

# Atrial Flutter With right ventricular pacing-Induced 1/1 Atrioventricular Conduction: A Case Report

## Flutter atrial avec une conduction atrioventriculaire en 1/1 induit par une stimulation ventriculaire droite : A propos d'un cas

Mariam Jabeur, Rania Gargouri, Amine Bahloul, Tarek Ellouze, Faten Triki, Selma Charfeddine, Leila Abid.

*HEDI CHAKER University Hospital of SFAX, Department of Cardiology*

### SUMMARY

Typical atrial flutter is a common atrial tachyarrhythmia. Symptoms are typically related to the rate of ventricular response. Although atrial flutter with 1/1 atrioventricular conduction is rare, it is important to recognize because it may precipitate rapid hemodynamic compromise. We present a case of right ventricular (RV) pacing-induced 1/1 atrioventricular conduction in a patient with typical atrial flutter.

### KEYWORDS

Atrial Flutter,  
Pacemaker,  
atrioventricular  
conduction

### RÉSUMÉ

Le flutter atrial typique est une tachycardie supraventriculaire fréquente. Les symptômes sont généralement liés à la fréquence ventriculaire. Bien que le flutter atrial avec conduction atrio-ventriculaire en 1/1 soit rare, il est important de le reconnaître car il peut provoquer rapidement un état de choc cardiogénique. Nous présentons un cas d'une conduction atrio-ventriculaire en 1/1 induite par la stimulation ventriculaire droite chez un patient présentant un flutter atrial typique.

### MOTS-CLÉS

Flutter atrial,  
Pacemaker,  
Conduction  
atrio-ventriculaire

### Correspondance

Mariam Jabeur, MD  
Department of Cardiology  
HEDI CHAKER University Hospital, Sfax  
Mariemjabeur2@gmail.com

## INTRODUCTION

Le bloc de branche gauche complet (BBGC) est responsable d'une désynchronisation électromécanique ventriculaire gauche qui peut déclencher un cercle vicieux avec un remodelage structurel progressif, un dysfonctionnement systolique et l'installation progressive par la suite d'une insuffisance cardiaque (1-4). L'étude du strain longitudinal (SL) par 2D Speckle Tracking présente une alternative adéquate dans l'analyse échographique afin d'estimer le degré de remodelage induit par le BBGC lui-même (5-7).

L'identification des modèles de déformation septale joue un rôle important dans la prédiction de la réponse à une thérapie de resynchronisation cardiaque (CRT) (8). Néanmoins, ces mesures écho cardiographiques sont encore en cours d'étude et ne sont pas encore validées dans la sélection des patients candidats à une CRT au-delà des recommandations actuelles (9).

L'objectif de ce travail était d'étudier les profils du strain longitudinal ventriculaire gauche dans une population de patients ayant un BBGC.

## CASE REPORT

A 67-year-old man with a history of dual chamber pacemaker for sinus dysfunction in 2020 and typical atrial flutter ablation in 2022; was admitted to the hospital with chest pain and tiredness. His comorbidities included hypertension and hyperlipidemia. His current medications included Apixaban 5mg\*2/day, Telmisartan 80mg/day, Rosuvastatine 10mg/day.

His symptoms started 3 weeks ago.

The diagnosis of typical atrial flutter with a rapid ventricular response (ventricular rate, 130 beats/min). He denied noticing any palpitations and also denied a history of syncope. The patient was hemodynamically stable. His electrocardiogram showed a 1/1 atrioventricular conduction of the atrial flutter with a ventricular rate of 250 beats/min (Figure 1).

The pacemaker control found in the records the beginning of the episode: atrial flutter, RV pacing following the rapid atrium which triggered a 1/1 atrial flutter (Figure 2).

A transthoracic echocardiogram showed a reduced ejection fraction of 35% to 40%. Ventricular rate control (Figure 3) was achieved by intravenous amiodarone 300mg. A coronary angiogram showed a no significant lesion. In the absence of any new obstructive lesion, the reduced ejection fraction was thought to be due to tachycardia-induced cardiomyopathy,

given the persistent atrial flutter and elevated ventricular rates. The patient underwent typical atrial flutter ablation 2 weeks after initial presentation. The atrial flutter ablation was successful. He was discharged the next day.



