**SUPPLEMENTARY INFORMATION**

**Risk of Post-Operative Renal Failure in Radical Nephrectomy and Nephroureterectomy: A validated risk-prediction model**

Ali A. Nasrallaha, Charbel Ghariosb, Mira Itanic, Dania S. Bachab, Hani M. Tamimd, Robert H. Habibe, Albert El Hajja

a: Division of Urology, Department of Surgery, American University of Beirut Medical Center, Beirut, Lebanon

b: Department of Internal Medicine, American University of Beirut Medical Center, Beirut, Lebanon

c: Department of Family Medicine, American University of Beirut Medical Center, Beirut, Lebanon

d: Clinical Research Institute, American University of Beirut, Beirut, Lebanon

e: Research Center, Society of Thoracic Surgeons, Chicago, Illinois, USA

Short title: Risk model for postoperative renal failure in RN/RNU

**Correspondence to:**

Albert El Hajj, MD

Associate Professor

Department of Surgery, Division of Urology, American University of Beirut Medical Center

P.O. Box 11-0236

Riad El-Solh, 1107 2020

Beirut, Lebanon

Email: ae67@aub.edu.lb

Phone: +961 1 350 000

**Table S1: Variable Definition as per the ACS-NSQIP Participant Use File:**

|  |
| --- |
| 1. **Baseline Demographics:**
 |
| Gender: Defined as male versus female |
| Race: Defined as White, Black, Other or Unknown. |
| Ethnicity: Defined as Hispanic, non-Hispanic and Unknown. |
| Age: Defined as the age of the patient at the time of surgery in years. |
| Weight: Defined as “The patient’s most recent weight documented in the medical record in pounds (lbs).” Transformed into kilograms in our dataset in order to finally compute BMI. |
| Height: Defined as “The patient’s most recent height documented in the medical record in inches (in).” Transformed into centimeters in our dataset in order to finally compute BMI. |
| BMI: Defined as the Body Mass Index, calculated using the following formula (BMI= weight/(height/100)2). Unit: kg/m2. |
| Current smoker within one year: Defined as anyone who has smoked *cigarettes* in the past year prior to the surgery. This excludes pipe, cigars and chewing tobacco.  |
| 1. **Preoperative State:**
 |
| Preoperative Creatinine: Defined as the creatinine level (in mg/dL) prior to the surgery - no time window provided.  |
| Preoperative BUN: Defined as the BUN level (in mg/dL) prior to the surgery - no time window provided.  |
| Preoperative hematocrit: Defined as the level of hematocrit (in %) prior to the surgery - no time window provided.  |
| Preoperative platelet count: Defined as the platelet count (in x103/mm3) prior to the surgery - no time window provided.  |
| Preoperative WBC count: Defined as the white blood cell count (in x103/mm3) prior to the surgery - no time window provided.  |
| Presence of ascites: Defined as the presence or absence of fluid in the peritoneal cavity as diagnosed by physical exam, abdominal ultrasound or abdominal CT/MRI within the 30 days prior to the surgery.  |
| More than 10% unintentional weight loss prior to surgery: Defined as the absence or presence of an unintentional weight loss of more than 10% of the original weight. |
| History of Severe COPD: Defined as yes in case the patient has one or more of the following:  |
| * Functional disability from COPD (e.g., dyspnea, inability to perform ADLs)
 |
| * Hospitalization in the past for treatment of COPD
 |
| * Requires chronic bronchodilator therapy with oral or inhaled agents
 |
| * An FEV 1 of <75% of predicted on pulmonary function testing
 |
| Patients are excluded if their only pulmonary disease is asthma. They are also excluded if they have diffuse interstitial fibrosis or sarcoidosis.  |
| **Cardiovascular risk factors as part of the preoperative state:** |
| Diabetes: Defined as the presence or absence of a history of diagnosed Diabetes Mellitus.  |
| Congestive Heart Failure (CHF) in 30 Days Before Surgery: Defined as only those patients who have been newly diagnosed with congestive heart failure within the previous 30 days *or* who fulfill a diagnosis of chronic CHF with new signs or symptoms in the 30 days prior to surgery. |
| Previous Cardiac Surgery: Defined as the presence or absence of having undergone a coronary artery bypass graft surgery, valve replacement or repair, repair of atrial or ventricular septal defects, great thoracic vessel repair, cardiac transplant, left ventricular aneurysmectomy, insertion of left ventricular assist devices (LVAD), etc. Pacemaker insertions or automatic implantable cardioverter defibrillator (AICD) insertions are *excluded* from this definition.  |
| Hypertension Requiring Medication: Defined as the presence or absence of a persistently elevated systolic blood pressure (>140 mmHg) or a diastolic blood pressure (>90 mmHg) or one who requires antihypertensive drug therapy during the last 30 days prior to the operation.  |
| History of Transient Ischemic Attack: Defined as the presence or absence of at least one transient ischemic attack in the patient’s history. |
| CAD: a combination of the three following variables  |
| * History of PCI: Defined as the presence or absence of having undergone a percutaneous coronary intervention, even if it was only attempted without completion or success, in one’s lifetime. Valvuloplasties are not included in this variable.
 |
| * History of Angina in 1 Month Before Surgery: Defined as the presence or absence of any pain between the diaphragm and the mandible that was proven to be the result of myocardial ischemia. Patients on anti-anginal drugs will only be considered to have this variable as a “Yes” if they have had this episode within the one month prior to surgery.
 |
| * History of Myocardial Infarction in the Last 6 months: Defined as the presence or absence of either a Q or non-Q wave myocardial infarct within the last 6 months. This must be proven by the patient’s medical records.
 |
| PAD: a combination of the two following variables  |
| * Rest Pain/Gangrene: Defined as the presence or absence of rest pain or gangrene. Fournier Gangrene is excluded from this variable.
 |
| * History of Revascularization/Amputation for Peripheral Vascular Disease: Defined as the presence or absence of any angioplasty or revascularization procedure resulting from sequelae of peripheral vascular disease. Amputation due to physical trauma and resection of the abdominal aortic aneurysm are excluded from this variable.
 |
| CVA: a combination of the two following variables |
| * History of CVA/Stroke With Neurological Deficits: Defined as the presence or absence of a history of a cerebrovascular accident, whether embolic, thrombotic, or hemorrhagic, with persistent residual motor, sensory, or cognitive dysfunction.
 |
| * History of CVA/Stroke With No Neurological Deficits: Defined as the presence or absence of a history of a cerebrovascular accident, whether embolic, thrombotic, or hemorrhagic, with neurologic deficit(s) lasting at least 30 minutes, but no current residual neurologic dysfunction or deficit.
 |

