0.01$ , CI(95):7.166-43.455), and stone-free status (35.3% vs 52.1%;  $p < 0.0001$ , CI(95):0.3638-0.6936) after opening of the Stone Centre. Infections, genitourinary complications, readmission to emergency, and minor and total complications were not statistically different.

**Conclusion:** At our institution, with a dedicated Stone Centre unit, stone-free and complication rates improved. Dedicated staff and facilities allow for increased competency in performing PCNL, which will continue to improve complication rates. The limitation of this analysis was time (in years), as the data frames for groups 1 and 2 were different. We will continue with data collection from the Stone Center to find other significant differences and improvements.

## UNDERSTANDING THE ROLE OF THE URINARY CONDITIONING FILM ON BACTERIAL ADHESION TO URETERAL STENTS

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(Presentation to be made by Dr. Lange)

**Purpose:** A common problem with indwelling ureteral stents is adhesion of bacteria to the device surface. We believe that urinary proteins within a conditioning film form anchor points to which bacteria adhere.

**Methods:** Polaris (Boston Scientific) and InLay stents (Bard) removed from patients, as well as stent pieces incubated in urine for up to 72 hours were analyzed for adherent proteins via Quadrupole Time of Flight Spectrometry. Stents Removed from Patients were incubated with *Escherichia coli* C1214 and *Staphylococcus aureus* Newman to determine bacterial adhesion in the presence of a conditioning film.

**Results:** In total, 116 and 99 unique proteins were identified on the Polaris (n=24) and InLay (n=20) stents, respectively. The most common proteins found on both stents were the following: Cytokeratins, Serum Albumin, Hemoglobin subunit alpha/beta, Uromodulin, Protein S100A9, Fibrinogen (alpha/beta/gamma chains), Vitronectin, and Apolipoprotein. Significantly less Polaris stents were found to contain Uromodulin ( $p=0.002$ ) and Fibrinogen gamma chain ( $p=0.026$ ) than InLay stents, while no significant differences were found for the remaining proteins.

Using non-stone former urine we found that keratins form a base layer on stents within 4–72 hours post-exposure. Studies using stone former urine will show whether the base layer differs. The analysis of proteins adherent to the stents removed from these patients will serve as a control.

Bacterial adhesion to stents removed from patients was not increased compared to control stents.

**Conclusions:** The conditioning film components of indwelling ureteral stents do not differ between stent types and patients, and the majority are known binding sites for bacteria. Despite this, the urinary conditioning film may not play a significant role in facilitating bacterial adhesion.

## **Fluid Intake Patterns from a Representative National Population Sample, Implications for Kidney Stone Disease Incidence**

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(Presentation to be made by Dr. Wright)

**Purpose:** Consistent variations in the incidence of kidney stone disease have been noted related to the demographic variables of gender, age, race, diabetes status, and BMI. Because of its strong association with stone recurrence, we hypothesize that fluid intake variations between individuals within these categories may contribute to observed differences in kidney stone incidence. To test this hypothesis, we use a cross sectional survey study design with data from a nationally representative sample to determine usual fluid intake habits in the population and compare this to known kidney stone incidence patterns.

**Materials and Methods:** The National Health and Nutrition Examination Survey (NHANES) surveys a nationally representative sample of persons annually. Detailed food intake interviews are included that collect complete data on the amounts and types of food and beverages ingested over a 24-hour period. Data from the 2007-2008 data release was analyzed using the SAS 9.2 statistical software package with appropriate sampling weights applied given the complex sampling design of NHANES. Predictor variables examined included gender, age, race, BMI, diabetes status, and kidney stone history. Total moisture and nutrition intake information was available for each individual in the survey over a 24-hour period. We normalized intake for body size by dividing it by body weight in kilograms. We also compared stone formers vs non-stone formers with respect to fluid intake, demographics, and medical comorbidities as well as nutrition intake variables including salt, calcium, vitamin C, protein, bottled water intake and tap water source.

