



Chia-Chun Chiang

Consultant and Assistant Professor of Neurology, Department of Neurology, Mayo Clinic, Rochester, Minnesota, USA; Visiting Scholar, Stanford University, California, USA; Faculty Member, Scientific Program Committee and Electronic Media Committee and Resident Education for Assessment and Care for Headache Program, American Headache Society; Representative of the Headache and Stroke Division, Neurology Artificial Intelligence Program, Mayo Clinic, Rochester, Minnesota, USA

Citation:

Neurol AMJ. 2024;1[1]:60-63.
<https://doi.org/10.33590/neurolamj/10300987>.

Q1 What, or who, inspired you to undertake a career in neurology?

My father, a dedicated neurosurgeon, played a significant role in my choice. He tirelessly shared stories of the lives he had saved, and the individuals he had helped through his work. My fascination with the intricate and enigmatic nervous system began at a young age. As a high school student, I had the opportunity to delve into neuroscience in a lab, particularly focusing on memory formation, which deeply intrigued me.

During my time in medical school, surrounded by various medical specialties, neurology emerged as the most compelling and intellectually stimulating field to me. My hospital rotations during clerkship and internship exposed me to the harsh realities of debilitating neurological diseases, but they also highlighted the potential for groundbreaking discoveries and advancements in the treatment of neurological conditions. The experiences solidified my unwavering determination to pursue a career in neurology.

Q2 You completed your medical degree and internship in Taiwan before moving to the USA for neurology training. What factors influenced your decision to practice in the USA?

I was born and raised in Taiwan, where I attended medical school at the National Yang Ming

University in Taipei. During this time, I immersed myself in research, guided by Arthur Chiou, and had the privilege to present my research findings at international conferences, where I won awards. Additionally, I had the opportunity to work at a bioengineering laboratory at University of California, San Diego, USA, under the mentorship of Shu Chien. This experience greatly resonated with me, and I found myself drawn to the vibrant research environment in the USA.

My aspiration had always been to pursue an academic career as a clinician-scientist, collaborating with some of the brightest minds worldwide. The prospect of working in the USA, which is renowned for its cutting-edge research and innovation, seemed like the ideal path to realize this ambition. Consequently, I made the decision to pursue my medical career in the USA.

Q3 You now specialize in managing headache in patients with vascular disorders. Could you discuss research updates exploring the association between migraine with aura, atrial fibrillation, and stroke risk?

Migraine, especially migraine with aura, is linked to approximately a two-fold increased risk of ischemic stroke. Additionally, research indicates an elevated risk of other cardiovascular conditions, such as myocardial infarction and atrial fibrillation, in individuals experiencing migraine with aura.

In females under the age of 50, migraine with aura is associated with a higher likelihood of experiencing ischemic stroke, and this risk is further exacerbated in individuals who smoke or use oral contraceptives. Onset of migraine with aura at the age of 50 years or older is associated with ischemic stroke occurring later in life. Furthermore, migraine with aura is linked to a greater risk of cardioembolic stroke, and a higher incidence of atrial fibrillation, when compared to migraine without aura. Various mechanisms, such as endothelial dysfunction, microembolism, paroxysmal embolism through a right-to-left shunt, a hypercoagulable state, and vasospasm, have been suggested as potential explanations for the connection between migraine with aura and stroke, and cardiovascular diseases. I have published a review article on this topic.¹

Q4 Another research focus of yours is the use of artificial intelligence (AI) to improve patient outcomes. Could you share the main areas in which you think AI can be utilized to optimize patient care in neurology?