**Table S2: Univariate analysis for the association between postoperative renal failure and demographic characteristics, preoperative factors, and surgical approach.**

|  |
| --- |
| **Postoperative renal failure** |
| **Continuous variables** | **No** | **Yes** | **Unadjusted OR (95% CI)** | **p-value** |
| Mean ± SD | Mean ± SD |
| Age (years) | 62.12 ± 14.12 | 66.42 ± 11.93 | 1.024 (1.015, 1.033) | <0.001 |
| BMI (kg/m2) | 29.88 ± 6.92 | 31.66 ± 8.19 | 1.032 (1.018, 1.047) | <0.001 |
| Creatinine clearance (mL/min) | 88.83 ± 37.48 | 64 ± 35.26 | 0.977 (0.973, 0.981) | <0.001 |
| Preoperative creatinine (mg/dL) | 1.09 ± 0.59 | 1.79 ± 1.05 | 1.636 (1.501, 1.784) | <0.001 |
| Preoperative BUN (mg/dL)  | 17.87 ± 8.1 | 28.08 ± 15.79 | 1.064 (1.055, 1.072) | <0.001 |
| Preoperative hematocrit (%) | 39.34 ± 5.21 | 37.01 ± 6.46 | 0.927 (0.909, 0.945) | <0.001 |
| Preoperative platelets (x103/mm3) | 254.45 ± 91.08 | 229.16 ± 83.2 | 0.996 (0.995, 0.998) | <0.001 |
| Preoperative WBC count (x103/mm3) | 7.69 ± 2.74 | 7.96 ± 3.35 | 1.031 (0.994, 1.069) | 0.098 |
| Operative time (minutes)  | 180.53 ± 83.25 | 210.59 ± 95.8 | 1.004 (1.003, 1.005) | <0.001 |

