



Toward Precision Migraine Care: Genetics, Symptoms, and Big-Data-Driven Approaches

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Migraine is an extremely common disease affecting approximately one billion people worldwide. Migraine-specific preventive treatments such as calcitonin gene-related peptide (CGRP) monoclonal antibodies, CGRP receptor antagonists, and the established botulinum toxin A therapy are now given higher priority than conventional treatments. However, delays in diagnosis and treatment remain substantial.¹ A deeper understanding of migraine is essential to improving patients' quality of life. The latest issue features in-depth research addressing multiple aspects of migraine.

One notable article is the systematic review “Genetic architecture of migraine: from broad insights to East Asian perspectives” by Kim and Chu.² According to this study, the estimated heritability of migraine ranges from 30% to 60%. This spectrum includes rare monogenic forms (*CACNA1A*, *ATP1A2*, *SCN1A*, *PRRT2*, *NOTCH3*, and *GLUT1*) as well as common polygenic migraine. Up to 181 migraine loci have been identified through genome-wide association studies. The molecular mechanisms underlying migraine pathogenesis may differ among ancestries. Genetic factors play a crucial role in migraine development, comparable in significance to hormonal influences.

As the saying goes, “if you don’t suspect it, you won’t find it.” Therefore, recognizing migraine-associated symptoms is essential, particularly when evaluating patients presenting with dizziness. A narrative review of vestibular

migraine estimated its annual prevalence at 1%–3%.³ For acute management, triptans may be considered in selected cases of vestibular migraine despite previous failed trials. A systematic review found valproic acid and flunarizine to be effective, while CGRP monoclonal antibodies have shown promising results in certain trials.

Additionally, what about prodromal symptoms? One study reported that 74.7% of migraineurs experienced at least one premonitory symptom.⁴ The most common were neck stiffness, followed by photophobia, fatigue, and phonophobia. These symptoms were often associated with cognitive impairment.

What further steps are needed for big data-based migraine research in the AI era to achieve valid conclusions? The article “Validity of migraine diagnoses in Korean National Health Insurance claims data” illustrates this potential. A retrospective review of the electronic medical records of 500 patients revealed that the positive predictive value (PPV) for a single claim was 74%. Accuracy increased markedly with three or more claims (PPV: 81.14%), particularly when combined with medication prescriptions (PPV: 94.96%; specificity: 85.37%).⁵

Precision medicine, incorporating machine learning and big data, may enable the prediction of individual treatment responses. For instance, beta blockers may be more effective in thin patients, whereas topiramate may be more effective in overweight individuals.⁶ A multifaceted,

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patient-tailored approach to migraine research, as emphasized in *Headache and Pain Research*, may open new horizons for both clinicians and investigators.

AVAILABILITY OF DATA AND MATERIAL

The data presented in this study are available upon reasonable request from the corresponding author.

AUTHOR CONTRIBUTIONS

Conceptualization: SJC; Writing–original draft: SJC; Writing–review & editing: SJC.

CONFLICT OF INTEREST

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