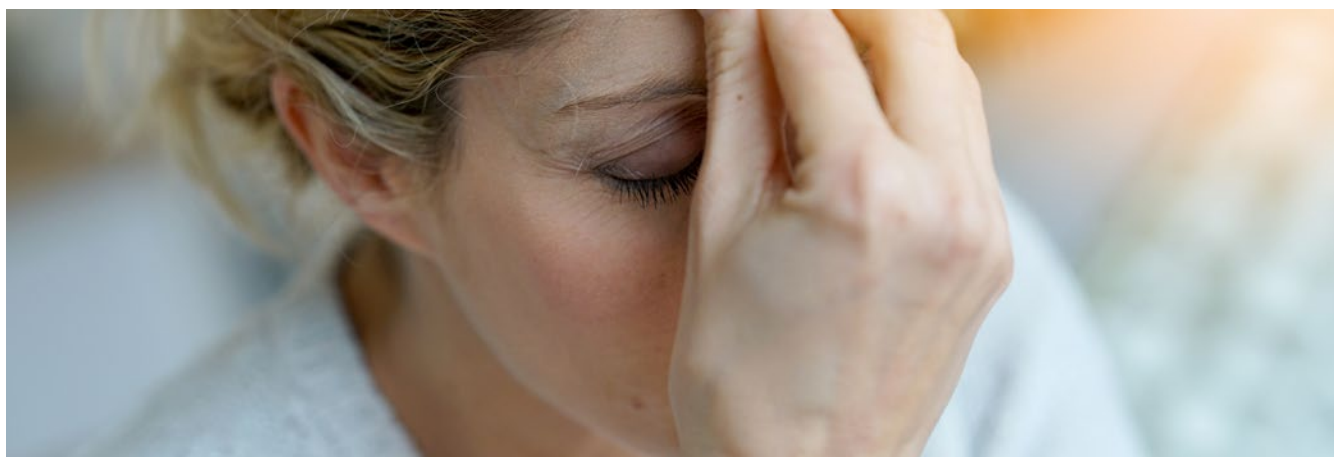
I believe that leveraging AI can offer significant benefits in optimizing patient care within the field of neurology, addressing various aspects of healthcare delivery. Taking the headache medicine field, for example, AI can enhance diagnostic precision; a study has shown that an AI algorithm can enhance diagnostic accuracy among non-headache specialists.² Given the high prevalence of migraine and other headache disorders, and the

limited number of headache specialists we have, such tools could empower patients to receive appropriate diagnoses, mitigate the burden of

"AI can offer significant benefits in optimizing patient care within the field of neurology."

severe headaches, and reduce the necessity for a referral to a neurologist.

AI can also help derive valuable insights from real-world patient data, for both clinicians and researchers. For example, we have leveraged big data from a smartphone electronic headache diary application, to compare the patient-reported treatment effectiveness of acute migraine medications.³ AI can improve the prediction of outcomes, like forecasting migraine attacks, predicting treatment responses, or predicting which patients with migraine would develop other comorbidities. Furthermore, AI can be applied to streamline clinical workflows. Since the emergence of large language models, like ChatGPT (OpenAI, San Francisco, California, USA), many researchers, including myself, have devoted time to how we could utilize these techniques to improve clinical workflow and research productivity. This includes using language models to extract essential information from electronic health records,⁴ improving efficiency for clinicians in gathering information,⁵ or exploring the potentials of using those tools to draft clinical notes and reduce the



time clinicians spend on documentation. Finally, in the realm of digital health, language models have the potential to significantly enhance access to care, particularly in regions where there is a scarcity of neurologists and headache specialists. By providing telemedicine support, these models can bridge geographical gaps, enabling patients to consult with experts remotely.

Q5 What do your roles as a Faculty Member for the Scientific Program Committee and Electronic Media Committee, and the Resident Education for Assessment and Care for Headache (REACH) Program at the American Headache Society (AHS) entail?

The AHS Scientific Program Committee plans and arranges details and logistics of the annual AHS scientific meeting. We plan out the meeting sections and contents, select speakers, review abstracts, and review the feedback from attendees. The Electronic Media Committee helps to raise awareness for migraine and other headache disorders on social media and the Internet. The REACH program helps the AHS faculty to deliver grand round presentations and resident educations to hospitals or healthcare institutions, where more headache education is desired.

Q6 In 2023, you presented at the American Academy of Neurology (AAN) Annual Meeting on the use of big data to study the efficacy of different migraine treatments. Are you attending the 2024 AAN Annual Meeting, and if so, what sessions are you most looking forward to?

Yes. I look forward to the 2024 AAN meeting, and cannot wait to hear about the updates from the plenary sessions, and research updates in headache and vascular neurology. I received the 2024 Harold Wolff–John Graham Award, and will be presenting a research study using AI to predict migraine attacks in the 2024 AAN Hot Topics in Headache section.

