

CMEARTICLE

All that quivers is not real: recognising pseudo-atrial flutter

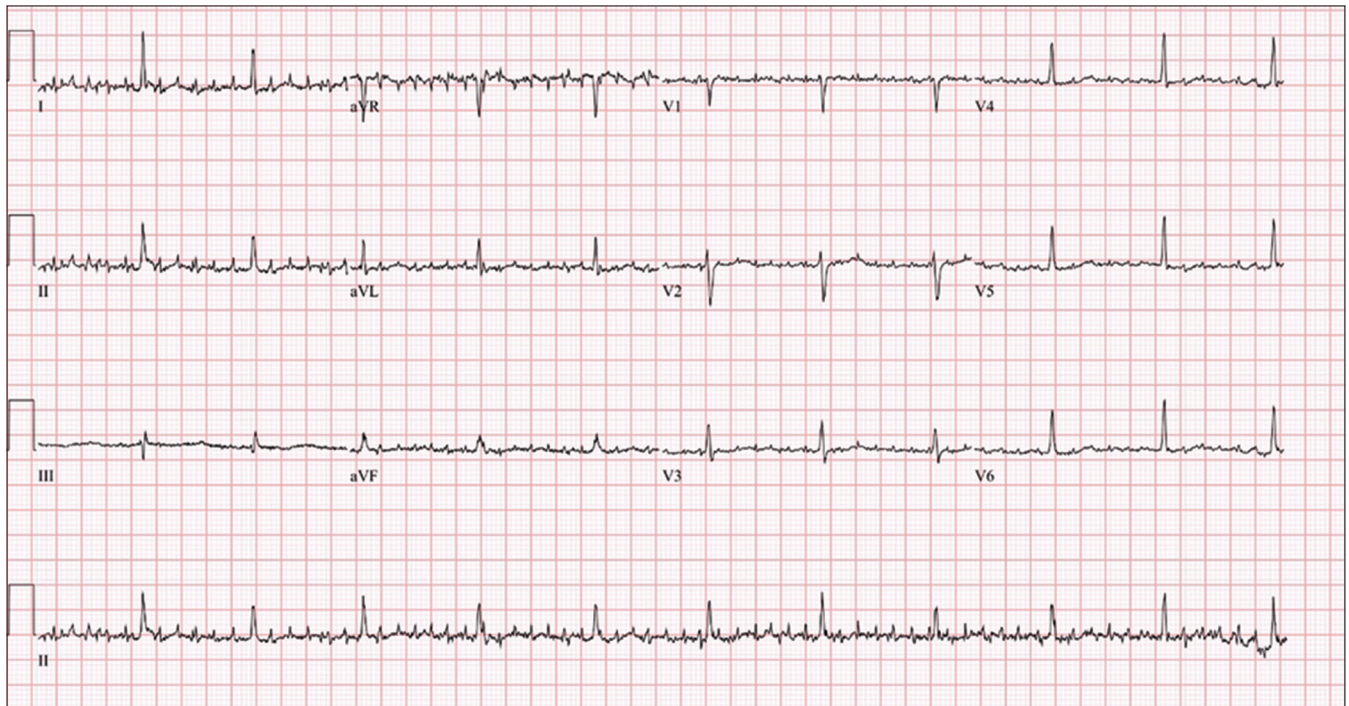
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Fig. 1 Case 1: ECG of the patient on arrival.

**CASE 1
CLINICAL PRESENTATION**

A 66-year-old woman with a past medical history of hypertension and left thalamic intracranial haemorrhage was reviewed in an outpatient clinic for persistent hypokalaemia with serum potassium levels of 2.8–2.9 mmol/L over a six-month period. Her family members reported that she was experiencing increasing lethargy. Physical examination showed a minimally communicative patient with the right arm contracted, increased tone and no right lower limb movement. An electrocardiogram (ECG) was obtained (Fig. 1) to look for electrophysiological changes of hypokalaemia. What does the ECG show?

ECG INTERPRETATION

The ECG in Fig. 1 shows regular narrow QRS complexes with irregular high-frequency sharp spikes of irregular amplitudes and morphologies at 500/min (8 Hz). These were dissociated with QRS complexes. These spikes were not typical of atrial

activity and were more likely related to muscle tremors, which have a typical frequency of 3–12 Hz. Despite the absence of classic hypokalaemia ECG features, this ECG appearance was related to artefacts from tremor that were probably related to the hypokalaemia. Other causes for tremors such as hyperthyroidism were excluded. The patient was not known to have essential tremor.

