

A preoperative nomogram to predict major complications after robot assisted partial nephrectomy

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OBJECTIVES

- To develop a preoperative multivariable decision-making tool to predict the occurrence of a major complication within 30-days of robotic partial nephrectomy.

PATIENTS AND METHODS

- We retrospectively reviewed the data of patients with clinically localized renal tumor who underwent RPN at seven academic medical centers between 2010 and 2017.
- Preoperative clinical, laboratory, radiological and comorbidity indices were collected.
- Complications occurring within 30-days of surgery were graded using the modified Clavien-Dindo scale.
- A multivariable logistic regression model was fitted to predict the risk of major complications after RPN.
- A nomogram was created from the multivariate model with internal validation using the bootstrapping technique.

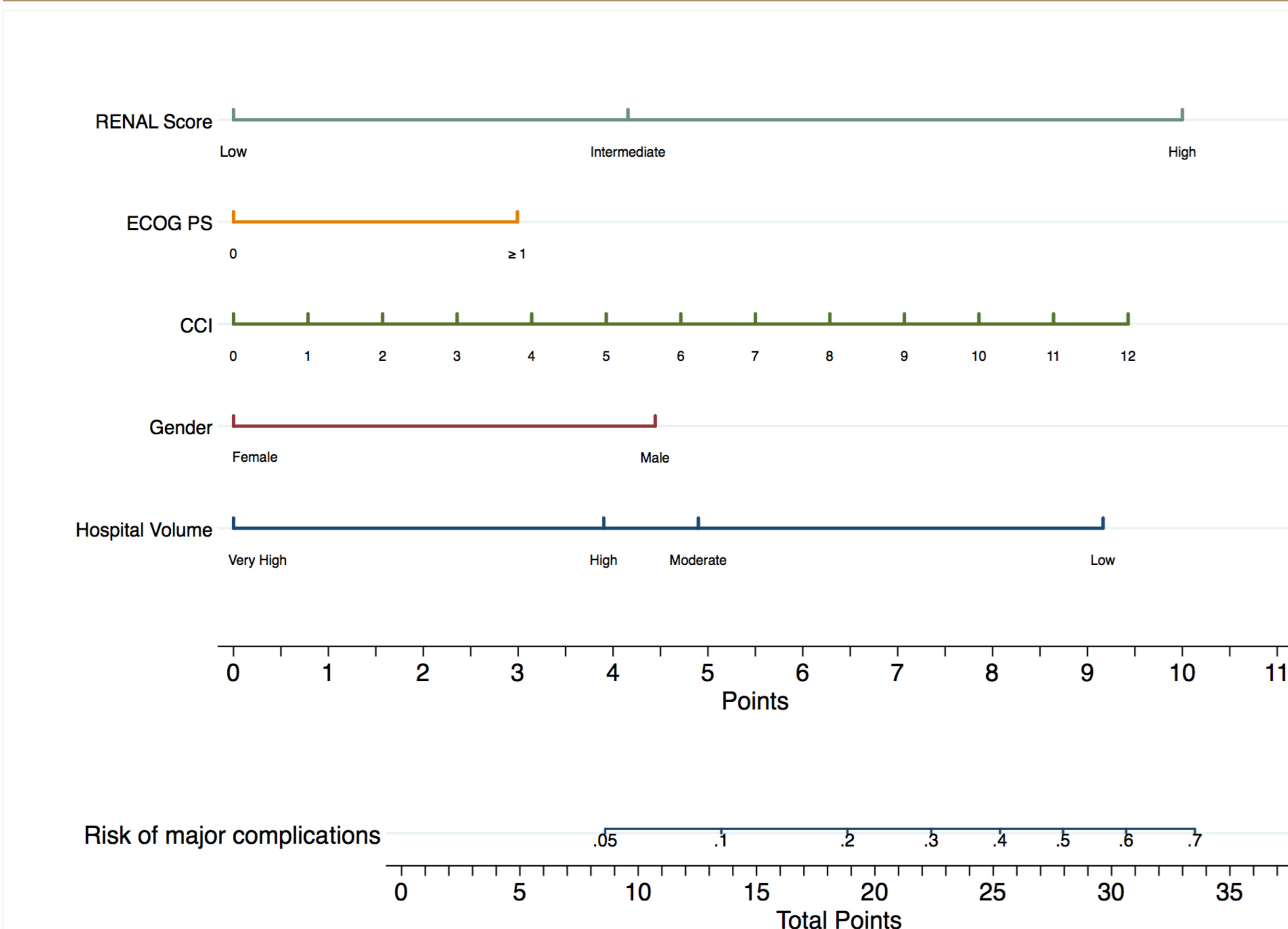
RESULTS

- 1342 patients were included.
- 326 patients (24%) had a complication including 189 (14%) \leq grade 2 and 137 (10%) \geq grade 3. There were 7 (1%) deaths within 30 days of RPN.
- In multivariate analysis, male gender, CCI, ECOG PS, hospital volume and RENAL score were significant predictors of major complications.
- The nomogram is shown in figure 1. For example, a man (4.4 pts) with an ECOG performance status of 1 (3 pts), CCI of 6 (4.7 pts), an intermediate tumor (4.2 points), and operated at a low volume hospital (9.2 pts) will have a total of 25.5 points which means a 40 % risk of major complication.

