THE INFLUENCE OF HOOK-WORM INFECTION ON THE HEART MUSCLE—AN EXPERIMENTAL INVESTIGATION

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R. E. HEILIG AND S. K. VISVESWAR (1942) found that in cases of Ankylostomiasis the heart muscle was damaged; and in 90 per cent. of their cases the cardiac condition improved after iron therapy while in the remaining 10% no improvement was seen until anthelmintic treatment was administered. They suggest that the cardiac muscle in Ankylostomiasis is affected by two factors, the microcytic hypochromic anaemia and a possible toxin. As any toxic effect on the heart muscle has to be exercised via the coronary circulation the responsible factor must be present in the blood. It was found desirable to investigate the presence of the toxin experimentally on a suitable cardiac tissue. The perfused isolated frog heart was chosen as the most suitable for this investigation. The experimental procedure was to perfuse the isolated frog hearts with certain known concentrations of blood sera of patients suffering from Ankylostomiasis and to note the results. A certain number of experiments with blood sera of normal individuals was also performed as a control.

Experimental

Cases of Ankylostomiasis with ova positive in the stools, with an anaemia showing 10–20% Hb (Sahli) and with marked cardiac damage were selected from the medical wards of the Krishnarajendra Hospital. The blood was drawn by suitable aseptic technique and collected in a dry test-tube which was given a serial number. The serum was allowed to separate out at laboratory temperature (25°–27° C.) for 24 hours after which it was pipetted out into a dry test-tube. The serum was centrifuged if it was not clear. The test-tube containing serum was stored in the refrigerator until use. The experiments were generally performed on the same day or as soon as possible. Three samples of blood were taken from each patient as follows:

Sample I . . Before treatment (ova + , Hb 10–20%).
Sample II . . After iron therapy (ova + , Hb 35% and above).
Sample III . . After anthelmintic treatment (ova − , Hb 40% and above).
Medium-sized frogs were used in making the heart preparations by exposing the hearts in pithed frogs and ligaturing all veins except the Inferior Vena Cava into which a suitable cannula was introduced. The heart was then dissected out, the cannula fixed to a stand, and the apex of the heart connected by hooks and thread to a light lever writing on a long paper kymograph. The hearts were perfused with Ringer-Locke solution for frog hearts. The apparatus was so arranged as to allow interchange between normal frog-heart solution and the solution containing known concentrations of serum. Altogether 93 sera were tested including 11 normal sera.

Preliminary experiments showed that any depressant effect on the frog-hearts by perfusing with solutions of ankylostome sera could be obtained only in great dilutions. Concentrations of 1 to $10^4$ and above caused a strengthening of beats rather than weakening. The strengthening in higher concentrations was traced to a serum effect because feeding the hearts with undiluted serum (introduced directly into the cannula) caused a great increase in the amplitude of the beats and this effect was obtained equally and constantly both with normal and ankylostome sera. In concentrations ranging from 1 in $10^6$ to 1 in $10^9$, however, the ankylostome sera produced depression of the heart beats, an effect which was not obtained or obtained only to a slight extent by normal sera in the same strengths. It was observed that in the higher concentrations the depressant effect was masked in the earlier stages of the perfusion by the predominant serum effect, but became apparent later when the serum effect had been overcome.

As a result of the experience gained in the preliminary experiments it was found desirable to try in each case the effect of (1) undiluted serum and (2) serum in different concentrations, the most suitable being 1 in $10^6$, 1 in $10^5$, and 1 in $10^4$. Control experiments were performed with normal serum in the same strengths. As a check on animal variations experiments were performed by frequently repeating the same concentrations and by using concentrations other than those mentioned above. In each case about 100–200 c.c. of serum solution was perfused so as to give sufficient time for the effect to manifest itself demonstrably before changing over to normal solution. Sufficient time was also given for the heart to recover its normal rhythm before starting the next perfusion with serum solution. Toxic effect (T) and Serum effect (S) were designated by single, double or triple + according to magnitude. Negative results were indicated by −.

Fig. 1 illustrates the difference between the effects produced by ankylostome serum (AS/25) and two normal sera (NS/2 and NS/3) when perfused in 1 in $10^6$ strength on the same heart preparation. Marked