CLINICAL COURSE

As the ECG revealed a diagnosis of atrial flutter (AFL), the patient was referred to the cardiology department. A repeat ECG after replacement of potassium demonstrated normal sinus rhythm with fewer movement artefacts.

**CASE 2
CLINICAL PRESENTATION**

A 60-year-old Indian woman presented to the emergency department after a fall. She had a six-month history of right-sided resting hand tremors. Physical examination revealed

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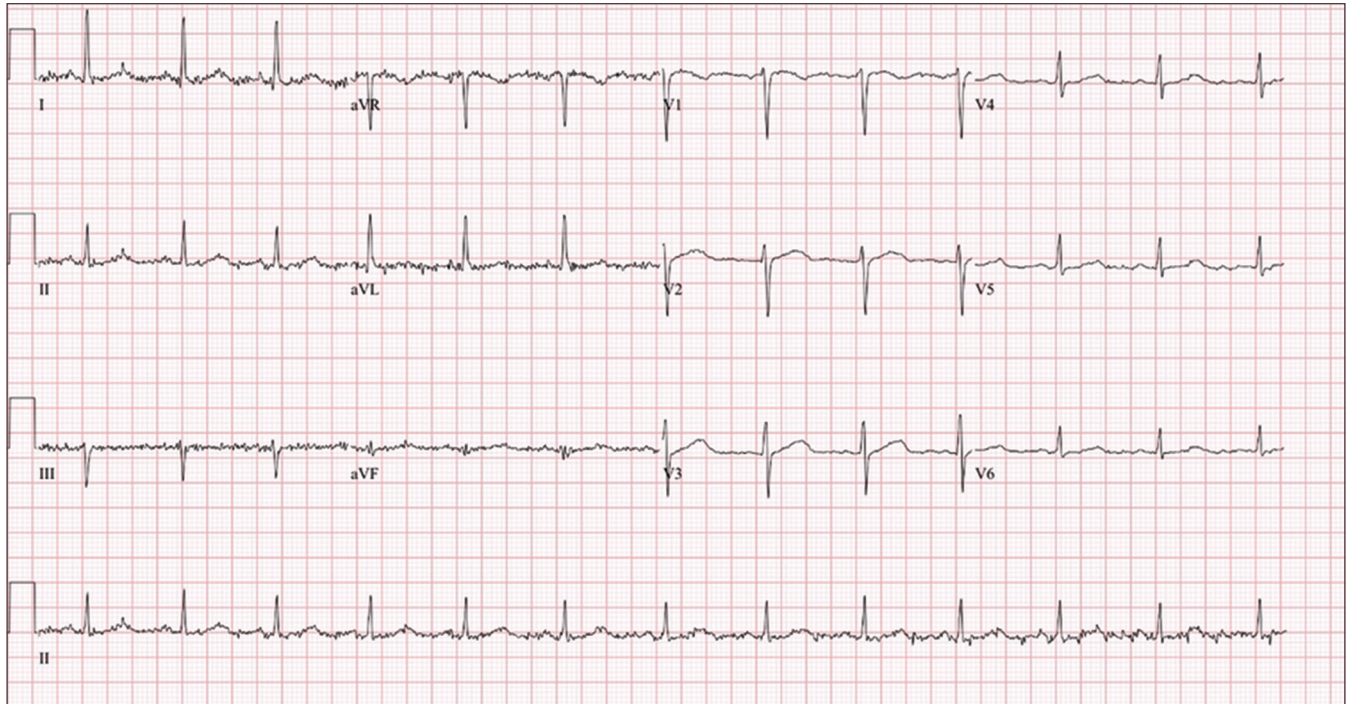


Fig. 2 Case 2: ECG of the patient on arrival.

