A Predictive Nomogram for Small Intestine Neuroendocrine Tumors (SI-NETs)

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BACKGROUND

- SI-NETs are concerning due to the poor survival with metastatic disease
- Prognostication is challenging due to inconsistencies in currently available grading and staging systems and none of the prognostic systems being developed are specific to the US population
- This study aimed to develop a SI-NET nomogram using US patients, that has a parsimonious inventory of routinely available prognostic factors

METHODS

- SI-NET patients diagnosed between 2004 and 2015 were selected from the SEER database
- Prognostic variable were selected: age, sex, race/ethnicity, tumor grade, primary tumor size, depth of invasion (T), regional lymph node (N) and distant metastasis (M)
- Parameter estimates of statistically significant variables in multivariate analysis were used to calculate nomogram scores
- Internal validation was performed using Cox regression and ROC analysis

RESULTS

- Of 2,734 patients, 2,050 was used for derivation of the nomogram and 684 for internal validation
- age ($p<0.0001$), primary tumor size >3 cm ($p=0.0022$), tumor grade ($p<0.0001$), depth of invasion ≥T3 ($p<0.0001$), and distant metastasis ($p=0.028$) were included in the nomogram
- The nomogram demonstrated high predictive accuracy during development (AUC 0.76) and during internal validation (AUC 0.75)
- Survival differences were seen between high risk (>32 points) vs low risk (<32 points) groups
- Each point increase in nomogram score doubled the hazard of death ($p<0.0001$)

CONCLUSIONS

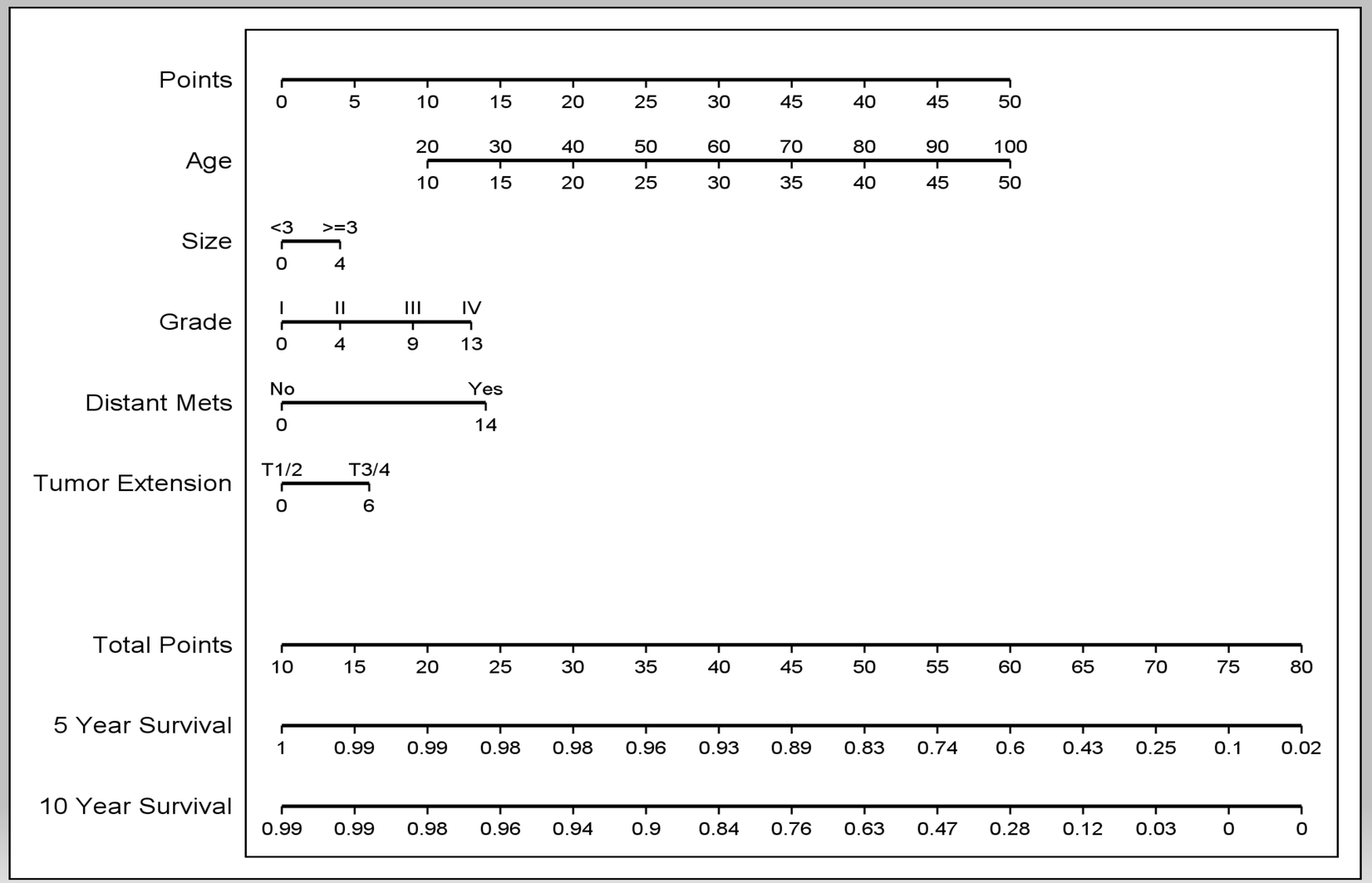
- This SEER nomogram has potential for wide-scale clinical utility given it contains a parsimonious list of routinely available prognostic factors and had high predictive accuracy during derivation and internal validation

RESULTS

Univariate Analysis	N (%)	P-value
Age at diagnosis (median, IQR)	62 (53-71)	**<0.0001**
Female	1314 (48%)	0.8
Race/Ethnicity		0.9
White	2099 (77%)	
Black	365 (13%)	
Hispanic	2.4 (8%)	
Other	56 (2%)	
Primary tumor size		**<0.0001**
< 3.0 cm	549 (20%)	
≥3.0 cm	2185 (80%)	
Tumor Extension		**<0.0001**
T1/2 (extension to and including the muscularis propria)	696 (26%)	
T3/4 (extension beyond the muscularis propria)	2038 (74%)	
Tumor Grade		**<0.0001**
G1	2132 (78%)	
G2	531 (19%)	
G3	55 (2%)	
G4	15 (1%)	
+ Regional Lymph Node	2015 (74%)	1.0
+ Distant Metastasis	736 (27%)	**<0.0001**

Multivariate Analysis	Hazard Ratio (HR)	P-value
Age at diagnosis	1.06/year	**<0.0001**
Primary tumor size		**<0.0001**
≥3.0 cm	1.56	**0.002**
Tumor Extension		**<0.0001**
T3/4	3.92	**<0.0001**
Tumor Grade		**<0.0001**
G1	Reference	
G2	1.48	
G3	2.49	
G4	3.69	
+ Distant Metastasis	1.58	**0.03**

SEER Nomogram:
Predicting Survival of Malignant SI-NETs after Surgical Resection



***T3/4**
Tumor extension beyond the muscularis propria