**Results:** Dietary data from a total of 5,592 subjects was available for analysis. Relationships between moisture intake and known epidemiologic stone risk was paradoxical for gender, race, and age, with groups at higher risk for stones having significantly higher normalized moisture intake. Total 24-hour moisture intake was higher in men than women (39.2 vs 37.5 ml/kg respectively), in caucasians compared to non-whites (39.6 vs 35.3 ml/kg respectively), and in those <50 years olds (40.4 ml/kg) vs ≥50 years old (35.3 ml/kg). Consistent with known stone risk, increased BMI was associated with decreased moisture intake (46.1 ml/kg BMI <25 vs. 34.5 ml/kg BMI ≥25). Diabetic individuals had lower moisture intake than non-diabetics (32.5 vs 38.8 ml/kg). Kidney stone formers had lower moisture intake than non-formers (35.6 vs 38.6 ml/kg). NHANES data were consistent with known variations in stone formation by gender, race, BMI, age and history of diabetes and gout. Stone formers vs non-stone formers had lower bottled water intake (3.6 vs 5.3 ml/kg respectively), calcium intake (10.6 vs 12.1 mg/kg respectively), and vitamin C intake (0.8 vs 1.1 mg/kg respectively). Tap water source, protein and sodium intake did not significantly differ between stone formers vs non-stone formers.

**Conclusions:** Using a nationally representative sample, moisture intake did not vary in a expected fashion with known demographic stone risk categories for gender, race, and age. However, moisture intake was lower for those with higher BMI, diagnosis of diabetes, or with a history of kidney stones. These results suggest that dehydration may play a greater role in stone risk among the overweight and diabetics and that the increased kidney stone risk seen in men, among whites, and in young to middle aged adults is not due to variations in dehydration. The importance of fluid intake in stone-formers is reinforced with emphasis on bottled water intake and maintenance of normal calcium intake.

## INTERIM ANALYSIS OF A MULTI-CENTRE RANDOMIZED CONTROLLED TRIAL COMPARING THREE DIFFERENT MODALITIES OF NEWER LITHOTRITES FOR PERCUTANEOUS NEPHROLITHOTOMY

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(Presentation to be made by Dr. Ben Chew)

**Purpose:** To compare the efficiency and fragmentation rate of the 3 newest lithotrites available on the market during percutaneous nephrolithotomy.

**Materials and Methods:** Patients undergoing percutaneous nephrolithotomy with stones greater than 2 cm in diameter were randomized to intracorporeal lithotripsy with either the Cyberwand (Olympus-ACMI), Lithoclast Select (EMS/Boston Scientific Microvative), or StoneBreaker (Cook Urological) and Olympus LUS-2 ultrasonic lithotripsy. The total time to perform the procedure including fragmentation time, grasping fragments, and ultrasonic lithotripsy was recorded. Clearance rate was calculated by dividing the surface area of the targeted stone by the total clearance time. Stone free rate was determined by post-operative CT scan or secondary nephroscopy within 30 days.

	Cyberwand (n=15)	Lithoclast Select (n=14)	StoneBreaker (n=16)	p-value
Median patient age (Years) (range)	50 (30-80)	63.5 (49-80)	58.5 (44-67)	ns
Median stone size (mm <sup>2</sup> ) (range)	449.7 (138.4-4884)	308.4 (182-671.5)	321.7 (109-732.6)	Ns, p=0.10
Median Clearance Efficiency (mm <sup>2</sup> /sec)	16.1 (7.8-175)	17.2 (6.2-30.2)	20.6 (4-44)	ns, p=0.24
Stone Free Rates	93%	79%	50%*	*p=0.006
Complications	Mucosal perforation 1	Fever 1 Mucosal perforation 1 Transfusion 1	Fever 1 Mucosal perf 1 Transfusion 3	ns

**Results:** Forty-five patients to date have been enrolled in the study across multiple sites.

**Conclusions:** Our preliminary data showed a slight advantage in stone free rate to the Cyberwand and Lithoclast Ultra groups over the Stone Breaker. There was no difference in clearance efficiency among groups. The study is ongoing and further patients will help determine if true differences exist among lithotrites in their efficiency of fragmenting stones during percutaneous nephrolithotomy.

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