The Microhematuria Nomogram: a simplified bladder cancer risk assessment tool

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Introduction and Objectives

Microhematuria (MH) is a common laboratory finding that can be a sign of occult GU malignancy. Currently, all patients with MH are recommended to undergo a cystoscopy and GU imaging. This is associated with low diagnosis rates at a high cost to the health system. **Identifying patients who are more likely to harbor pathology and focusing evaluation resources in a risk-stratified manner may reduce patient morbidity, lower costs, and improve diagnostic yield.**

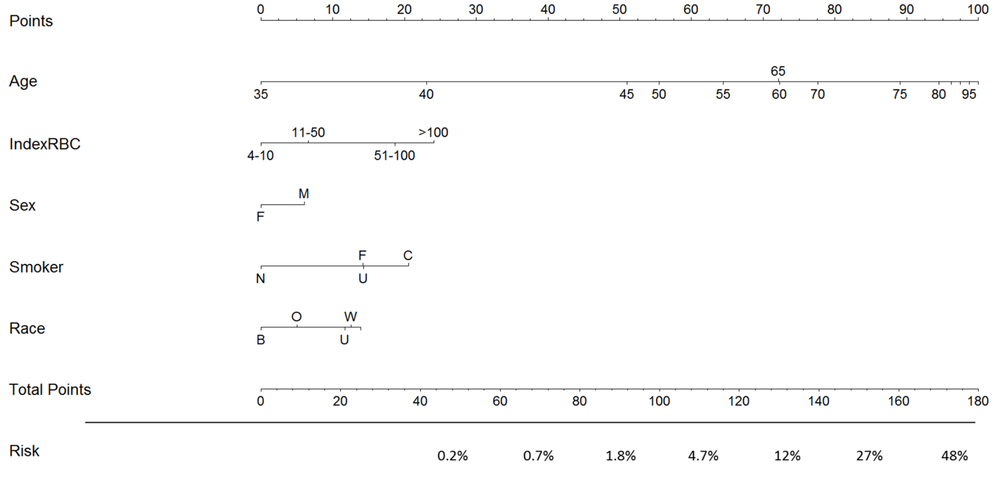
Methods

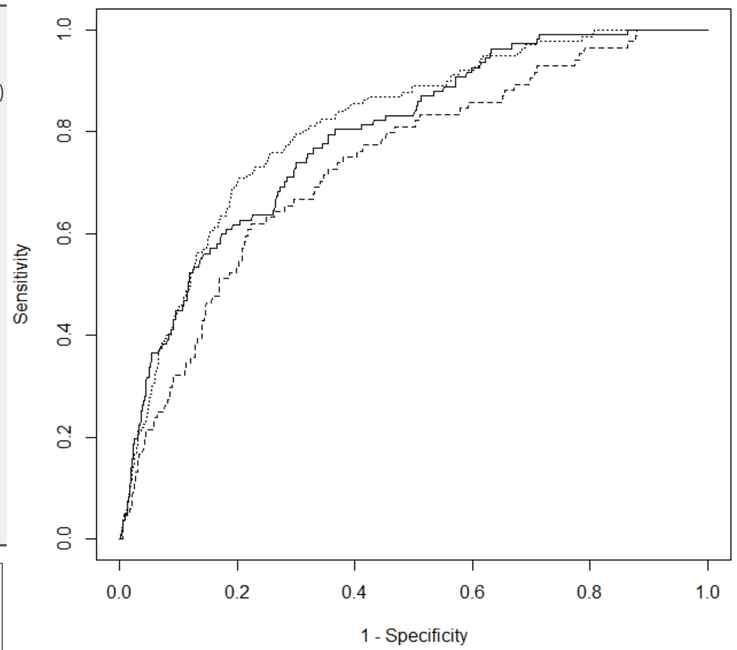
Using a multi-hospital data warehouse, all patients with a new diagnosis of MH were identified from 2010-2017. Separate training and validation cohorts were created via 1:1 randomization. The effects of clinical and demographic data on a bladder cancer diagnosis were evaluated via multivariate logistic regression to the training set and then fit to a validation set. Comparison of AUC values for each cohort was assessed with the chi-squared test. A nomogram predicting risk of a bladder cancer diagnosis was developed based on the training set of this model in patients who underwent a complete MH evaluation.

Results

		TRAINING SET, WORKED UP (N=2126)		VALIDATION SET, WORKED UP (N=2052)		VALIDATION SET, ALL PATIENTS (N=26053)	
		N	MEAN (SD)	N	MEAN(SD)	N	MEAN(SD)
Age in years		2126	58.8 (13.0)	2052	59.1 (13.1)	26053	56.79 (15.55)
		N	%	N	%	N	%
Sex	Female	1050	49.39	1064	51.85	16684	64.04
	Male	1076	50.61	988	48.15	9369	35.96
Race	White	1248	58.70	1196	58.28	14989	57.53
	Black	432	20.32	441	21.49	4858	18.65
	Asian	67	3.15	82	4.00	1061	4.07
	Other	230	10.82	205	9.99	2743	10.53
	Unknown	149	7.01	128	6.24	2402	9.22
Index UA (RBC/hpf)	4-10	587	27.61	556	27.10	6341	24.34
	11-50	949	44.64	885	43.13	14808	56.84
	51-100	133	6.26	142	6.92	1459	5.60
	>100	457	21.50	469	22.86	3445	13.22
Smoking status	Never	707	33.25	722	35.19	7767	29.81
	Former	438	20.60	415	20.22	3849	14.77
	Current	135	6.35	122	5.95	1128	4.33
	Unknown	846	39.79	793	38.65	13309	51.08
No Bladder Cancer		2019	94.97	1968	95.91	25916	99.47
Bladder Cancer		107	5.03	84	4.09	137	0.53

Risk Factor	Odds Ratio	95% Confidence Interval		p-value
Age in years	1.06	1.04	1.08	<.0001
Sex: male vs female	1.38	0.88	2.16	0.16
Index RBC 11-50 vs 4-10 RBC/hpf	1.37	0.76	2.47	0.29
Index RBC 51-100 vs 4-10 RBC/hpf	2.41	1.07	5.43	0.03
Index RBC >100 vs 4-10 RBC/hpf	3.28	1.93	5.57	<.0001
Smoking status: former vs never	2.06	1.13	3.77	0.019
Smoking status: current vs never	2.70	1.07	6.83	0.036
Smoking status: unknown vs never	2.05	1.17	3.60	0.01
Race: Black vs White	0.54	0.28	1.06	0.073
Race: Asian vs White	1.05	0.36	3.12	0.92
Race: Other vs White	0.70	0.34	1.46	0.34
Race: Unknown vs White	0.91	0.40	2.08	0.83





ROC for nomogram predictor of malignancy.

- Solid line = Training set, patients fully worked up, 2126 patients with 107 malignancies
- Dashed line = Validation set, patients fully worked up, 2052 patients with 84 malignancies
- Dotted line = Validation set, all patients, 26053 patients with 137 malignancies

Conclusions

A nomogram predicting risk of bladder cancer diagnosis in patients with a new diagnosis of microhematuria was created. After further validation, this may be used as a shared decision making tool in patients diagnosed with MH in deciding the risks and benefits of pursuing cystoscopy and GU imaging.

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