Pacemaker implantation for treating migraine-like headache secondary to cardiac arrhythmia
A case report
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Abstract
Rationale: Co-occurrence of headache and arrhythmia is not rare. However, their causal relationship remains unclear. Here, we described a case of migraine-like headache relieving with pacemaker implantation. Our case study indicates that arrhythmia is causal for migraine-like headache, which, to our knowledge, has never been reported.

Patient concerns: A 63-year-old woman patient suffered from paroxysmal headache with a visual aura presenting like migraine for 2 years. No ophthalmic or neurological disorder was found, but cardiac examination detected bradycardia, which was confirmed by 24-hour dynamic electrocardiogram (DCG) revealing sinus bradycardia mixed with ventricular premature beats and supraventricular tachycardia. Transcranial doppler (TCD) detected an equal echo flat plaque on the anterolateral wall of the common carotid artery (CA) bifurcation.

Diagnosis: Migraine-like headaches secondary to arrhythmia.

Interventions: The patient underwent pacemaker implantation.

Outcomes: Both visual aura and headache were resolved following pacemaker implantation.

Lessons: To the best of the authors’ knowledge, we are the first to report migraine-like headache as a secondary symptom of arrhythmia. Arrhythmia may aggravate insufficient blood supply to the brain due to CA lesion and induce a migraine-like headache. This case study indicated that pacemaker implantation could be a fundamental treatment for migraine-like headaches caused by cardiac arrhythmia.

Abbreviations: CA = carotid artery, CHD = coronary heart disease, DCG = dynamic electrocardiogram, ECG = electrocardiogram, EEG = electroencephalogram, SCD = sudden cardiac death, SPB = supraventricular premature beats, SVT = supraventricular tachycardia, TCD = transcranial doppler.

Keywords: arrhythmia, bradycardia, cardiac cephalalgia, migraine-like headache

1. Introduction
Migraines are a common type of primary headache that manifest as serious headache attacks and can be accompanied by varied arrhythmias, including bradycardia, tachycardia, premature beats, and abnormal T waves.[1,2] Co-occurrence of migraine and arrhythmia is indicative of dysfunctional autonomic nerve pathogenesis.[3,4] Multiple clinical studies have investigated the underlying link between arrhythmia and headaches, especially migraines, but a causal relationship between migraine and cardiac arrhythmias has not yet been elucidated and there is no effective treatment for the condition.

Here, we described a case of migraine-like headache with a visual aura occurring after cardiac palpitation. A 24-hour dynamic electrocardiogram (DCG) showed sinus bradycardia mixed with ventricular premature and supraventricular tachycardia. Both visual aura and headache resolved following pacemaker implantation, indicating that migraine-like headaches are secondary to arrhythmias.

2. Case report
A 63-year-old woman was admitted with a 2-year long paroxysmal headache that had been aggravated for 1 week. There was no clear trigger for the headache, such as physical activity, but the patient did report having sleep deprivation and nervousness. The patient also reported a visual aura that lasted approximately 10 minutes and appeared in a zigzag ripple with a shiny and vague center zone, followed by a distending pain on the calvaria, approximately the size of a hen egg. The headache spread gradually through the whole head and exhibited medium
to severe (Visual Analog Scale 6–8) distending or throbbing pain, during which the patient had photophobia and phonophobia, and thus feared moving, resulting in having to stay in bed. After 10 minutes to 1 hour, the pain spontaneously remitted. These symptoms arose nearly once a week and, under most circumstances, palpitation existed ahead of visual disorder or headache and was resolved with pain mitigation. The patient had never visited the hospital and occasionally took ibuprofen for pain management. One week before consulting, headache occurred more frequently at a rate of 2 to 3 times a day, following cardiac

**Figure 1.** Electroencephalogram (EEG), electrocardiogram (ECG), and 24-hour dynamic electrocardiogram (DCG) before, 1 week, and 6 months after pacemaker implantation. Blue square indicates EEG feature before implantation showing numbers of θ wave at left temporal region with medium amplitude at a rate of 5 to 7 waves/s.
pulmonary edema every time. Feature, severity, and duration of the pain, as well as visual aura, were consistent with previously reports. The patient did not report having hypertension, diabetes, coronary heart disease (CHD), or physical activity elicited palpitation, chest tightness, and pain. No head trauma or addiction to smoking or alcohol was reported. The patient had no long-term exceptional medication history. The ocular, neurological, and the brain Magnetic Resonance Imaging (MRI) were unremarkable. Transcranial doppler (TCD) and ultrasound detected a 13.6 x 1.5 mm equal echo flat plaque on the anterolateral wall at the common carotid artery (CA) bifurcation. The spectrum in the right vertebral artery suggested a relatively high resistance of blood flow. Electroencephalogram (EEG) showed a 0 wave at the left temporal region with a medium amplitude at the rate of 5 to 7 waves/s (Fig. 1). Electrocardiogram (ECG) at the onset of headache indicated sinus bradycardia with heart rate (HR) of 45 beats/min (Fig. 1). DCG detected 12,883 supraventricular premature beats (SPB), 417 paired SPB, 136 SPB bigeminy, and 13 supraventricular tachycardia (SVT), mixed with paroxysmal atrial tachycardia and aberrant ventricular conduction. Moreover, frequent sinus arrest was recorded when palpitation occurred with the longest RR interval of 3960 seconds (Fig. 1). The TCD foaming test detected an innate minor right to left atrial shunt. Since the patient reported no history and presented no symptoms of angina, and neither ECG nor DCG showed evidence of myocardial ischemia, coronary angiography was not performed. Based on the following procedure, the patient underwent permanent pacemaker implantation. Under local anesthesia with 1% lidocaine, the left subclavian vein was punctured to insert 2 8F peelable sheath introducers, in which 2 guide wires were located. The sheath was advanced under the fluoroscopy to the inferior vena cava area, after which a small incision was made in the puncturing area where a subcutaneous pocket was created. Next, the guidewires were retracted, followed by lead insertion, which was advanced and attached to the right ventricular septum and the right atrial appendage. Afterwards, the sheath was removed. Following the sensing and pacing tests, the lead was sewn to the subcutaneous tissue and the generator was set to the pocket and connected to the lead. Finally, the incision was closed and ECG was monitored until normal pacemaker rhythm was achieved. One week after implantation, visual disorder and headache ceased and the EEG indicated less rate of 5 to 7 waves/s (Fig. 1). Electrocardiogram (ECG) at the onset of headache indicated sinus bradycardia with heart rate (HR) of 45 beats/min (Fig. 1). 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