

C H A P T E R - I V
EFFECTS OF OXYGEN ON THE ELECTROCARDIOGRAPHIC
CHANGES DURING HYPOTHERMIA.

In the last chapter, effects of hypothermia on the cardiovascular system have been presented. It has been observed that hypothermia has a profound effect on the electrocardiogram of cats reflecting primarily an injury pattern as the body temperature falls below 29°C . Also both heart rate and blood pressure were found to fall linearly as the animals were cooled. The myocardial blood flow, as estimated by the praecordial uptake of radioactive rubidium, also falls significantly as the cats were cooled to 27°C . Whether the heart under the condition suffers from oxygen deficit, however, will depend on the myocardial oxygen demand during cold. To assess this, in the present chapter a very direct approach has been made by administering oxygen directly in the cats during hypothermia and demonstrating its effects on the known changes produced on electrocardiogram at lower body temperatures.

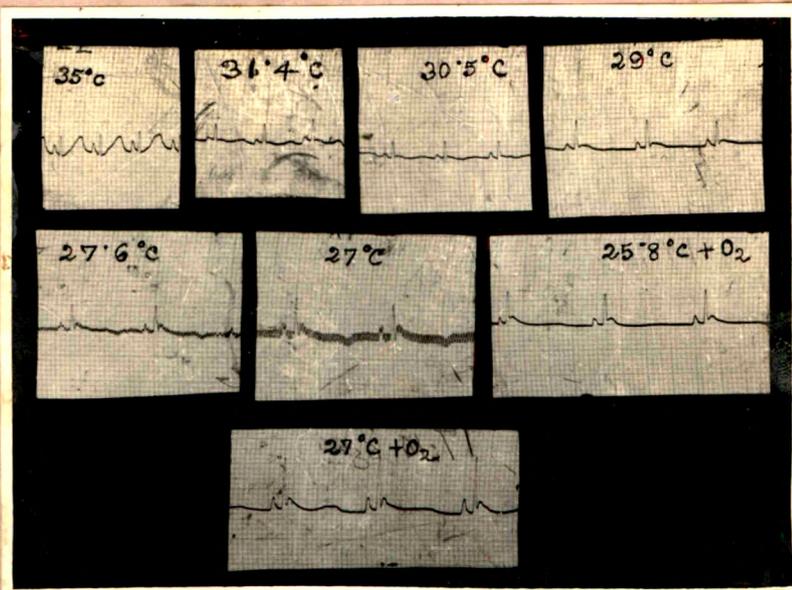
Materials and Methods

Four cats of both sexes with an average weight of 2.5 Kg. were anaesthetized with nembutal (50 mg/Kg. intraperitoneally) and placed in a supine position on the operating table. The body temperature was measured by mercury thermometer inserted into the rectum. The femoral artery was dissected and a polythene catheter was inserted into it for collecting blood samples. A tracheotomy was then performed and a tracheal tube was inserted into the trachea. Initially respirations were spontaneous but later the animals were put on artificial ventilation by a respiratory pump for administration of oxygen. Hypothermia was induced by surface cooling technique and the electrocardiogram was recorded as described previously. Surface cooling was continued until the T wave became inverted and the ' Osborn wave ' appeared in the electrocardiogram. From this period pure oxygen was administered to note its effect on electrocardiographic changes induced by cold. At this stage cooling was discontinued and the effect of oxygen was observed for 30 minutes in each case.

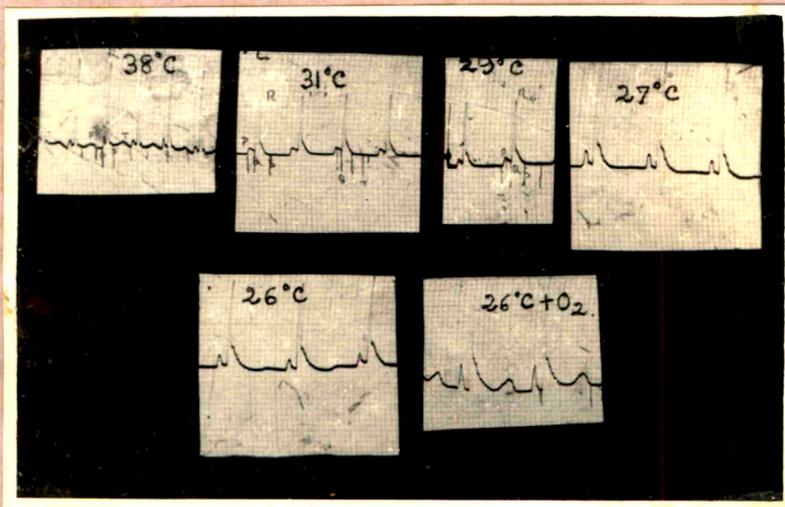
Percentage saturation of oxygen in the arterial blood was estimated using Atlas oximeter before and after the administration of oxygen .

R e s u l t s

No change in heart rate was observed in cats during hypothermia following the administration of oxygen. The PR interval remained same, except in one where there was a slight reduction, whereas the observed Q-T interval was reduced in two and in one there was an increase. The same change was observed with respect to S-T interval. The changes in the amplitude of J wave was inconsistent. The most significant change was, however, confined to T wave. The T waves which were upright at normal body temperature became flat and subsequently inverted as the body temperature was cooled, was rendered either flat or upright following administration of oxygen at the same temperature (Figs:27,28). The above observations have been made for a period of half an hour while the oxygen was administered continuously. The results of 3 representative cats have been presented in Table VI. During hypothermia, the percentage of oxygen saturation which had a mean value of $87.3 \pm 3.2\%$ at normal body temperature fell to a mean value of $74.5 \pm 11.0\%$ when the body temperature was lowered to 27°C . With the administration of oxygen the same increased significantly upto a mean value of $92.6 \pm 2.0\%$ ($t = 2.99$; $p < .05$; Table VII).



(Fig. 27).



(Fig. 28).

Figs. 27-28 : Shows the effects of administration of Oxygen on the electrocardiographic changes produced in cats during hypothermia (for details see text).

C o m m e n t s

The above observations show that following administration of oxygen, most of the changes produced during hypothermia on the electrocardiographic pattern could not be reverted back to normal excepting the T wave changes. Oxygen has very little or no effect on the conduction mechanism nor on the ' Osborn wave' once it appears. An earlier work in this department could, however, demonstrated that the onset of 'Osborn wave ' (be shifted to lower temperature in presence of oxygen (Sen et al, 1962). They demonstrated in cats that it is possible to shift the J wave which normally appears in the temperature range from 27^o - 29^o C to a still lower temperature by artificial administration of oxygen during hypothermia prior to the onset of J wave . The most profound effect of oxygen as observed in the present work was on the T wave changes which it restores almost to normal. Results of such investigations have been published in the literature by previous workers (Smith, 1956; Gollan et al, 1955) in which they have claimed in contrast to the present observation, that it is possible to restore the electrocardiogram to normal by perfusing coronary artery with oxygenated blood during hypothermia.