

Is the predictive model for asthma development useful as a tool for diagnosing pediatric asthma

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Asthma is known to be underdiagnosed in 18%-75% of asthmatic children. Likewise, an overdiagnosis of asthma is commonly made.¹⁾ Among 80% of children with asthma develop before the age of 6, most of whom are under 3 years of age.²⁾ Young children who will ever develop asthma can benefit from both timely asthma diagnosis and preventive interventions for asthma, even if they may outgrow asthma later in life.³⁾ However, the diagnosis of asthma in preschool children has not yet been standardized, and it is seemingly difficult to perform some tests that are used when diagnosing asthma.⁴⁾ Most clinicians practically diagnose asthma at preschool age on the basis of subjective clinical aspects.

Asthma is nowadays understood as a heterogeneous disease or a complex syndrome with this being an umbrella term that indicates patients with the similar spectra of symptoms, but with a diverse or uncertain etiopathogenesis.⁵⁾ In this context, a diagnosis of asthma should depend on consensus achieved in the scientific community. Accordingly, such a consensus is usually embodied in the fashion of clinical practice guidelines (CPG), most of which (including Global Initiative for Asthma, GINA) are determined by a group of experts selected on a structured basis.⁴⁾ The Guidelines are mostly linked to the diagnosis of asthma in preschool children based on the repeated presence of compatible symptoms (several episodes of bronchial obstruction, preferably witnessed by a doctor), appropriate response to treatment and exclusion of other alternative diagnoses.⁴⁾

On the other hand, several predictive models have been developed to predict whether preschool children will have asthma at school age, such as the stringent and loose forms of the Asthma Predictive Index (API).^{6,7)} The API was developed 20 years ago by using data from the Tucson Children's Respiratory Study birth cohort and is currently applied partially in Korea and is used to predict asthma.⁷⁾ Otherwise, it is presumably necessary to examine

whether the API is useful or not when applied in Korea, since the API has been determined and evaluated by the standards of epidemiological studies in other countries.

Therefore, the study conducted by Lee *et al.*⁸⁾ published in the current issue reveals the association of current asthma with the API and other tests. It also verifies the diagnostic accuracy of the API.

This study showed that the questionnaire-based diagnosis of current asthma is fairly associated with the API, but neither with spirometry, airway hyperreactivity (AHR), fractional expiratory nitric oxide (FeNO), nor with atopic sensitization in preschool children.⁸⁾ This study seems to be limited by cross-sectional design and small number of current asthmatic patients. Also, AHR or atopic sensitization tests were performed in just a small number of asthmatic subjects, making it somehow difficult to draw rationale conclusions. However, as the authors suggested, asthma at preschool age may differ from that in late childhood or adult patients.

In this study, the loose and stringent APIs had high negative predictive values (NPVs) of 98.7% and 98.6%, respectively, but conversely low positive predictive values (PPVs) of 12.7% and 14.1%.⁸⁾ Comparing these results with those of the original study that showed the usefulness of the API, NPVs shown in the result of this study attained similar values; however, PPVs showed lower results.⁹⁾ In contrast, the API of this study showed higher sensitivity and specificity than those of the original study; therefore, it can be evaluated that it showed applicability to patients with recurrent wheezing.⁹⁾

Although predictive models for the development of childhood asthma have been designed to facilitate the diagnosis and prevention of asthma, the usefulness of predictive models for pediatric asthma remains unclear in clinical practice.¹⁰⁾ To be clinically valuable, such predictive models need high PPV and high sensitivity.⁶⁾ High PPV increases the likelihood

that a child with high predictive risk will actually develop asthma. High sensitivity allows the model to identify most children who will develop asthma in the future.^{6,10)} All predictive models developed to date have low PPVs or low sensitivity. Currently, such models cannot achieve sufficient accuracy for routine clinical use.¹⁰⁾ Nevertheless, the API is a simpler and less expensive tool to identify children at risk of asthma. It should be easy to apply, validated in different populations, and shown to improve patient outcome to be used by busy clinicians.⁷⁾

In conclusion, predictive models for the development of childhood asthma, for example API, are considerably helpful in the diagnosis and prevention of asthma, but may not be enough to replace the diagnostic process of childhood asthma. At present, predictive models for the development of asthma are valuable as a supportive role to clinical diagnosis based on guidelines. Through further researches, predictive models of asthma are supposed to be improved and it is necessary to conduct a prospective study applying the API or other predictive models of asthma in Korean preschoolers to confirm its effectiveness.

References

- 1) Nolte H, Nepper-Christensen S, Backer V. Unawareness and undertreatment of asthma and allergic rhinitis in a general population. *Respir Med* 2006;100:354-62.
- 2) Martinez FD. Development of wheezing disorders and asthma in preschool children. *Pediatrics* 2002;109:362-7.
- 3) Andersson M, Hedman L, Bjerg A, Forsberg B, Lundback B, Ronmark E. Remission and persistence of asthma followed from 7 to 19 years of age. *Pediatrics* 2013;132:e435-42.
- 4) Moral L, Vizmanos G, Torres-Borrego J, Praena-Crespo M, Tortajada-Girbes M, Pellegrini FJ, et al. Asthma diagnosis in infants and preschool children: a systematic review of clinical guidelines. *Allergol Immunopathol (Madr)* 2019;47:107-21.
- 5) Gauthier M, Ray A, Wenzel SE. Evolving Concepts of Asthma. *Am J Respir Crit Care Med* 2015;192:660-8.
- 6) Savenije OE, Kerkhof M, Koppelman GH, Postma DS. Predicting who will have asthma at school age among preschool children. *J Allergy Clin Immunol* 2012;130:325-31.
- 7) Castro-Rodriguez JA. The Asthma Predictive Index: a very useful tool for predicting asthma in young children. *J Allergy Clin Immunol* 2010;126:212-6.
- 8) Lee DH, Kwon J-W, Kim HY, Seo J-H, Kim H-B, Lee S-Y. Asthma Predictive Index as a useful diagnostic tool in preschool children: a cross-sectional study in Korea. *Korean J Pediatr* 2019;62.
- 9) Castro-Rodriguez JA, Holberg CJ, Wright AL, Martinez FD. A clinical index to define risk of asthma in young children with recurrent wheezing. *Am J Respir Crit Care Med* 2000;162:1403-6.

- 10) Luo G, Nkoy FL, Stone BL, Schmick D, Johnson MD. A systematic review of predictive models for asthma development in children. BMC Med Inform Decis Mak 2015;15:99.

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