Figure 1. A 1/1 atrioventricular conduction flutter with a ventricular rate of 250 beats/min

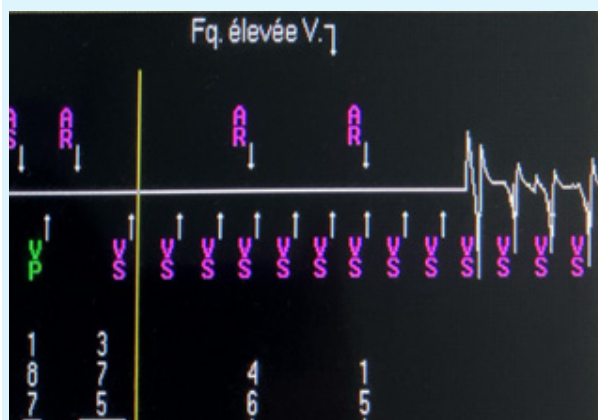


Figure 2. Atrial Flutter With right ventricular pacing-Induced 1/1 Atrioventricular Conduction

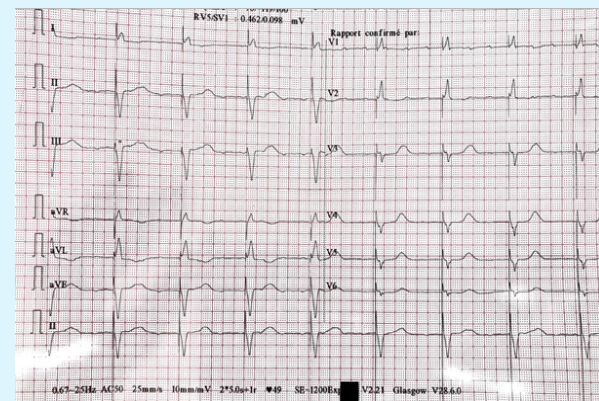


Figure 3. Ventricular rate control was achieved after administrating amiodarone

## DISCUSSION

Typical atrial flutter is a macroreentrant rhythm in the right atrium, with an atrial rate between 250 and 350 beats/min. (2) Its circuit involves the cavotricuspid isthmus, with the arrhythmia often being termed cavotricuspid isthmus-dependent atrial flutter. This condition

can degenerate into atrial fibrillation and can revert to sinus rhythm within hours or days. (4)

Management of atrial flutter is similar to that of atrial fibrillation in terms of symptom management, ventricular rate control, stroke prevention, and consideration for restoration of sinus rhythm. Ventricular rate control is often more difficult to achieve with atrial flutter than with atrial fibrillation. (5)

Atrial flutter with 1/1 conduction occurs when every atrial impulse is conducted through the atrioventricular (AV) node to the ventricles, resulting in a very fast ventricular rate. This is a more dangerous and uncommon presentation of atrial flutter, as the ventricular rate can approach 250-350 beats per minute, leading to hemodynamic instability.

Several factors can cause or contribute to 1/1 AV conduction in atrial flutter:

### Increased AV nodal conduction

- Sympathetic stimulation (e.g., stress, exercise, anxiety) can enhance AV nodal conduction, allowing more atrial impulses to pass through to the ventricles.
- Medications like catecholamines (e.g., dopamine, dobutamine) can increase AV conduction, facilitating 1/1 conduction.

### IA or IC antiarrhythmic drug

Atrial flutter with 1/1 atrioventricular conduction has commonly been described in the setting of class IA or IC antiarrhythmic drug therapy, as these medications are known to slow the atrial flutter rate and, thereby, increase the potential for 1/1 conduction through the atrioventricular node (3).

### Pacemaker influence

Right ventricular pacing, such in this case, or certain pacemaker settings can inadvertently promote 1/1 conduction by synchronizing atrial and ventricular contractions or enhancing AV node conduction.

### AV nodal bypass tracts

Accessory pathways, as seen in Wolff-Parkinson-White (WPW) syndrome, can allow rapid conduction of atrial impulses to the ventricles, bypassing the natural delay of the AV node, and result in 1/1 conduction.

### Hyperthyroidism

Increased thyroid hormone levels can cause the heart to beat faster and enhance AV nodal conduction, increasing the risk of 1/1 conduction during atrial flutter.

### Withdrawal of AV nodal blocking medications

Sudden cessation of drugs like beta-blockers, calcium channel blockers, or digoxin, which slow AV nodal conduction, can lead to rapid conduction and 1/1 AV conduction.

### Cardiac conditions

Underlying heart conditions, such as structural heart disease, can alter the electrical conduction system of the heart, potentially leading to 1/1 AV conduction during atrial flutter.

Atrial flutter is a potential cause of presyncope and syncope and can precipitate hemodynamic compromise quickly if it sustains, (6) especially in patients with a reduced ejection fraction. (7) During exercise, there is an increase in atrial flutter cycle length, a withdrawal of vagal tone, and an increase in sympathetic activation that facilitate atrioventricular nodal conduction. (8) (9)

One-to-one atrioventricular conduction is more likely to occur when atrial rates are less than 250 beats/min. (10)

In the current case, the patient transitioned to 1/1 atrioventricular conduction with a ventricular rate of 250 beats/min after rapid RV pacing. In instances in which 1/1 atrioventricular conduction develops; initial management should focus on gaining rate or rhythm control to maintain hemodynamic stability and reduce symptoms.