Q7 In 2022, you received the Early Career Award from the American Headache Society. What research did you receive this award for, and what were the key findings?

Using a cutting-edge AI-ECG algorithm in a comprehensive study, we have found that the atrial fibrillation (AF) prediction model output of those with migraine with aura was significantly higher than those with migraine without aura. This finding indicates a higher likelihood of concurrent paroxysmal or impending AF in individuals with migraine with aura, both among females and males. Our results underscore that migraine with aura serves as an independent risk factor for AF, particularly in patients under the age of 55 years. This implies that AF-related cardioembolism could be a key contributor to the connection between migraine and stroke for certain patients. The research also demonstrated how we could use modern computer technologies, like the AI algorithm, to study association between diseases, such as migraine and AF.

Q8 Do you feel there are any gaps in the current literature, or topics that warrant greater attention in headache and vascular disorder research?

Certainly, there are several areas within headache and vascular disorder research that could benefit from further exploration. Firstly, I believe there is a need for more in-depth investigation into the treatment of headaches in patients with vascular conditions. Specifically, we should delve into the risk-benefit profiles of various medications in this context. Currently, the risks associated with many migraine medications remain unclear, and it is equally important to establish a clearer understanding of their therapeutic benefits in this particular patient population.

Secondly, I would emphasize the importance of studying migraine aura in greater detail. This includes cases of aura occurring without the typical headache symptoms, and late-onset migraine aura. We should determine the criteria and guidelines for when to be concerned, and when to recommend vascular evaluations in



these scenarios. Additionally, understanding the optimal timing and approach to treatment for these specific migraine manifestations is crucial for improving patient care and outcomes in the field of headache and vascular disorder research.

Q9 You are involved in educating and training medical students, residents, and fellows. What are three pieces of advice you would suggest to students or younger clinicians aspiring towards a career in neurology?

Firstly, I would suggest a detail-oriented approach to history taking and examinations. In the realm of neurology, meticulous attention to detail is paramount when conducting patient interviews and physical examinations. Second, I would recommend persistence and perseverance. Neurology, and academic medicine overall, can be a challenging and intricate field. Like any other career path, a strong sense of persistence is important to pursue success. Finally, prioritization is key. While hard work is crucial, it is equally essential to work smart and prioritize. A career in academic neurology demands not only diligence, but also strategic decision-making. Prioritize your tasks, set clear

"Migraine with aura serves as an independent risk factor for AF."

goals, and focus on what truly resonates with your interests and career objectives.

Q10 As a clinician, researcher, and educator, where do you see your focus lying in the next 5 years?

In the coming 5 years, my primary focus will be on pioneering the integration of AI within the fields of headache medicine and vascular neurology. I aim to leverage AI technology to develop innovative tools that can deliver precision medicine to our patients, tailoring treatments and interventions to their unique needs and conditions. Additionally, I am committed to using AI to enhance patient access to care, especially for those in underserved areas who may not have easy access to specialized medical expertise. By combining my roles as a clinician, researcher, and educator, I aspire to contribute to the advancement of healthcare in these areas, and make a meaningful impact on patient outcomes and wellbeing. ●

References

- Chiang MC et al. Migraine with visual aura and the risk of stroke- a narrative review. *J Stroke Cerebrovasc Dis.* 2021;30(11):106067.
- Katsuki M et al. Developing an artificial intelligence-based headache diagnostic model and its utility for non-specialists' diagnostic accuracy. *Cephalalgia.* 2023;43(5):3331024231156925.
- Chiang CC et al. Simultaneous comparisons of 25 acute migraine medications based on 10 million users' self-reported records from a smartphone application. *Neurology.* 2023;101(24):e2560-e2570.
- Chiang CC et al. A large language model-based generative natural language processing framework finetuned on clinical notes accurately extracts headache frequency from electronic health records. *medRxiv.* 2023;10.1101/2023.10.02.23296403.
- Fleming SL et al. MedAlign: A clinician-generated dataset for instruction following with electronic medical records. *arXiv.* 2023;10.48550/arXiv.2308.14089.