UNIVARIATE AND MULTIVARIATE ANALYSIS

Variables	Univariate Analysis			Multivariate Analysis		
	Odds Ratio	95% CI	P	Odds Ratio	95% CI	P
Age	0.99	0.98-1.01	0.74			
Gender	2.28	1.41-3.68	0.001	3.06	1.53-6.11	0.001
BMI	1.01	0.98-1.04	0.5			
CCI	1.15	1.05-1.25	0.001	1.19	1.05-1.34	0.005
ASA classification	1.39	0.89-2.18	0.14			
ECOG PS	2.08	1.39-3.14	<0.001	1.89	1.09-3.28	0.02
Anticoagulant treatments	0.87	0.58-1.31	0.503			
Tumor size	1.01	1-1.03	0.02	1	0.98-1.02	0.77
RENAL score						
Low						
Intermediate	1.84	1.15-2.93	0.01	2.06	1.07-3.98	0.03
High	4.49	2.64-7.65	<0.001	3.67	1.66-8.11	0.001
MAP score	1.13	0.98-1.31	0.08			
Hemoglobin	0.98	0.81-1.21	0.91			
eGFR preop	0.99	0.98-1.00	0.79			
Comorbidities						
Cardiovascular disease	1.58	1.03-2.61	0.05	1.03	0.54-1.97	0.91
Hypertension	1.28	0.85-1.94	0.23			
Diabetes	0.81	0.42-1.51	0.51			
History of smoking	1.42	0.91-2.22	0.11			
Hospital volume						
Low HV (<20/year)	Ref			Ref		
Moderate (20-44/years)	0.72	0.39-1.34	0.31	0.38	0.16-0.91	0.03
High HV (45-70/ years)	0.56	0.31-1.04	0.06	0.24	0.11-0.54	0.001
Very High HV (>70/year)	0.43	0.21-0.84	0.01	0.22	0.09-0.54	0.001

NOMOGRAM TO PREDICT MAJOR POSTOPERATIVE COMPLICATIONS



CHARACTERISTICS OF THE STUDY POPULATION

Variables		
Patient factors		
Age, median (IQR)	60	(50-67)
Gender, n (%)		
Male	875	(65.20)
Female	467	(34.80)
Comorbidities, n (%)		
Cardiovascular disease (%)	243	(18.11)
Hypertension	624	(46.50)
Diabetes	186	(13.86)
History of smoking	357	(26.60)
BMI, median (IQR)	28	(24-33)
ASA classification, n (%)		
1-2	984	(73.32)
3-4	358	(26.68)
ECOG, n (%)		
0	1028	(76.60)
≥ 1	314	(23.40)
Charlson's comorbidity index, median (IQR)	3	(2-5)
Previous abdominal surgery, n (%)	407	(30.33)
Anticoagulant/antiplatelet treatments, n (%)	390	(29.06)
Laboratory blood test		
Hemoglobin, median (IQR)	13.8	(12.6 -14.6)
Platelet, median (IQR)	221	(189-268)
eGFR preop, median (IQR)	86	(71-100)
White blood cells, median (IQR)	7.2	(6-9)
Radiographic characteristics		
Tumor size, median (IQR)	33	(20-47)
RENAL score, median (IQR)	7	(5-9)
RENAL score, n (%)		
Low	588	(43.82)
Intermediate	582	(43.37)
High	171	(12.74)
MAP score, median (IQR)	2	(0-4)
Hospital volume		
Low HV (<20/year)	164	(12.22)
Moderate (20-44/years)	352	(26.23)
High HV (45-70/ years)	503	(37.48)
Very High HV (>70/year)	323	(24.07)
Complications		
Overall complication, n (%)	326	(24.29)
Major complications, n (%)	137	(10.21)

CONCLUSIONS

- RENAL score, CCI, gender, ECOG PS and hospital volume were the most important predictive factors of major complications after RPN.
- We developed a nomogram based on these factors to identify patients with a high probability of major complications.
- We believe this nomogram can help treatment decision making and patient counseling.