Intravenous Infusion of Ultra-Short-Acting β-Blocker for Postoperative Atrial Fibrillation Is the One of Choice

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Postoperative atrial fibrillation (POAF) develops during the early phase in 20–40% of patients undergoing cardiac surgery. Its incidence depends on the type of surgery, the patient’s age, history of atrial fibrillation, left ventricular function, arterial hypertension, chronic obstructive pulmonary disease, history of heart failure and so on. POAF may affect the length of hospital stay and prognosis. If it appears, intravenous verapamil or diltiazem, or oral β-blocker, is often administered empirically in the clinical setting in Japan. Onsite management is allowed because most episodes of AF spontaneously convert to sinus rhythm.

Previous prospective studies, consisting of a small number of subjects, and a retrospective observation, advocated the superiority of continuous intravenous infusion of the short-acting β-blocker, esmolol, over the non-dihydropyridine calcium-channel blocker, diltiazem. Because the EACTS guideline released in 2006 did not hand down an opinion concerning the relative merit of various medications, including amiodarone, digoxin, β-blocker, calcium-channel blocker or other anti-arrhythmic agents, intravenous β-blocker has been used infrequently in Japan. It may be also because the pricey short-acting β-blockers were not available until 2002 and were initially restricted to intraoperative use. Japanese health insurance later allowed the use of landiolol after the operation also.

Intravenous administration of dioxin takes time to slow the heart rate in the postoperative setting. It is not shrewd to use amiodarone against POAF, because in most cases it will convert spontaneously. From this point of view, it is clinically important to compare the seldom-used short-acting β-blocker, landiolol, and the nationally popular drug, diltiazem, for the treatment of POAF.

In this issue of the Journal, Sakamoto et al demonstrate that landiolol has clinical superiority over diltiazem for the treatment of POAF. They show that landiolol converted POAF to sinus rhythm more often and more quickly. In addition, no cases of heart failure developed in the course of β-blocker administration.

In a prospective randomized study, Sezai et al showed the preventive effect on POAF of using 48-h administration of intravenous landiolol (2 μg · kg⁻¹ · min⁻¹) from the beginning of the coronary artery bypass graft operation, supporting the retrospective observation of Fujiwara et al.

Now in Japan we are able to use 2 short-acting β-blockers, landiolol and esmolol, which have β₁-selectivity. Sakamoto et al did not directly compare the 2 drugs, but they emphasized the few side effects with landiolol, noting that studies reporting the side effects of esmolol were not uncommon. Although no direct comparison was undertaken in that study, hypertension <90 mmHg occurred in 4 cases among 35 subjects (11.4%) with landiolol compared with 7 cases among 15 (46.7%) for esmolol.

Ikeshita et al used whole isolated rabbit heart preparations to compare the inhibitory action of landiolol and esmolol against isoproterenol-induced tachycardia. Both drugs decreased heart rate in almost the same dose-dependent manner (equivalent negative chronotropic action). However, esmolol produced the more profound decrease in left ventricular dP/dt or developed pressure (more negative inotropic action) at the high concentration. Sasao et al used rabbit preparations and demonstrated that both landiolol and esmolol produced a dose-dependent decrease in heart rate, whereas only esmolol produced a dose-dependent decrease in mean arterial pressure, which was not observed with landiolol. These experimental results suggest that landiolol has a similar negative chronotropic effect as esmolol, but that it has a less potent negative inotropic effect and less significant effect on blood pressure.

The merits of short-acting β-blockers are: (1) rapid disappearance of the drug’s effect once its use is discontinued and (2) a linear relation between the dose of continuous infusion and the blood concentration of the drug because of the applicable 1-compartment model, resulting in faster and safer achievement of the target heart rate. It is of note that the half-life in blood of landiolol is 4 min compared with the 9 min of esmolol. Its safety and effectiveness may offset the slightly greater cost of landiolol.

The superiority of short-acting β-blocker over calcium-channel blocker against AF is limited for POAF, because the converting effect is comparable for AF in patients visiting the emergency room.

Although we have to keep the limitations in mind, this study encourages the use of the ultra-short-acting β₁ blocker, landiolol, for the treatment of POAF and possibly for tachycardia in various clinical settings.
References