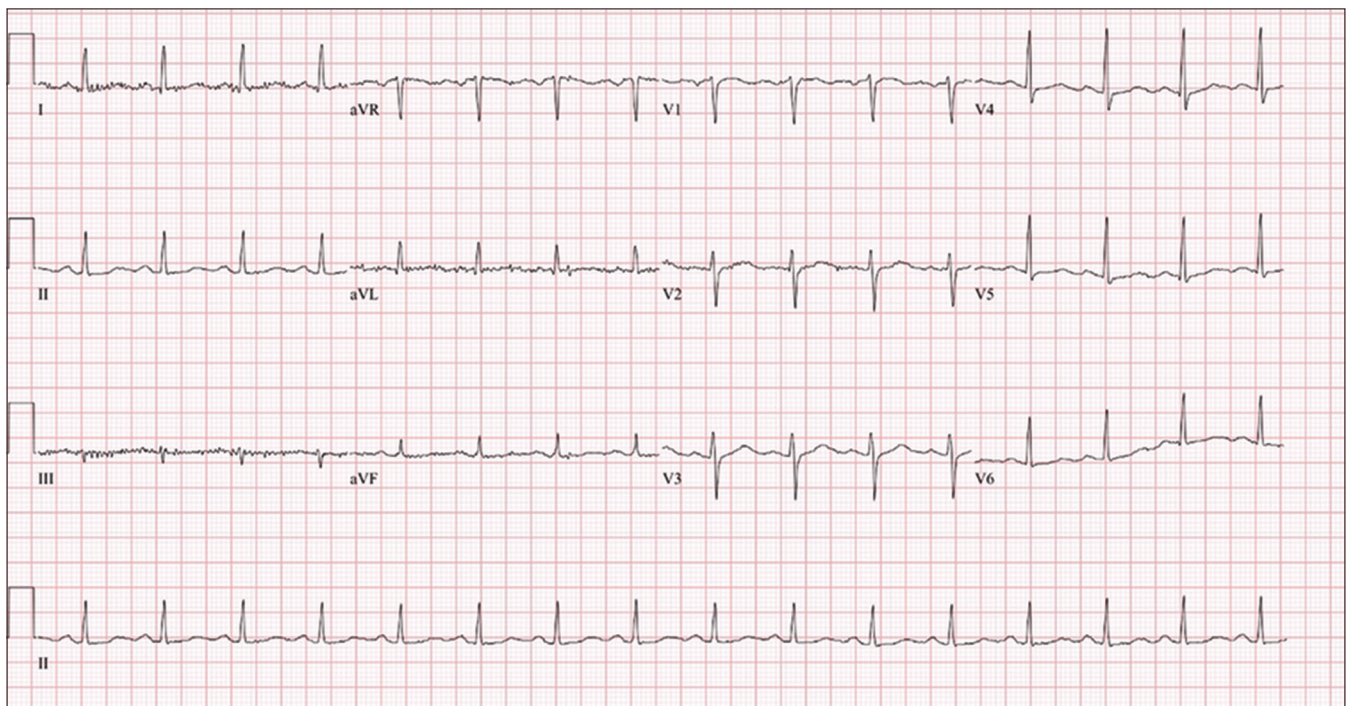


Fig. 3 Case 2: Repeat ECG shows resolution of artefacts.

right-sided coarse resting tremors with bradykinesia. An ECG (Fig. 2) was obtained to screen for cardiac rhythm disorders that could have contributed to the fall. What does the ECG show?

ECG INTERPRETATION

The ECG in Fig. 2 shows regular narrow QRS complexes with baseline spikes that do not resemble sinus p waves. These baseline spikes are seen more prominently in the limb leads. The computer interpretation of the ECG reported AFL.

CLINICAL COURSE

The patient was admitted to further evaluate the cause of her fall. An inpatient neurology review diagnosed Parkinsonism, and she was started on a dopamine agonist. Her tremor markedly improved upon initiation. A repeat ECG (Fig. 3) subsequently revealed resolution of the artefacts that had been contributed by muscle tremors.