1/1 conduction in atrial flutter is dangerous because it can lead to dangerously high heart rates, reduced cardiac output, and potentially life-threatening arrhythmias. Immediate intervention, such as medications to slow the AV node, cardioversion, or adjusting pacemaker settings, is often required.

Synchronized direct-current cardioversion must be considered for immediate rhythm control in a hemodynamically unstable patient. Long-term options for ventricular rate control include beta blockers,

nondihydropyridine calcium channel blockers, digoxin, and amiodarone hydrochloride. Esmolol is often the preferred beta blocker because of its rapid onset and offset and because it is easily titratable. Nondihydropyridine calcium channel blockers, such as diltiazem, can be used for ventricular rate control as well; however, these medications must be used with caution if the ejection fraction is reduced, as they may precipitate heart failure. (9)

Digoxin works by enhancing parasympathetic tone and, thus, would be only minimally effective for ventricular rate control in the setting of exercise when sympathetic tone predominates. Amiodarone has a beta-blocking effect and can be used for ventricular rate control acutely; however, it has a long-term adverse effect profile and can precipitate restoration of sinus rhythm. (9)

An important consideration when attempting to restore sinus rhythm is that severe sinus node dysfunction may be unmasked after the termination of the atrial flutter.

As a result, options for transvenous or transcutaneous pacing should be ready for use if a viable native rhythm does not occur after atrial flutter termination. In patients with an atrial flutter, the ventricular rate is often more difficult to control than in patients with atrial fibrillation, and, thus, a rhythm control strategy is often pursued rather than a rate control strategy in patients with atrial flutter. (5) The high success rate of atrial flutter ablation combined with its low complication rate make catheter ablation a popular management option.

There is a limited role for exercise stress testing in patients who present with atrial flutter.

## CONCLUSION

Typical cavotricuspid isthmus-dependent atrial flutter is a common atrial tachyarrhythmia. Atrial flutter with 1:1 atrioventricular conduction can be precipitated by RV pacing. It is crucial to be cognizant of the clinical scenarios that can precipitate 1:1 atrioventricular conduction of atrial flutter, as well as the management strategies.

## REFERENCES

- Granada J, Uribe W, Chyou PH, et al. Incidence and predictors of atrial flutter in the general population. *J Am Coll Cardiol*. 2000;36 (7):2242-2246.
- Wellens HJ. Contemporary management of atrial flutter. *Circulation*. 2002;106(6):649-652.
- Aliot E, Capucci A, Crijns HJ, Goette A, Tamargo J. Twenty-five years in the making: flecainide is safe and effective for the management of atrial fibrillation. *Europace*. 2011;13(2):161-173. doi:10.1093/europace/euq382
- Lee KW, Yang Y, Scheinman MM. Atrial flutter: a review of its history, mechanisms, clinical features, and current therapy. *Curr Probl Cardiol*. 2005;30(3):121-167. doi:10.1016/j.cpcardiol.2004.07.001
- Cosío FG. Atrial flutter, typical and atypical: a review. *Arrhythm Electrophysiol Rev*. 2017;6(2):55-62. doi:10.15420/aer.2017:5:2
- Kawabata M, Hirao K, Higuchi K, et al. Clinical and electrophysiological characteristics of patients having atrial flutter with 1:1 atrioventricular conduction. *Europace*. 2008;10(3):284-288. doi:10.1093/europace/eun012
- Uritto G, Akhrass P, Leonardi M, Saponieri C, Sette A, El-Sherif N. Atrial flutter with spontaneous 1:1 atrioventricular conduction in adults: an uncommon but frequently missed cause for syncope/presyncope. *Pacing Clin Electrophysiol*. 2009;32(1):82-90. doi:10.1111/j.1540-8159.2009.02180.x
- van den Berg MP, Crijns HJ, Szabó BM, Brouwer J, Lie KI. Effect of exercise on cycle length in atrial flutter. *Br Heart J*. 1995;73(3):263-264.
- Ryan Burkhart, DO; Gregg Gerasimon, MD. Atrial Flutter With Exercise-Induced 1:1 Atrioventricular Conduction. *The Journal of the American Osteopathic Association* May 2018 | Vol 118 | No. 5.
- Gooch AS, Sumathisen DR. The influence of exercise on atrial flutter. *J Electrocardiol*. 1975;8(1):39-48