Atrial fibrillation complicating acute myocardial infarction: how should it be interpreted and how should it be treated and prevented?

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This editorial refers to ‘Atrial fibrillation in acute myocardial infarction: a systematic review of the incidence, clinical features and prognostic implications’, by J. Schmitt et al., on page 1038

Atrial fibrillation (AF) has been reported to complicate the course of acute myocardial infarction (AMI) in ~6–21% of hospitalized patients.1 Possible precipitating factors of AF in this setting include atrial ischaemia or infarction, right ventricular infarction, pericardial inflammation, acute hypoxia or hypokalaemia, and haemodynamic impairment secondary to left ventricular (LV) dysfunction.2–5 Endogenous or exogenous catecholamines may also precipitate AF. These factors can be found alone or in combination, and may superimpose on predisposing diseases affecting cardiac anatomy and physiology, such as previous cardiomyopathy, valvular impairment, or chronic lung disease. Finally, AF in the setting of AMI has been reported to be associated with ageing, severely impaired LV function, presence of mitral regurgitation, or frequent ventricular arrhythmias plus right bundle branch block, and presence of left bundle branch block. Although most of these factors are claimed to be causative of AF, the intimate relationship between their presence and AF occurrence is not known. Despite the variability of factors and conditions associated with AF in clinical practice, patients developing this arrhythmia during AMI are usually reported as a uniform category.

AF can cause haemodynamic instability because of the rapid ventricular rate, irregular ventricular filling, and/or loss of atrial contribution to cardiac output,5 ultimately leading to an increase in oxygen demand. If deterioration of the haemodynamic balance secondary to AF may intuitively affect pre-discharge outcome of AMI victims, less intuitive is the association between AF in the early phase of AMI and long-term outcome. Schmitt et al. report on a clinical review evaluating the incidence, clinical features, and prognostic implication of AF in AMI.6 Through this investigation, the authors provide a summary on clinically relevant items such as identification of clinical variables associated with the development of AF and their prognostic implications, incidence of in-hospital and post-discharge mortality in AF groups vs. the remaining population, causes of death, impact of AF on stroke risk, efficacy of anticoagulation strategies, and treatment of AF during AMI. Ageing, Killip class IV, heart rate at admission, and pre-existing AF were consistently found to be strong independent predictors in different trials; not unexpectedly, the prevalence of patients presenting with these parameters, except for ageing, appeared to decrease in most recent trials under the influence of early reperfusion therapies, and use of β-blockers, angiotensin-converting enzyme (ACE) inhibitors and angiotensin (AT) II inhibitors. Also LV hypertrophy, probably as an indicator of increased intracardiac pressure, was shown to be a significant predictor, whereas the ST-segment elevation myocardial infarction (STEMI) vs. non-ST-segment elevation myocardial infarction (NSTEMI) nature of myocardial damage did not appear to influence the propensity to develop in-hospital AF.6 The presence of AF during AMI carried an increased risk of developing in-hospital re-infarction, cardiogenic shock, heart failure, and asystole. Importantly, the presence of AF of new onset during AMI carried an increased risk of in-hospital, 30-day, 1-year, and 3-year mortality, whereas pre-existing AF did not appear to carry any such risk.6–9 Increased risk included both sudden and non-sudden cardiac death. Some evidence was reported regarding the independent significance of short-lasting vs. long-lasting AF episodes. The independent value of AF as a predictor of mortality was not substantiated in all trials, which raises doubts about the impact of AF therapies on...
outcome.\textsuperscript{10} Also the risk of stroke was significantly increased in AF patients. Similar to mortality, stroke risk was increased in hospital, at 30 days, and during intermediate follow-up. Use of oral anticoagulation, which in this population needs to be integrated with antiplatelet agents, appeared to provide additional protection within early follow-up and not always in prospective series.\textsuperscript{11,12} Finally, the authors report on the lack of consistent data with regards to the impact of anti-arrhythmic therapies to terminate or control AF in the setting of AMI.

By outlining the many uncertainties still existing in the field of AF complicating AMI, the study of Schmitt et al.\textsuperscript{1} offers a clue to which questions are in most urgent need of an answer in the near future and provides suggestions on how they should best be approached.

**How should AF during AMI be interpreted?**

The appearance of AF in the setting of AMI should raise two levels of concern, one related to the impact on the current clinical condition and the other related to the prognostic implications that AF may have. In AMI patients developing AF, assessment of the clinical profile should be performed inclusive of pre-existing co-morbidity (quality and entity), site and extent of MI, site of culprit lesion, impairment of LV function, impact of reperfusion, tolerability to and effects of b-blockers, ACE, and AT II inhibitors (or reasons preventing drug administration), blood electrolytes, hormones, and pO\textsubscript{2}, pCO\textsubscript{2}, and pH levels.