DISCUSSION

Movement artefacts in movement disorders resulting in mimics of arrhythmia have been well described in Parkinson's disease

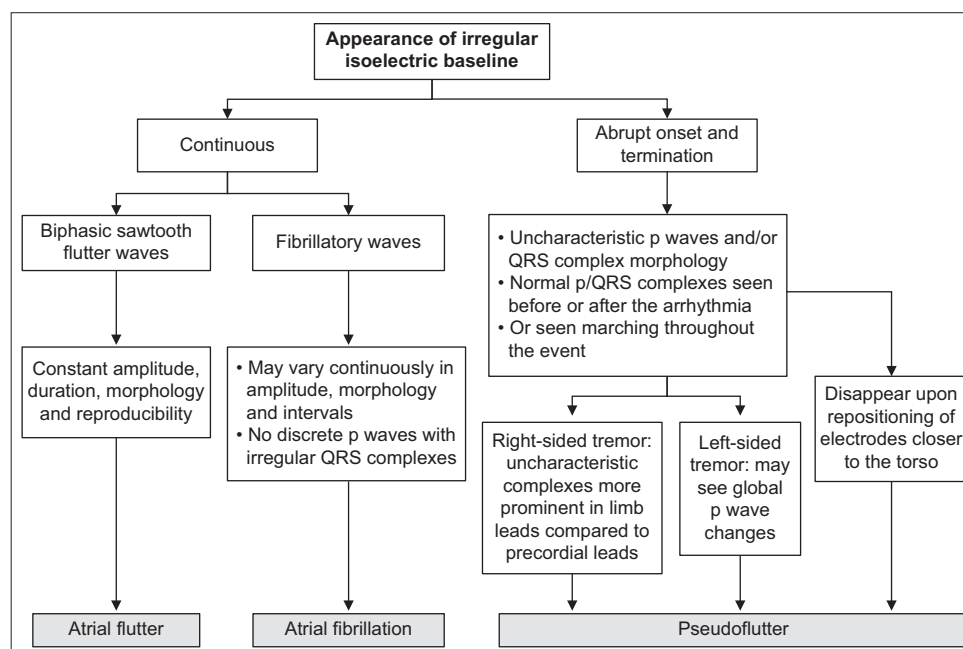


Fig. 4 Flowchart shows an algorithm to distinguish a pseudoflutter from true atrial fibrillation or atrial flutter.

(PD). A Parkinsonian tremor has a high probability of causing artefacts, and tremors with sufficient amplitude can lead to a misinterpretation of AFL, atrial fibrillation (AF) or even ventricular tachycardia (VT), as compared to those without.^(1,2) The tremor in PD is 5–6 Hz, which translates to 300–360 cycles per minute, similar to the frequency at which a pseudoflutter can appear on an ECG. Hence, computer ECG interpretation may not be able to differentiate artefacts, with a tendency to misinterpret these artefacts as AFL.

Misinterpretation of artefactual ECGs as AF or AFL may lead to serious medical omissions and errors. Firstly, this may result in undertreatment of the precipitating neurological movement disorder or severe metabolic disturbance. Secondly, it can lead to unnecessary investigations such as echocardiography or overtreatment with anticoagulation for cardioembolic stroke prophylaxis.⁽³⁾ For patients with suspected VT, this may include unnecessary intravenous infusions, cardioversions, electrophysiological studies and implantation of devices.⁽⁴⁾ This highlights the importance of correct identification of a suspected arrhythmia.

Various factors that can help to distinguish a pseudo-AFL from a true arrhythmia should be considered. Firstly, artefacts would be observed during periods of tremulousness (e.g. from shivering or seizure), with an abrupt onset during the tremor and termination when the tremor ceases.⁽⁴⁾ Secondly, p waves may have uncharacteristic p wave and QRS complex morphologies with sharp contours. Normal complexes may also be seen before

and after these periods of artefactual changes on ECG. Having a keen eye is useful in recognising these normal complexes that march in and out throughout the event. Thirdly, repositioning electrodes closer to the torso may help to minimise interference to the isoelectric baseline from limb movements. In a similar vein, we may notice that these artefactual changes are more prominent in limb leads than in precordial leads.⁽¹⁾ This can be appreciated in the ECGs of both Cases 1 and 2. However, one caveat is that in left-sided tremors, a prominent precordial flutter wave may be seen on the ECG, resulting in global p wave changes. It is suggested that this may be attributable to left limbs forming the negative composite pole of the precordial ECG waveform.⁽⁵⁾ This serves as a reminder that ECGs should always be interpreted within the clinical context. The algorithm in Fig. 4 summarises the stepwise approach to distinguishing a pseudo-AF/AFL from a true AF/AFL.

