

A Fluttering Heart

On a recent shift, I had a gentleman present from a clinic due to tachycardia. He stated that he was completely asymptomatic and was only at the clinic to have his wound care performed on his diabetic foot. Other than hypertension and diabetes, the patient denied any other past medical problems. He reported non-compliance with his medications and a recent party where he “drank too much, did a little blow, and smoked some kush.” As I looked at the monitor, I noticed the patient’s heart rate remained at 151. It did not matter if the patient shifted in the bed or was talking, his heart remained at 151 the whole time. When the EKG was finally performed, the readout by the machine was “Atrial Flutter with a 2:1 AV Nodal Block.” This was the point that I thought back to my medical school and remembered that I only learned about the sawtooth pattern and did not really learn what atrial flutter was, let alone how to treat the condition.

Atrial flutter is a type of **supraventricular tachycardia that is caused by a re-entrant circuit in the right atrium alone**. This circuit is similar to the one in WPW; however, **it does not involve a re-entrant pathway connecting the ventricles and atria. It involves solely the right atrium**. The circuit is almost always between 270 and 330 beats per minute. This rate is consistent when a patient is in flutter due to the circuit. The pace of the circuit does not speed up or slow down unless outside forces are applied (i.e. vagal maneuvers, medications). The ventricular rate is determined by the degree of the block that is occurring through the AV node. The degrees are multiples of 1 (i.e. 1:1, 2:1, 3:1). This means that with a 1:1 block, the ventricular rate matches the atrial rate (around 300 bpm). For 2:1 the atrial rate is divided by two and for the 3:1 it is divided by 3 and so on. Keep in mind that although rare, blocks of 8:1 and higher can be seen. And if a 1:1 atrial flutter is seen, the patient is usually hemodynamically unstable and the EKG should not be scrutinized too closely, as the patient needs immediate treatment.

But on an EKG, how can atrial flutter be determined and what causes the sawtooth pattern? In typical atrial flutter, the atrial circuit can be clockwise or counterclockwise (most common). In counterclockwise, the flutter waves will be **inverted in the inferior leads and positive in V1**. The positive waves in V1 resemble P waves. In clockwise, the opposite pattern is seen. First, inspect the R-R interval. If the QRS is narrow and the ventricular rate is around 150 beats per minute, you are most likely looking at atrial flutter. Next, measure the P-P intervals. A ratio to the R-R interval will give the amount of AV block. Keep in mind that sometimes the AV block is variable with a mixture of 1:1, 2:1, 3:1, etc., thus making the measuring of the intervals difficult. The sawtooth pattern is created by the QRS complex followed by multiple flutter/P waves, and the T waves of the ventricular repolarization.

Now that you have found the condition on the patient’s EKG, how will you treat it? Obviously, if the patient is hemodynamically unstable, the first move is **synchronized cardioversion**; however, if the patient is stable, cardioversion is not a wise move as the patient could have an atrial thrombus like in atrial fibrillation. Our role as emergency physicians is to rate control the patient with medications in the emergency department and talking to cardiology. At our institution most of the emergency room physicians use either a calcium channel blocker or a beta blocker, more specifically **diltiazem and metoprolol**; however, the cardiologists prefer beta blockers. The goal heart rate is less than 110. Careful scrutiny of the EKG must be performed to

make sure the patient **does not have WPW** as both of these drugs would make the patient's condition worse. If using diltiazem, the **initial dose is 0.25 mg/kg IV given over two minutes with a dose of 0.35 mg/kg IV given every 15 minutes until the rate is controlled. Then an infusion is started at 5 mg/hr, titrating by 5 mg/hr every 15 minutes up to 15 mg/hr.** If using metoprolol, the **initial dose is 2.5-5 mg IV given over 2 minutes with a repeat dose every 15 minutes if needed up to 15 mg.** Once rate controlled, the maintenance dose is 25 mg PO bid. Digoxin and amiodarone can be considered in patients with heart failure and hypotension, and when diltiazem and metoprolol do not work.

Is there an advantage to using diltiazem or metoprolol? Recently, an article published in the Journal of Emergency Medicine discussed this exact question. In their study entitled "Diltiazem vs. Metoprolol in the Management of Atrial Fibrillation or Flutter with Rapid Ventricular Rate in the Emergency Department," Fromm et. al. compared the effectiveness of each of the drugs with these two rhythms. The investigators found that after the first 5 minutes, 50% of the diltiazem group had reached the goal heart rate versus only 10.7% of the metoprolol group. After 30 minutes, 95.8% of the diltiazem group had reached the target heart rate versus only 46.4% in the metoprolol group. It was also found that there was no difference in the feared side effects of hypotension or bradycardia. It seems that from their study, **diltiazem** would be the preferred medication to use in the emergency department. Despite which medication is chosen, it is important to know that our goal in the department is to slow the patient's heart down safely so that they may be admitted for cardioversion potentially after an echocardiogram to rule out thrombus (future question: which patients can we safely send home from the ED?).

References

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