The definition of the patient’s clinical profile is not only valuable to guide therapies which may contribute to revert rhythm disturbances, but would also serve to categorize patients with AF more accurately. For example, patients with AF in the absence of LV dysfunction (i.e., those with successful reperfusion therapy or little myocardial damage) and pre-existing AF may represent a different population compared with patients with AF of new onset and with significant LV dysfunction. In these subgroups, similar therapies may lead to opposite effects. Another example is given by the duration of AF and its tendency or not to recur. Similarly, patients with other characteristics could fall into identifiable subgroups.

The role that subgroup identification may play in generating observational data is intuitive and may help to understand contradictory literature data better, as well as to individualize treatment strategies or re-define prognostic implications based on different patient characteristics. One example related to the prognostic implication in AF subgroups is given by the need for long-term oral anticoagulants. While there is some evidence that this therapy may protect from early and late thromboembolic risk, it is not clear whether the benefit could be extended to the entire population or to subgroups with recurrent paroxysmal AF, significant asymptomatic arrhythmic burden episodes of longer duration, drug-refractory AF, or post-discharge AF.

**How should AF during AMI be treated and prevented?**

Early reperfusion and anticoagulation strategies represent the cornerstone of all therapies in patients with AMI and are likely to reduce, probably by \( \geq 50\%\), the risk of developing AF and to protect against the associated thromboembolic risk. A further contribution to limit the risk of developing AF is the use of b-blockers, ACE inhibitors, and AT II inhibitors.\textsuperscript{13,14} The mechanism by which these drugs prevent AF is most probably related to their capacity to limit the changes in the substrate produced by ischaemia of the culprit artery, although they can also have a direct effect on the arrhythmic substrate.

Once AF has occurred, compensation of haemodynamic or electrolyte imbalance with the use of anti-hypertensive or anti-hypotensive agents and electrolyte infusion should be aimed for, when appropriate. Restoration of haemodynamic and electrolyte balance may not only favour spontaneous restoration of sinus rhythm, but may also contribute to the maintenance of sinus rhythm following electrical cardioversion. Although difficult to obtain, categorization of patients based on the presence or absence of transient precipitating factors, response to compensating manoeuvres, need for and response to electrical cardioversion, and presence or absence of concomitant LV dysfunction would serve to aid in the interpretation of the independent role of AF in patient prognosis.

Control of ventricular rate is an acceptable alternative to sinus rhythm restoration, but the use of b-blockers, digoxin, and calcium antagonists should be considered in light of their potential negative inotropic effect and increased oxygen consumption. It is of importance that the prognostic implications of selecting a rhythm vs. rate control strategy in the setting of AF complicating AMI have not been investigated as early restoration of sinus rhythm might have some potential benefit in this patient population.

In addition to electrical cardioversion, usually preferred under conditions of AF-related imbalance of patient haemodynamics, amiodarone can be used for restoration of sinus rhythm. This drug is usually preferred to other antiarrhythmic agents because of its limited negative inotropic effect. Data are lacking with regard to the comparative efficacy of amiodarone vs. placebo in restoring sinus rhythm during the early phase of AMI, the role of other anti-arrhythmic agents in patients with AF and well preserved LV function, and whether early and stable restoration of sinus rhythm carries an independent prognostic benefit. It would be important to identify risk predictors for development of AF in the setting of AMI. Identification of patients at high risk might allow prophylactic anti-arrhythmic strategies to be devised and for them to be assessed in the in-hospital and long-term prognosis of patients.

Protection from early and late thromboembolic risk in AF patients is currently left to unfractionated heparin and to oral anticoagulants in addition to clopidogrel, respectively. However, more solid data are required to establish the need for long-term oral anti-coagulants, particularly in patients with well preserved or well restored LV function, single in-hospital short-lasting AF, and low CHADS2 score.

In summary, the onset of AF in the setting of AMI represents a worrying event requiring immediate intervention. The mode of intervention influences the short-term outcome and may have implications for long-term patient outcome. Selection of the best therapies and interpretation of their effect is often limited by our inability to discriminate among the several variables in play and by lack or inconsistency of data according to evidence-based medicine. With this perspective in mind, efforts should be made...
to provide better patient categorization in ongoing trials. The level of information generated through this methodology will probably help to discriminate among variables in play, to improve interpretation of currently available data, and to generate studies addressing unsolved issues in this crucial field of medicine.

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