INCIDENT CHRONIC KIDNEY DISEASE FOLLOWING KIDNEY CANCER SURGERY

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Introduction: We sought to characterize the risk of clinically significant chronic kidney disease (CKD) following radical (RN) or partial nephrectomy (PN). We examined kidney function outcomes using data from the Veterans Health Administration (VHA). The VHA is the largest integrated national health care system in the US and uses a standardized electronic health record, including measures of vital signs, laboratory values, and cancer specific data.

Methods: We identified patients treated with RN or PN in the VHA from 2001-2013. We extracted all available measures of pre-op kidney function (N=120,746), post-op kidney function (N=584,043), and tumor specific data. For patients with pre-operative eGFR>30, we fit proportional hazards models to test the association with RN and the outcome of stage 4 CKD (eGFR<30 or dialysis). We performed a parallel analysis of patients with normal or near-normal preoperative kidney function (eGFR >=60) and the incidence of stage 3b CKD (eGFR<45). We fit adjusted competing risks models to determine the risk of CKD or death.

Results: We identified a cohort of 14,129 patients with pre-operative eGFR>30 that underwent kidney cancer surgery with either RN (n=9759) or PN (n=4370). Patients treated with PN had a >50% reduced risk (HR 0.49, 95%CI 0.42-0.58) of stage 4 CKD (eGFR <30) in our multivariable model after controlling for age, sex, race, comorbidities, year of surgery, and pre-operative kidney function. This association remained (HR 0.39, 95%CI 0.32-0.48) after controlling for T-stage in patients with tumor specific data (N=8598). Patients with normal or near-normal pre-op kidney function (N=8089) treated with PN had a >80% reduced risk (HR 0.17, 95%CI 0.14-0.21) of developing stage 3b CKD (eGFR<45) when compared with RN. All associations remained significant in our competing risk multivariable model.

Conclusions: Partial nephrectomy is associated with marked reduction in the incidence of clinically significant CKD when compared with RN.

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**Introduction and Objective:** Nephron sparing treatment (NST) of Stage 1 renal masses (especially those <4cm) should be utilized over radical nephrectomy when clinically appropriate. Studies have shown long-term benefits, reduced need for hemodialysis, and improved overall survival with NST as well as reduced cost of care. Modeling a program called the Urological Surgery Quality Collaborative we conducted phase one of three to assess rates of NST in a large integrated healthcare system for the management of stage 1 renal cell carcinoma.

**Methods:** An IRB approved retrospective review of all patients with Stage 1 RCC from 2004-2011 within the KP Northern California Tumor Registry were identified. Treatment type was defined as NST, nephrectomy, or surveillance captured from their medical record. Nephrometry score was assigned based upon preoperative CT scan for all patients undergoing Nephrectomy in 2011 to ascertain surgical complexity.

**Results:** A total of 1301 cases of pT1a renal cell carcinoma (RCC) were treated during this time frame. Rates of NST have gone from 42% in 2004 to 63% in 2011 (p <0.01). In 2011, 75 nephrectomies were performed out of 202 cases of pT1a RCC. Review of the preoperative imaging shows that 7%, 8%, 18%, 28%, and 39% had a Nephrometry score of 6, 7, 8, 9, or 10 (the highest score for tumors less than 4cm).

**Conclusions:** Over this time period NST increased for stage 1 renal cell carcinoma. Surgical complexity as defined by Nephrometry score was high for most but not all nephrectomy cases. Phase one of this work demonstrates that there is potentially room for improving rates of NST. Further efforts to increase rates of NST are ongoing based upon the model of Urological Surgery Quality Collaborative.