REFERENCES

1. Hwang WJ, Chen JY, Sung PS, Lee JC. Parkinsonian tremor-induced electrocardiographic artifacts mimicking atrial flutter/fibrillation or ventricular tachycardia. *Int J Cardiol* 2014; 173:597-600.
2. Baranchuk A, Kang J. Pseudo-atrial flutter: Parkinson tremor. *Cardiol J* 2009; 16:373-4.
3. Finsterer J, Stöllberger C, Gatterer E. Oral anticoagulation for ECG tremor artefact simulating atrial fibrillation. *Acta Cardiol* 2003; 58:425-9.
4. Knight BP, Pelosi F, Michaud GF, Strickberger SA, Morady F. Clinical consequences of electrocardiographic artifact mimicking ventricular tachycardia. *N Engl J Med* 1999; 341:1270-4.
5. Nam MCY, Best L, Greaves K, Dayananda N. Global pseudo-atrial flutter ECG appearance secondary to unilateral parkinsonian tremor. *BMC Case Rep* 2016; 2016:bcr2015214048.

SINGAPORE MEDICAL COUNCIL CATEGORY 3B CME PROGRAMME

(Code SMJ 202204B)

Question 1. These can produce pseudo-arrhythmias:

- (a) Parkinson's tremor
- (b) Convulsive seizures
- (c) Shivering
- (d) Hypernatraemia

True	False
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Question 2. Regarding the Parkinsonian tremor on an electrocardiogram (ECG):

- (a) It has a similar frequency to atrial flutter.
- (b) It may be misinterpreted as atrial fibrillation.
- (c) It may be misinterpreted as atrial flutter.
- (d) It cannot be misinterpreted as ventricular tachycardia.

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Question 3. Regarding misinterpretation of artefactual ECG changes for true arrhythmias:

- (a) It may result in undertreatment of the precipitating cause.
- (b) It is not harmful.
- (c) It may lead to additional investigations and treatments.
- (d) It can result in the mistaken placement of an implantable cardioverter-defibrillator.

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Question 4. Regarding how to distinguish pseudo-arrhythmias:

- (a) Pseudo-arrhythmias have characteristic p waves/QRS complexes that help to distinguish them from true arrhythmias.
- (b) Pseudo-arrhythmias have normal complexes marching throughout the event.
- (c) Repositioning of electrodes can help to reduce the effect of pseudo-arrhythmias seen on ECGs.
- (d) Tremors may cause continuous global p wave changes.

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Question 5. Regarding the common pitfalls of ECG interpretation:

- (a) Computer ECG diagnosis differentiates artefacts easily.
- (b) Computer ECG diagnosis may misinterpret tremors as AFL if the tremors are of a similar frequency as pseudo-flutter.
- (c) Incorrect calibration along the vertical scale can lead to concerns over ST elevation myocardial infarction.
- (d) Artefacts can be minimised by optimising lead placements closer to the torso.

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Doctor's particulars:

Name in full: _____ MCR no.: _____
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SUBMISSION INSTRUCTIONS:

Visit the SMJ website: <http://www.smj.org.sg/current-issue> and select the appropriate quiz. You will be redirected to the SMA login page.

For SMA member: (1) Log in with your username and password (if you do not know your password, please click on 'Forgot your password?'). (2) Select your answers for each quiz and click 'Submit'.

For non-SMA member: (1) Create an SMJ CME account or log in with your SMJ CME username and password (for returning users). (2) Make payment of SGD 21.40 (inclusive of 7% GST) via PayPal to access this month's quizzes. (3) Select your answers for each quiz and click 'Submit'.

RESULTS:

(1) Answers will be published online in the SMJ June 2022 issue. (2) The MCR numbers of successful candidates will be posted online at the SMJ website by 30 June 2022. (3) Passing mark is 60%. No mark will be deducted for incorrect answers. (4) The SMJ editorial office will submit the list of successful candidates to the Singapore Medical Council. (5) One CME point is awarded for successful candidates. (6) SMC credits CME points according to the month of publication of the CME article (i.e. points awarded for a quiz published in the December 2021 issue will be credited for the month of December 2021, even if the deadline is in February 2022).

Deadline for submission (April 2022 SMJ 3B CME programme): 12 noon, 23 June 2022.