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# Effect of low Temperature on Isolated Mammalian Heart

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The occurrence of arrhythmias and myocardial fibrillation during hypothermia has been studied in intact animals (1 and 2) and in heart-lung preparations (3). The present study was designed to study the direct effect of low temperatures on the isolated mammalian heart.

## MATERIALS AND METHODS

10 adult rabbits and 10 mongrel puppies of both sexes, weighing 1.5 to 3 kg, were used in this study. The rabbits were killed by a blow on the head and their hearts were removed and perfused at a pressure head of 55 mm Hg with Locke solution according to Langendorff method. The puppies were anaesthetized with sodium pentobarbital, 35, mg/kg, intraperitoneally and their hearts were removed and perfused as above.

One electrode was tied round the aorta and the other electrode was placed on the apex of the heart. The electrodes were connected to a Sanborn 550 ECG preamplifier. The electrical activity of the heart was monitored on Hewlett-Packard cathode ray tube type 780-6A, and recorded by Sanborn Polybeam Recorder.

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Each heart was at first perfused for 30 minutes with Looke solution at the temperature of 37° C ± 0.5, and the recorded ECG was used as control. The temperature of the Locke solution was then lowered at the rate of approximately 5° C in ten minutes. After the heart ceased to contract, the temperature of the perfusing fluid was raised again to 37° C to test the reversibility of the heart function after being exposed to low temperatures.

## RESULTS

The mean temperature at which the isolated rabbits' hearts ceased to contract was 12.9° C ± 1.8 (SD) and the range was 11-16° C. The mean temperature at which the puppies' hearts ceased to contract was 10° C ± 1.2 (SD) and the range was 9-12° C. The most striking result of this study was that none of the hearts showed any arrhythmias or myocardial fibrillation during the whole cooling procedure. However, the QRS complexes, in comparison with the normal electrical activity at 37° C, were widened at low temperatures. The electrical activity of all the hearts returned to the control values after the temperature was restored to 37° C.

## DISCUSSION

Reissman and Kappor (3) showed that at low temperatures the work capacity of the heart decreases but it is still considerably higher than the work load the heart has to cope with in an intact animal at the same temperature. Angelakos and Daniels (2), on the other hand, noticed arrhythmias and myocardial fibrillation during progressive hypothermia and ascribed it to local conduction blocks caused by a reduced excitability in the myocardium at low temperatures.

The results of the present study show that when the heart is perfused outside the body with low-temperature Locke solution, no arrhythmia or myocardial fibrillation develops, but the QRS complex widens. It seems probable that the occurrence of arrhythmias and myocardial fibrillation at low temperatures in intact animals might be due to the superimposition of extracardiac causes on the reduced excitability in the myocardium.

## SUMMARY

Effect of perfusion with low temperature Locke solution on the isolated hearts of adult rabbits and mongrel puppies was studied. The study showed no arrhythmias or myocardial fibrillation at low temperatures in the isolated mammalian heart.



## RESUME

Effet de basse température sur le coeur isolé du mammifère. L'effet de la perfusion avec la solution Locke a basse température sur les coeurs isolés des lapin adultes et des chiots a été étudié. Cette étude ne montra aucune arythmie, ni fibrillation du myocarde à basse température sur le coeur isolé du mammifère.


References


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