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Key Words: Kidney Cancer, integrated healthcare system, Urological Surgery Quality Collaborative

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TUMOR HISTOLOGY AND GRADE INFLUENCE ONCOLOGICAL OUTCOME FOLLOWING PERCUTANEOUS RENAL TUMOR CRYOABLATION IN RENAL CELL CANCER: A MULTICENTER ANALYSIS

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Introduction and Objectives: Percutaneous renal cryotherapy (PRC) is an option for management of small renal mass (SRM). We analyzed oncological outcomes in patients who underwent PRC in patients with documented renal cell carcinoma RCC by perioperative biopsy.

Methods: Multicenter retrospective analysis of 153 patients [median follow-up 48 months] who underwent PRC from 09/2005-08/2014. We divided the cohort into patients who developed recurrence vs. no recurrence. Demographics, clinical characteristics, outcomes and complications (Clavien) were analyzed between the two groups. Primary outcome was tumor recurrence, whether by primary treatment failure, or progressive disease by metastasis. Multivariable analysis (MVA) was performed to identify risk factors associated with tumor recurrence. Kaplan-Meier analysis (KMA) estimated the disease free survival by comparing the grades 1 vs. 2/3 with log-rank test.

Results: 18 patients (11.8%) developed recurrence and 135 (88.2%) patients were without evidence of tumor recurrence after PRC. There was a greater proportion of non-Caucasian patients in the recurrence group (83.3% vs. 54.8%; p=0.021). Surgical variables (RENAL score, number of probes) were similar between groups. Recurrence group had larger tumor size (3.1 vs. 2.4 cm; p=0.011), upper pole tumor location (p=0.016), and proportions of high grade tumor (33% vs. 0.7%; p<0.001) and clear cell histology (77.8% vs. 45.9%; p=0.011). MVA demonstrated non-white ethnicity (OR=5.25; p<0.024), upper pole tumor location (OR=3.83; p=0.007), increasing tumor size (OR=3.08; p=0.003), clear cell histology (OR=5.68; p=0.012) and increasing tumor grade (OR=14; p<0.001) as independent risk factors associated with tumor recurrence. KMA for DFS (Figure) revealed that Grade I/II tumors had median DFS of 68 months, but grades 1 and unknown histology were disease free at last follow-up (p<0.001).

Conclusions: Association of higher grade and Clear Cell histology with recurrence and progression suggests need for increased emphasis on preoperative risk stratification by biopsy, with non-Clear Cell histologies and grade I Clear Cell RCC being associated with better outcomes than higher grade Clear Cell RCC.
POSITIVE SURGICAL MARGINS ARE ASSOCIATED WITH INCREASED RISK OF RECURRENCE AFTER PARTIAL NEPHRECTOMY FOR LOCALIZED RENAL TUMORS

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Presentation to be made by Dr. Zhamshid Okhunov.

Background and objectives: Complete tumor resection constitutes a cardinal principle in the surgical management of malignancies. A strong emphasis placed on renal preservation has led to increasing utilization of reduced resection margins during nephron sparing surgery for localized renal tumors. The clinical significance of positive surgical margins (PSM) at time of partial nephrectomy, however, remains controversial. Herein, we evaluate the association of PSM and the risk of recurrence among patients with localized renal tumors undergoing partial nephrectomy (PN).

Methods: We performed a multi-institutional retrospective review of 1240 patients undergoing PN (open or laparoscopic) for localized renal malignancy between from 2002 to 2013. Recurrence-free survival was estimated using the Kaplan-Meier method and evaluated as a function of PSM with log-rank test and Cox proportional hazards models adjusting for tumor size, grade, histology, pathologic stage, focality, and laterality. Site of recurrence (local or distant) as a function of PSM was tested with Fisher’s exact test.

Results: A total of 97 (8%) patients had PSM. PSM was unrelated to tumor size, grade, histology, pathologic stage, focality or laterality (all P > 0.05). A total of 69 (6%) patients developed recurrence over a median follow up of 33 months (interquartile range [IQR] = 15-57). Of these, 42 (61%) were local and 27 (39%) were distant recurrences. The median time to recurrence was 19 months (IQR = 12-35). On univariable analysis, PSM was associated with higher recurrence rates (Figure, P = 0.002). On multivariable analysis, PSM remained associated with higher recurrence rates (hazard ratio = 2.91, 95% confidence interval = 1.25-6.78, P = 0.013). PSM was not associated with site of recurrence (P = 0.52).

