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Comparative effectiveness of lignocaine, quinidine, propranolol and procainamide as antifibrillatory agents

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The effects of quinidine, procainamide, lignocaine and propranolol on the ventricular fibrillation threshold (VFT), irritability and contractility of the isolated perfused heart from the rabbit (Langendorff preparation) were compared. The VFT was measured by the method described previously (MacConaill & Murnaghan, 1967). It consisted of using a single square-wave 10 ms pulse applied during the vulnerable period of late systole, and measuring the minimal current required to produce fibrillation or tachycardia. The diastolic extrasystolic threshold was determined to indicate the degree of irritability and the contractility was measured with a strain-gauge attached to the apex of the heart. The perfusion apparatus was constructed so that any one of three solutions of different composition could be selected by the turn of a tap. Several concentrations of each drug could be tested and control values could be measured after, as well as before, those due to the drug. To indicate the magnitude of the change produced on the VFT by the drug, the VFT change ratio was calculated—VFT during the drug/VFT of the control.

Quinidine (2·5–15 μM) in seventeen trials on nine hearts raised the VFT in seven trials, lowered it in five and lowered it before raising it above the control value in five. The mean±S.E.M. VFT change ratio in the twelve trials where it was raised was 4·68±1·2; in the ten trials where the VFT change ratio was lowered the value was 0·49±0·06. These results with quinidine were reported earlier (Murnaghan, 1969). The respective values with procainamide (30–100 μM) were 1·6±0·17 and 0·61±0·11. With this drug the threshold was lowered in three out of eight trials on four hearts. Propranolol (1–10 μM) gave values of 1·84±0·24 and 0·42±0·04; the threshold was lowered in three out of nine trials on five hearts. With lignocaine (6·6–26·4 μM) the VFT change ratios were 3·06±1·15 and 0·47; the threshold was lowered in only one out of thirteen trials on six hearts. As indicated by the incidence of lowering the VFT, quinidine was the drug most liable to predispose to fibrillation, lignocaine was the least and propranolol and procainamide were intermediate in position. All four drugs reduced the irritability of the heart; quinidine was the most potent, lignocaine and propranolol were moderately so, while procainamide was relatively weak. All drugs except lignocaine depressed cardiac contractility, propranolol being the most potent.

The results are consistent with those obtained clinically which show that lignocaine is an effective anti-arrhythmic agent and posseses the advantage over quinidine that it does not predispose, or rarely predisposes, to ventricular arrhythmia or even fibrillation.

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