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Postoperative Renal Failure** |  |  |
| Categorical variable | No PORF | Yes PORF |  |  |
| N (column%, row %)  | N (column%, row%) | OR (95%CI) | P-value |
| Gender |   |   |   |   |
|  Male | 8195 (57.62, 97.52) | 208 (70.27, 2.48) | 1 |   |
|  Female | 6028 (42.38, 98.56) | 88 (29.73, 1.44) | 0.575 (0.447, 0.74) | <0.001 |
| Race |   |   |   | 0.031 |
|  White | 11032 (77.56, 97.99) | 226 (76.35, 2.01) | 1 |   |
|  Black | 924 (6.5, 96.86) | 30 (10.14, 3.14) | 1.585 (1.077, 2.333) |   |
|  Other‎/Unknown | 2267 (15.94, 98.27) | 40 (13.51, 1.73) | 0.861 (0.614, 1.209) |   |
| Ethnicity |   |   |   |   |
|  Non-Hispanic | 13245 (93.12, 97.92) | 282 (95.27, 2.08) | 1 |   |
|  Hispanic | 978 (6.88, 98.59) | 14 (4.73, 1.41) | 0.672 (0.392, 1.154) | 0.147 |
| Smoking |   |   |   |   |
|  No | 11372 (79.96, 97.81) | 255 (86.15, 2.19) | 1 |   |
|  Yes | 2851 (20.04, 98.58) | 41 (13.85, 1.42) | 0.641 (0.46, 0.894) | 0.008 |
| ASA class |   |   |   | <0.001 |
|  Class I | 377 (2.65, 100) | 0 (0, 0) | N/A |   |
|  Class II | 5083 (35.74, 99.16) | 43 (14.53, 0.84) | 0.143 (0.094, 0.218) |   |
|  Class III | 7968 (56.02, 97.48) | 206 (69.59, 2.52) | 0.437 (0.316, 0.605) |   |
|  Class IV or V | 795 (5.59, 94.42) | 47 (15.88, 5.58) | 1 |   |
| Steroid use for chronic condition |   |   |   |   |
|  No | 13555 (95.3, 98) | 277 (93.58, 2) | 1 |   |
|  Yes | 668 (4.7, 97.23) | 19 (6.42, 2.77) | 1.392 (0.869, 2.23) | 0.167 |
| Bleeding disorders |   |   |   |   |
|  No | 13830 (97.24, 98.02) | 280 (94.59, 1.98) | 1 |   |
|  Yes | 393 (2.76, 96.09) | 16 (5.41, 3.91) | 2.011 (1.203, 3.361) | 0.007 |
| Transfusion of PRBCs in 72 hours before surgery |   |   |   |   |
|  No | 14063 (98.88, 98.01) | 286 (96.62, 1.99) | 1 |   |
|  Yes | 160 (1.12, 94.12) | 10 (3.38, 5.88) | 3.073 (1.605, 5.884) | <0.001 |
| Diabetes |   |   |   |   |
|  No | 11497 (80.83, 98.36) | 192 (64.86, 1.64) | 1 |   |
|  Yes | 2726 (19.17, 96.33) | 104 (35.14, 3.67) | 2.284 (1.793, 2.911) | <0.001 |
| Hypertension  |   |   |   |   |
|  No | 5405 (38, 99.12) | 48 (16.22, 0.88) | 1 |   |
|  Yes | 8818 (62, 97.26) | 248 (83.78, 2.74) | 3.167 (2.321, 4.322) | <0.001 |
| CHF in 30 days before surgery |   |   |   |   |
|  No | 14134 (99.37, 98) | 288 (97.3, 2) | 1 |   |
|  Yes | 89 (0.63, 91.75) | 8 (2.7, 8.25) | 4.411 (2.12, 9.179) | <0.001 |
| Previous cardiac surgery |   |   |   |   |
|  No | 13987 (98.34, 98) | 286 (96.62, 2) | 1 |   |
|  Yes | 236 (1.66, 95.93) | 10 (3.38, 4.07) | 2.072 (1.089, 3.944) | 0.023 |
| History of CAD |   |   |   |   |
|  No | 13900 (97.73, 98) | 283 (95.61, 2) | 1 |   |
|  Yes | 323 (2.27, 96.13) | 13 (4.39, 3.87) | 1.977 (1.122, 3.484) | 0.016 |
| History of CVA |   |   |   |   |
|  No | 14068 (98.91, 98.02) | 284 (95.95, 1.98) | 1 |   |
|  Yes | 155 (1.09, 92.81) | 12 (4.05, 7.19) | 3.835 (2.107, 6.98) | <0.001 |
| History of TIA |   |   |   |   |
|  No | 14111 (99.21, 97.97) | 292 (98.65, 2.03) | 1 |   |
|  Yes | 112 (0.79, 96.55) | 4 (1.35, 3.45) | 1.726 (0.632, 4.71) | 0.281 |
| History of PAD |   |   |   |   |
|  No | 14175 (99.66, 97.97) | 293 (98.99, 2.03) | 1 |   |
|  Yes | 48 (0.34, 94.12) | 3 (1.01, 5.88) | 3.024 (0.936, 9.763) | 0.052 |
| History of severe COPD |   |   |   |   |
|  No | 13465 (94.67, 98.01) | 273 (92.23, 1.99) | 1 |   |
|  Yes | 758 (5.33, 97.06) | 23 (7.77, 2.94) | 1.497 (0.972, 2.305) | 0.065 |
| History of ascites |   |   |   |   |
|  No | 14205 (99.87, 97.98) | 293 (98.99, 2.02) | 1 |   |
|  Yes | 18 (0.13, 85.71) | 3 (1.01, 14.29) | 8.08 (2.367, 27.581) | <0.001 |
| >10% unintentional loss of body weight in last 6 months |   |   |   |   |
|  No | 13875 (97.55, 97.99) | 284 (95.95, 2.01) | 1 |   |
|  Yes | 348 (2.45, 96.67) | 12 (4.05, 3.33) | 1.685 (0.936, 3.031) | 0.078 |
| Surgical Approach |   |   |   |   |
|  Laparoscopic | 9121 (64.1, 98.59) | 130 (43.9, 1.41) | 1 |   |
|  Open | 5102 (35.9, 96.85) | 166 (56.1, 3.15) | 2.283 (1.81, 2.879) | <0.001 |

