

Tab. 2. Echocardiographic predictors and thresholds for NOAF

Table with 7 columns: Parameter, How to measure / When, Approximate cut-off, AUROC, What it indicates, When to use, Note. Rows include parameters like LAVi, LA ESD, LAEF, AVTI, E/e' septal, TR Vmax, LVEF, and LVOT VTI with their respective measurement methods, cut-offs, AUROC values, clinical indications, and usage timing.

Legend: AA – antiarrhythmic drug; A4C – apical four-chamber view; A2C – apical two-chamber view; A5C – apical five-chamber view; AUROC – area under the receiver operating characteristic curve (*based on an analysis of the PRASE study); CW – continuous-wave Doppler; LVEF – left ventricular ejection fraction; E/e' – ratio of transmitral E wave and mitral annulus e' wave; AVTI – velocity time integral of A-wave; LAEF – left atrial emptying fraction; LA ESD – left atrial end-systolic dimension; LAVi – left atrial volume index; LAP – left atrial pressure; LVOT VTI – velocity time integral in left ventricular outflow tract; NOAF – new-onset atrial fibrillation; PW – pulsed-wave Doppler; TR Vmax – maximum velocity of tricuspid regurgitation; PLAX – parasternal long-axis view; SR – sinus rhythm; ECV – electrical cardioversion; TDI – tissue Doppler imaging; HR – heart rate; sPAP – systolic pulmonary artery pressure; RV – right ventricle; CO – cardiac output.

Principles of arrhythmia management in septic shock

In accordance with the 2024 ESC guidelines, atrial fibrillation therapy should be structured according to the AF-CARE framework: [C – comorbidity] comorbidities and risk factor management, [A – avoid] prevention of ischaemic stroke and thromboembolism, [R – rate/rhythm] symptom reduction through rate and rhythm control, [E – evaluation] ongoing assessment [7]. In critically ill patients, the priority is stabilisation of homeostasis: optimisation of volume and preload, reduction in catecholamine dosage (if vasopressor support is required, vasopressin is considered as a second vasopressor), correction of electrolytes (K+, Mg2+), provision of oxygenation, adequate analgesia, and treatment of the underlying cause of sepsis (source control and antibiotic therapy). In clinical practice, particularly with excessive β1-stimulation and the need for higher catecholamine doses, following the aforementioned stabilisation, the rate control is more appropriate than immediate rhythm control [29–31]. The 2021 SSC guidelines emphasise that, after correction of reversible causes and minimisation of adrenergic burden, the choice between rate and rhythm strategy should be individualised [32].

The combination of ECG and echocardiography helps to target pharmacotherapy: in conduction disorders, drugs prolonging the PQ interval should be avoided, and in structural heart disease or severe systolic dysfunction (LVEF < 35%), drugs with significant cardiodepressive effects (e.g., propafenone and diltiazem) should be limited. Conversely, in hypercontractile LV, excessive adrenergic stimulation, or dynamic LVOT obstruction, following preload optimisation, beta-blocker (BB)–based therapy is chosen. In haemodynamic instability, urgent synchronised electrical cardioversion (ECV) is indicated [7]. ECV has high success rates; however, in the intensive care setting, early recurrences (within 24 hours) are common, and therefore ECV is typically combined with an antiarrhythmic agent [33].

For rhythm control, propafenone (class Ic) can be considered in patients without significant structural disease (approximately LVEF ≥ 35% and non-dilated LA), whilst amiodarone (class III) is suitable in severe systolic dysfunction and structural disease (e.g., dilated LA) due to its minimal cardiodepressive effect [20, 27, 28, 34]. Echocardiography is also useful when the duration of the arrhythmia is uncertain. The finding of a markedly dilated LA or significant valvular disease (e.g., mitral regurgitation/stenosis) increases the likelihood of chronic AF and reduces the prospect of maintaining SR. For rate control, BBs and non-dihydropyridine calcium channel blockers (CCBs) are most commonly used. BBs (class II) are particularly suitable in NOAF with hyperkinetic circulation where there is excessive β1-adrenergic stimulation, as well as in hypertension and ischaemic heart disease [7]. Ultra-short-acting and selective BBs (esmolol, landiolol) allow titration of heart rate whilst preserving perfusion. Landiolol in prospective randomised controlled trials (J-Land 3S, STRESS-L, LANDI-SEP) demonstrated effective heart rate control and haemodynamic safety without a significant increase in vasopressor support and without impaired perfusion; however, review data showed no short-term or long-term mortality benefit [29–31]. In a subgroup of intensive care patients with NOAF, a non-significant trend favouring landiolol was described, though without proven mortality benefit [35]. Observational studies suggest an advantage of BBs over other rate control strategies; however, patient selection is crucial. In a systematic review of 17 studies evaluating landiolol use in critically ill patients with atrial fibrillation, landiolol demonstrated good efficacy and tolerability in rate control as well as the ability to induce cardioversion to sinus rhythm in both non-surgical (75.7%) and surgical patients (70.1%) [36]. Although the data are promising, the safety and efficacy of beta blockers in NOAF need to be further validated in randomised controlled trials. Transthoracic echocardiography can serve as a fundamental tool for selecting suitable patients to initiate BB therapy.