Calcium Dynamics and Ventricular Fibrillation

To the Editor:

Warren et al. recently performed an optical mapping study in blood-perfused pig hearts. They concluded that their results did not support the presence of nonvoltage-gated intracellular calcium (Ca) transients during ventricular fibrillation (VF) and suggested that action potential (AP)/Ca transient dissociation is a consequence rather than a cause of wave fragmentation. A major piece of evidence in support of this conclusion is the failure of BAPTA-AM, a calcium chelator, in preventing VF in these pig hearts. These latter experiments were performed by perfusing the heart with 25 mg of BAPTA-AM in 1.5 L of Tyrode solution over a 10-minute period. The hearts were then blood-perfused, and the studies on VF induction were performed.

BAPTA-AM is known to incorporate into tissues slowly, and 20 to 60 minutes of infusion are generally needed before testing the antiarrhythmic effects. To test whether or not the duration of BAPTA-AM infusion affected its antifibrillatory effects, we performed a study with hearts harvested from 4 New Zealand White rabbits (3.5 to 4.6 kg). The hearts were Langendorff-perfused with oxygenated Tyrode solution equilibrated with 95% O₂ and 5% CO₂ to maintain a pH of 7.4 ± 0.05 at a rate of 35 to 45 mL/min. The coronary perfusion pressure was regulated and maintained at 70 to 80 cm of H₂O. We infused BAPTA-AM 20 μmol/L for 30 minutes (N=2) and for 70 minutes (N=2) before the commencement of the rapid-pacing protocol. The results showed that BAPTA-AM infusion for 30 minutes failed to suppress either Ca alternans or VF induction during rapid pacing. However, after 60 minutes of BAPTA-AM infusion, neither Ca alternans nor VF was inducible. The only arrhythmia inducible was sustained monomorphic ventricular tachycardia.

In the present study, we confirmed that a short duration of BAPTA-AM infusion did not prevent VF in rabbit hearts in vitro, consistent with that reported by Warren et al. However, alternans and VF were no longer inducible after 70 minutes of BAPTA-AM infusion. These latter findings confirmed the antifibrillatory effects of BAPTA-AM as reported by Billman and colleagues. The results also indicate that the duration of BAPTA infusion (10 minutes) in the study by Warren et al. may be insufficient to test the importance of Ca dynamics in the mechanisms of VF.

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Disclosures
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