Conclusions: PSM is associated with an increased risk of recurrence after PN. Urologist should strive to obtain negative surgical margins in order to maximize disease-free survival. For patients with PSM, close follow-up is advisable given their higher risk of disease recurrence.
POINT / COUNTERPOINT

Comprehensive Management of the Small Renal Mass.

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DO LIMITED AND EXTENDED WARM ISCHEMIA TIMES IMPACT LONG-TERM KIDNEY FUNCTION?

(Presentation to be made by Mr. Wesley Yip)

Objectives: The impact of extended warm ischemia time (WIT) during minimally-invasive partial nephrectomy (MIPN) remains controversial. We compare perioperative and functional outcomes after MIPN with long WIT (≥30 min, range 30-59) to limited WIT (≤20 min, range 9-20) and zero WIT.

Materials and Methods: 141 patients who underwent MIPN at our institution were retrospectively analyzed through our IRB approved renal database. Patients were separated into three groups by WIT: Long (WIT≥30 min, n=21), Limited (WIT≤20 min, n=60), and Zero (WIT=0 min, n=60). 3D kidney images were rendered from CT scans with Synapse 3D software and used to determine tumor volumes, pre-operative functional parenchymal volumes (FPV), post-operative FPVs, and FPV % change. Perioperative outcomes were compared based on operative time, estimated blood loss (EBL), transfusions, complications, and hospital stay. Functional outcomes were compared based on ≥3-month follow-up estimated glomerular filtration rate (eGFR) using the CKD-EPI equation.

Results: Until date, complete functional data were available for 7 patients in the Long group, 34 in the Limited group, and 60 in the Zero group. Median age was 61 years (32-88), median tumor diameter was 3.2cm (1.2-7.6), and median RENAL score was 7 (4-11). Operative time, EBL, transfusions, complications, and hospital stay, were comparable between the three groups (p=0.13, 0.38, 0.56, 0.77, 0.54, respectively). Only the Long and Zero groups had a significant difference in discharge eGFR % change from baseline (p<0.01). There was no statistical difference in ≥3-month follow-up eGFR (p=0.76) between the three groups. A subset of patients in the Limited (n=19) and Zero (n=22) groups had post-operative FPV calculated. FPV % change was greater in the Limited group than the Zero group (p=0.01), while ≥3-month follow-up eGFR % change from baseline was not significantly different (p=0.74).

Conclusions: Perioperative outcomes after MIPN with extended WIT are comparable to limited and zero WIT. While zero WIT is beneficial in terms of discharge eGFR (short-term renal function), ≥3-month eGFR (long-term renal function) does not appear to be affected by extended WIT.

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HOW A DONOR NEPHRECTOMY POPULATION CAN HELP CLARIFY THE EFFECTS OF WARM RENAL ISCHEMIA DURING PARTIAL NEPHRECTOMY

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(Presentation to be made by Dr. Shen)

INTRODUCTION AND OBJECTIVES: The most important modifiable risk factors for kidney function after partial nephrectomy (PN) are the quantity of parenchyma removed and the length of warm ischemia time (WIT) although the relative importance of these two factors has been debated. In this study, the effects of WIT on renal function were investigated by comparing PN patients to completely healthy patients undergoing donor nephrectomy (DN).

METHODS: A retrospective review was performed of 119 PN and 250 DN patients at a single academic institution. Baseline characteristics, WIT, and follow-up serum creatinine (sCr) at discharge, 1-7 months and at last follow-up were compared. Estimated GFR (eGFR) was calculated using sCr and the Modification of Diet on Renal Disease (MDRD) formula. Data was analyzed using the Mann-Whitney U and Chi-square tests as appropriate.

