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**Review Article**

# Atrial fibrillation for the Acute physician

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## Abstract

Atrial fibrillation (AF) is the most common arrhythmia in patients admitted to acute medical unit (AMU) and its prevalence increases with age. Acutely ill patients who suffer AF can be known to have AF - preexisting or can suffer from new onset AF secondary to the acute illness. Loss of atrial systole in presence of rapid ventricular response (RVR) can lead to a reduction in cardiac output and further hemodynamic compromise. New-onset AF in an acutely ill patient increase the risk of morbidity and mortality and is considered a marker of disease severity, priorities for the acute physician are to evaluate the hemodynamic status of the patient suffering with AF with RVR and consider urgent direct current cardioversion (DCCV) if evidence of hemodynamic compromise. Following steps after ensuring hemodynamic stability are to treat the cause of AF as well as assess for pharmacological treatment aiming for rate or rhythm control. New onset AF is also associated with an increase in the risk of heart failure, stroke, and death, there is evidence now that new onset AF in hospital is associated with 50% chance of recurrence within one year of discharge.

**Keywords:** Atrial fibrillation; Magnesium; Acute medicine unit; Sepsis.

**Abbreviations:** AF: Atrial Fibrillation; AMU: Acute Medicine Unit; RVR: Rapid Ventricular Response; DCCV: Direct Current Cardioversion; PAF: Paroxysmal Atrial Fibrillation; CCB: Calcium Channel Blockers.

## Introduction

Management of acute onset AF in AMU is debatable, and strategies are different among colleagues, rate control versus rhythm control is still a question which has different answers and the authors can explain the rationale of choosing either in this review, prescribing anticoagulation is another challenge in acute setting as paroxysmal AF (PAF) is recurrent which means anticoagulation is required if CHA2DS2VASc [congestive heart failure, hypertension, age 75 years- 2 points, diabetes, previous stroke or transient ischemic attack- 2 points, vascular disease, age 65 to 74 years, female sex) is 1 in males or 2 in females or more in the absence of contraindications like


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bleeding risk, however, the risk of bleeding is increased in acutely ill patients [1].

AF is an arrhythmia which occurs commonly in elderly and acutely ill patients due to an arrhythmogenic trigger like sepsis, pulmonary embolism, or alcohol for example, on a background of an existing proarrhythmic atrial substrate. Atrial substrate is usually created remodeling in the atria secondary to structural heart disease like heart failure or valve disease, coronary artery disease, or hypertension among other causes which all can lead to inflammation and renin-angiotensin system activation with fibrosis as result [2]. In addition to atrial fibrosis, electrical remodeling defined as abnormal automaticity or re-entrant circuits can also predispose to AF, common causes of the electrical remodeling are electrolyte abnormality like hypomagnesemia, hypokalemia, increase in sympathetic activity, and hypovolemia [3]. The incidence of paroxysmal AF in AMU setting is common as it can occur due to arrhythmogenic trigger which are common in acutely ill patients even in the absence of atrial substrate, while persistent AF or new onset sustainable AF points more towards a trigger in the presence of arrhythmogenic substrate (atrial fibrosis or electrical remodeling) [4]. Infection as well as increased sympathetic drive, electrolyte abnormality, hypovolemia, and inflammation (postoperative) are common triggers of AF during critical illness. Bacterial toxins can produce electrical remodeling and Inflammation can lead to arrhythmia due to oxidative damage to atrial myocytes and direct inflammatory cell infiltration. Evidence that anti-inflammatory agents like steroids and statins may reduce the incidence of AF [5,6]. AF is a disorganized atrial electrical impulse which leads to erratic contraction leading to loss of the atrial systole which compromises the ventricular filling during diastole. Patients with heart failure (systolic and/or diastolic) have a high risk of hemodynamic compromise with the loss of atrial systole in AF. Up to 50% of patients with sepsis suffer from impaired ventricular relaxation and are prone for hemodynamic compromise with the new onset AF, rapid ventricular response which is common in new onset AF compromise the cardiac output further [7]. Worth noting that significant number of acutely unwell patients with new-onset AF suffer from hemodynamic instability, and the majority suffer from RVR with heart rate 150 or more, and some patients show some signs of cardiac ischemia and heart failure [8]. So far, we can conclude that new onset AF in acutely ill patient is a marker of disease severity as well as an independent risk factor which increases the severity of the disease itself. Therefore, New onset AF increases morbidity and mortality for acutely ill patients as an independent risk factor. Large observational study concluded that more than 50% of patients who had PAF in the context of sepsis developed recurrent AF within five years of hospital discharge. PAF in these patients require risk assessment for ischemic stroke and initiation of anticoagulation accordingly in the absence of high bleeding risk, also, patients who suffer PAF acutely do require frequent monitoring and perhaps referral to cardiologist for further assessment [9].

## Discussion

Initial treatment of new onset AF depends on the hemodynamic status of the patient while in AF, presence or absence of triggers or reversible causes, patient's comorbidity status


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and the potential risk of the medications used. Direct current cardioversion (DCCV) is indicated in the presence of hemodynamic instability like low blood pressure leading to syncope, pulmonary oedema, or acute myocardial infarction [10].

Concomitant use of agents to rate or rhythm control is advisable as failure to sustain sinus rhythm or recurrence of AF in the acute setting after DCCV is common [11]. Role of anticoagulation is debatable in new onset AF requiring DCCV, we still don't know if giving anticoagulation will reduce the risk of thromboembolic events and how soon anticoagulation should be given, but the current recommendations are to give anticoagulation as soon as DCCV is planned if risk of bleeding is minimal [12].

