Clinical nomograms: Is a picture worth a thousand words?

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Central Message

A nomogram to determine the risk of invasive pulmonary adenocarcinoma in patients with solitary peripheral subsolid pulmonary nodules may help stratify patients beyond current guidelines.

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Nomograms are pictorial devices that synthesize biologic and clinical variables, both categorical and continuous, to determine the probability of a clinical event occurring in a given patient.¹ These models may provide benefit over TNM staging by avoiding the Halstedian assumption that anatomic disease progression always correlates with worse outcome. Rather, nomograms attempt to provide a finer risk stratification. Nomograms are visually simple but represent complex calculations and require careful development and application. The clinical question, study population, and experimental outcome are all imperative to produce a useful tool.

Asking a clinically relevant and important question is paramount to model development. For example, nomograms have been developed that query the risk of recurrence after sublobar resections, recurrence after tyrosine kinase inhibitor treatment, and risk of invasive pulmonary adenocarcinoma on the basis of imaging.²⁻⁷ Jin and colleagues⁸ have developed a nomogram to determine the risk of invasive pulmonary adenocarcinoma in patients with solitary, peripheral subsolid pulmonary nodules. This question is particularly relevant with the increase in computed tomography screening programs after publication of the National Lung Screening Trial.⁹ Because these lesions may represent invasive pulmonary adenocarcinoma, noninvasive disease, or a benign lesion, preoperative differentiation can prevent unnecessary interventions and change the operation performed.¹⁰ Jin and colleagues⁸ constructed a nomogram with computed tomography attenuation, size, spiculation, vascular convergence, pleural tags, and percentage of solid component. They have paired specific and clinically relevant outcome with clinical parameters and shown a correlation with invasive disease.

Nomogram validation is equally important. This validation is ideally external (performed on multiple, separate datasets) to demonstrate reliability for general implementation. However, many nomograms are internally validated because of insufficient patient numbers requiring

multiple iterations of the model applied over variable subsets of the same experimental population. This validation risks overfitting the data that limit the nomogram's generalizability. Jin and colleagues⁸ identified 293 patients and used an internal validation method. Despite the relatively small sample and internal validation, the variables used in this nomogram were similar to those in a larger, externally validated nomogram. She and colleagues¹¹ recently reported a nomogram with 898 cases split into a model development cohort and a validation cohort. This nomogram is not a true validation cohort of the nomogram reported by Jin and colleagues.⁸ The terminology is different, such as "speculation" as opposed to "uneasily differentiated margins" and "irregular shape." In addition, the findings of smoking status and solid component did differ between the models. Despite these relatively minor differences, the findings are similar, which suggests that both nomograms may be generalizable.

Is this nomogram clinically useful? Does it improve clinical decisions beyond current guidelines?¹² For patients with certain subsolid pulmonary nodules, continued surveillance, biopsy, and resection can be equally accepted options according to guideline parameters. In these situations, use of this nomogram may help with clinical decisions. Jin and colleagues⁸ are to be commended for asking a relevant question that can clarify a common clinical scenario. However, with lack of external validation and slight differences from other nomograms, caution should be applied to avoid overuse of this model.

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