RESULTS: The DN patients were younger (37.5 vs. 60.8; p<0.001), had lower BMI (26.9 vs. 30.9; p<0.001), lower ASA scores (p<0.001) and higher preoperative eGFR(108.4 vs. 77.4; p<0.001). In the PN cohort, the median tumor size was 3.6 cm and mean WIT was 27.8 minutes. DN patients were found to have greater eGFR decline upon discharge (~40.5% vs. -1.1%; p<0.001), at 1-7 month postoperatively (~34.1% vs. -6.0%; p<0.001) and at the latest follow-up (~33.2% vs. -5.0%; p<0.001). On univariate analysis, DN patients where 3.14 times more likely than PN patients to develop S-CKD at discharge [CI 1.8-5.3 for DN;p<0.001]. On multivariate analysis, DN was an independent predictor of developing surgical CKD postoperatively.

CONCLUSIONS: Despite being younger and healthier, the donors had a much greater decrease in eGFR than all PN patients including those with >30 min WIT. This dramatic benefit of partial nephrectomy compared with radical nephrectomy in all patients emphasizes the benefit to GFR derived from renal parenchymal preservation. Surgeons should utilize warm renal ischemia when indicated if it facilitates the preservation of renal parenchyma.

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LEAK POINT PRESSURE IS AFFECTED BY RENAL VASCULAR CLAMP TYPE AND POSITION IN HUMAN RENAL ARTERIES

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OBJECTIVES: Attempts to clamp the renal artery during a partial nephrectomy can be unsuccessful in achieving complete vascular control. Recently, it has been demonstrated that robotic bulldog clamps were not effective at preventing leakage on a penrose drain model. The purpose of this study was to determine the ability of robotic and laparoscopic bulldog clamps to control blood flow from the renal artery. In addition, the effect of clamp position was also evaluated.

MATERIALS AND METHODS: With the use of a novel bench top model, fresh human cadaveric renal arteries were connected to a pressure gauge, and were then continuously infused with normal saline. Leak point pressures (LPP) of seven different bulldog vascular clamps from three manufacturers (see table) were determined. Five separate trials were performed at four different locations along the clamp including: the fulcrum, proximal, middle, and distal positions. Analysis was performed using the Kruskall- Wallis procedure with multiple comparisons of post hoc hypotheses adjusted for multiple testing. P values < 0.05 were considered significant.

RESULTS: The lowest LPP observed in all clamps when applied at the proximal, middle or distal position was 220 mmHg. In general LPP decreased as the artery was positioned more distally along the clamp. However, the exception was when the vessel was placed at the fulcrum position. At the fulcrum position, both Klein and Scanlan clamps had significantly lower LPP when compared to the mean LPP at the other positions (p<.001). (See table). Eighty to 100% of Klein clamp trials and 60% to 80% of Scanlan trials leaked at pressures below 210 mmHg when the clamp was placed at the fulcrum position.

CONCLUSIONS: Each vascular clamp tested resulted in adequate control of the renal artery when applied at the proximal, middle, or distal positions. To our knowledge this is the first study to use fresh human arteries to compare vascular bulldog clamps, and to demonstrate leakage at physiologic pressures when the artery is placed at the fulcrum of the Klein and Scanlan clamps. These results suggest that application of a bulldog clamp at the fulcrum could potentially lead to inadequate vessel occlusion and potentially catastrophic intraoperative bleeding.

Table 1: Leak point pressure (mmHg) of vascular bulldog clamps at fulcrum, proximal, middle and distal positions. P values demonstrate a comparison of LPP at the fulcrum position with the mean LPP at the proximal, middle and distal positions.

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STATE OF THE ART

Ultrasound vs. CT Imaging for ER Evaluation of Renal Colic: Appraisal of the NEJM Study.

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