**Table S3: Result of backwards-stepwise multivariable logistic regression**

|  |  |  |  |
| --- | --- | --- | --- |
| Step 12\* | P-Value | Odds Ratio | 95% C.I. for Odds Ratio |
|  |  |  | Lower | Upper |
| Age | 0.053 | 1.011 | 1 | 1.021 |
| BMI | 0.001 | 1.028 | 1.012 | 1.046 |
| Pre-Op Creatinine | 0 | 1.313 | 1.198 | 1.439 |
| Pre-Op BUN | 0 | 1.035 | 1.026 | 1.043 |
| Pre-Op HCT | 0 | 0.96 | 0.939 | 0.982 |
| Pre-Op Platelets | 0.002 | 0.998 | 0.996 | 0.999 |
| Gender (Ref = Male) | 0.007 | 0.69 | 0.528 | 0.903 |
| ASA Class (Ref =IV/V) | 0.009 |  |  |  |
| ASA Class (I) | 0.994 | 0 | 0 | . |
| ASA Class (II) | 0.001 | 0.462 | 0.289 | 0.738 |
| ASA Class (III) | 0.184 | 0.786 | 0.552 | 1.121 |
| Diabetes (Ref = No) | 0.066 | 1.282 | 0.983 | 1.671 |
| Hypertension requiring medication (Ref = No) | 0.012 | 1.541 | 1.098 | 2.163 |
| History of Stroke (Ref = No) | 0.004 | 2.509 | 1.338 | 4.702 |
| Surgical Approach (Ref = MIS) | 0 | 2.148 | 1.685 | 2.739 |
| Constant | 0 | 0.009 |  |  |

\*:Variable(s) entered on step 1: Age, BMI, Pre-Op Creatinine, Pre-Op BUN, Pre-Op HCT, Pre-Op Platelets, Pre-Op WBC, Gender, Race, ASA Class Combines, Bleeding disorders, Transfusion >4 units PRBCs in 72 hours before surgery, Diabetes YN, Hypertension requiring medication YN, Congestive heart failure (CHF) in 30 days before surgery YN, Previous cardiac surgery YN, CAD Hx, CVA Hx, PAD Hx, COPD Hx, ASCITES Hx, >10% loss body weight in last 6 months, Open vs Laparoscopic.

**Figure S1: Comparison of the ROC-AUC graphs of the backwards-stepwise and final regression models**



**Figure S2: Sample patient case using risk prediction calculator**