The common question while managing new onset AF with RVR in a hemodynamically stable patient is rate or rhythm control and before making any suggestions we would like to remind our readers that magnesium and amiodarone have both rate and rhythm control, flecainide as well has both properties but we will not mention it here as it is contraindicated in the presence of ischemic or structural heart disease and hence limited use when dealing with acutely ill patients or elderly who could well have an underlying heart disease.

Common rate control medications used in AMU are betablockers like metoprolol, digoxin, or nondihydropyridine calcium channel blockers (CCB).

CCB like verapamil and diltiazem can lower the blood pressure by causing vasodilatation, worsen heart failure as these medications have a strong negative inotropic effect, as well as reduce the heart rate by decreasing depolarization of the AV node. Betablockers (BB) have similar effects as CCB, however, BB blocks the beta1 receptors reducing the effect of catecholamines on the myocardium and hence cause a less but favorable negative inotropic effect, worth mentioning the role of esmolol, which is an ultra-short acting BB and can be given by infusion if concerns regarding side effects as upon discontinuation fast recovery occurs due to its very short duration of action [13]. Digoxin is a common choice in situations where heart failure or low blood pressure (BP) are a concern, the rationale that digoxin is a weak positive inotropic and doesn't cause vasodilatation, the downside of using digoxin that is works by increasing the vagal tone which means that digoxin is less effective in acutely ill patients who probably have a high catecholamine level and due to its narrow therapeutic index there is evidence that digoxin can increase mortality in patients with underlying heart failure with digoxin levels over 1.2 ng/ml [14-16].

The role of magnesium (Mg) in new onset AF is unique and underestimated by many doctors, its effect on ion channels leads to an increase in the AV node refractoriness leading to rate control and decrease in myocardial automaticity leading to conversion to sinus rhythm (SR) with an important advantage that Mg does not have negative inotropic effect which is beneficial to patients with underlying heart failure [17]. Amiodarone has similar effect to Mg and can lead to slowing of the AV node conduction as well as conversion to SR, and unlike flecainide it can be safely used in patients with underlying structural or ischemic heart disease [18]. Multiple side effects can occur with amiodarone use, amiodarone can lead to hypotension, is pro-arrhythmic and has organ toxicity effect on


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the lungs, thyroid, and liver with chronic use mainly [19-20]. We briefly discussed the mechanism of action of most common antiarrhythmic drugs used in AMU for the treatment of new onset AF, but which one is more effective and what are we aiming for?

There is evidence that the use of BB in new onset AF in acutely ill patients with sepsis has a lower in-hospital mortality rate than amiodarone, CCB, and Digoxin [21]. Metoprolol showed superiority to amiodarone and diltiazem when given initially in patients with AF and RVR in terms of lower need for a second agent compared to amiodarone and better rate control at 4 hours compared to diltiazem [22]. Esmolol has shown to reduce in-patient mortality by improving cardiovascular efficiency when used in AF with RVR in the context of sepsis [23].

**Conclusion**

The conclusion based on several studies which favors the use of esmolol infusion in acutely ill patients with new onset AF and RVR as a first line agent (unless contraindications like severe asthma, acute decompensated heart failure, or hypotension), the rationale is esmolol has shown superior reduction in mortality by improving cardiovascular efficiency as mentioned above and is ultra-short acting which means rapid recovery if complications were to happen. We recommend treating the trigger for AF of course as without treating the reversible cause cardioversion may well be futile and hence, we prefer rate control in the acute setting. If rate is not well controlled on esmolol infusion or chemical cardioversion is felt to be appropriate we recommend Mg as the second line agent due to strong safety profile, similar rate of cardioversion efficiency as amiodarone, and rate control effects [24].

Anticoagulation for AF in the acute setting is underused as acute illness with AF increases the risk of in-hospital ischemic stroke by twofold [25]. However, anticoagulation in this group of patients tends to increase the risk of bleeding as well [26]. Practice is variable among different physicians regarding initiating anticoagulation in acutely ill patients during illness, due to the potential of causing harm and the likelihood of interrupting anticoagulation during illness due to organ failure or the need to perform procedures for example, some clinicians prefer to start anticoagulation when patients are more stable unless DCCV was used.

AF is commonly converted back to SR in patients with acute illness whether spontaneously or after using medications, however, the risk of long-term thromboembolic event remains high [27].

A thorough monitoring for acutely ill patients in whom the AF resolved after discharge as the risk of recurrent AF is high, and for those who have persistent AF to start anticoagulation according to CHA2DS2VASc and if bleeding risk is low [28,29].

**Learning points**

1. Rate control for AF with RVR in acutely ill patients is preferred unless hemodynamically unstable, pure lone AF, or symptomatic after rate control, as most if not all cases of AF have an underlying trigger which increase the risk of recurrence after cardioversion.
2. Betablocker has shown more efficacy and safety than other common


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antiarrhythmics medications in treating PAF.
3. Role of Magnesium in rate and rhythm control is underutilized although its safety profile is better than amiodarone.
4. Anticoagulation is debatable in the acute event unless cardioversion is used, as risk of ischemic stroke increases with PAF as well as risk of bleeding.
5. Up to 50% of PAF in the acute setting is recurrent and thorough monitoring is recommended after discharge.

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