

HAEMATOLOGICAL STUDY OF SOME COMMON ANAESTHETICS IN DOGS

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With the evolution of the art of anaesthesia, many anaesthetic agents have been discovered and workers have casually been confronted with the ill effects of various agents and have tried to study the reasons behind them.

Changes in blood were first reported by Hamberger and Ewing (3). Their study was with special reference to Nitrous Oxide. Bourne, Burger and Dreyer (1) studied the effects of Barbituric acid series of anaesthetics on the liver function tests and reported that these had very little effect on liver function though it was a common belief that they could not be administered to patients with liver disease. Working with ether, Searles (4) observed an increase in total red cell count, cell volume, haemoglobin content and thrombocyte count; a decrease in the coagulation time with contraction of spleen. The increase was reduced to half in splenectomised dogs so they inferred that spleen gave out more number of cells into the periphery during ether anaesthesia. Graca and Garst (2) studied the early blood changes following intravenous pentobarbital anaesthesia and found a drop in blood pressure, initial increase in heart rate followed by a bradycardia, initial leucopenia and erythrocytopenia which came to control values between 130 to 190 minutes. They also observed an increase in the sedimentation rate.

A study of the available literature with regards to the effect of anaesthetics on the physiology of the body reveals that the study is far from complete. An attempt has therefore been made to study haematological changes induced after the administration of some common anaesthetics used in animals for experimental purposes.

METHODS

Twentyone healthy mongrel dogs were obtained from the Municipal Corporation of Lucknow and seven each were anaesthetised with chloralose, nembutal and ether.

Chloralose and Nembutal were slowly given intravenously at the rate of 80 mg/kg and 30 mg/kg of body weight respectively dissolved in enough normal saline so as to make a 1% solution. Chloralose was given as a warm solution. Ether was given by open method.

From each of these experimental dogs 3 c.c. of venous blood was drawn from the tibial vein before giving the anaesthesia and the following tests were done on this sample which acted as control.

- (a) Hb. in Gms. % by Hellige's Haemoglobinometer
 - (b) Total red blood cell count
 - (c) Total white blood cell count
 - (d) Differential white blood cell count
 - (e) Erythrocyte sedimentation rate by Wintrobe's Method
 - (f) Packed cell volume
- } using a Neubauer counting chamber

The second sample of blood was taken immediately after the dog went under anaesthesia, the third after the dog had been under the influence of the anaesthetic for 1-2 hrs. and the last sample was taken at the time of the reappearance of the corneal reflex. The aforesaid tests were performed in all these samples. The significance of these subsequent readings was analysed with respect to the preanaesthetic readings. The results of Student's 't' test have been deduced. Values more than 2.3 were taken as significant at 0.05 probability.

RESULTS

With Chloralose: The haemoglobin content showed a progressive decrease of 16 to 35% upto the time of recovery. The erythrocyte count also showed a decrease which was not of the same degree in each dog and was not comparable to the decrease in the haemoglobin content. The white blood cell count also showed a decrease in the total count the range being from 9 to 32%. In two dogs, however, the total count rose by 15 to 23% respectively but had a tendency to come down in the final reading. In three of the animals the total count decreased further by 12 to 14% in the final reading whereas in two dogs the final reading was more or less the same as the reading taken after one and a half hours of anaesthesia. The lymphocytes had a general tendency to rise (8 to 20%) except in two dogs where there was a negligible change. In the last sample the lymphocytes decreased towards the initial reading in four dogs whereas in the other three they increased by another 4 to 8%.

The erythrocyte sedimentation rate and haematocrit showed very slight change. The E.S.R. showed a rise which had a tendency to regress to control values by the end, and in one dog went lower than the initial value. Haematocrit showed an initial increase which was followed by a fall (Table 1).

With Nembutal: The haemoglobin content showed a progressive decrease of 10 to 30% till the time of recovery except in two dogs where it had a tendency to rise towards control by about 5% in the final reading. The erythrocyte count showed a decrease from 12 to 20% for about one and a half hours after start of anaesthesia and had a tendency to go towards normal by the end except in two dogs where a further decrease was observed.

The white blood cell count decreased up to 30% of the initial after one and half hours of anaesthesia and had a tendency to go towards normal by the end except in two dogs where a further decrease was observed.

The white blood cell count decreased upto 30% of the initial after one and half hours of anaesthesia and then it showed no change till recovery.

In the differential white blood cell count a progressive lymphocytosis was observed and was at the cost of the polymorphonuclear cells.

The erythrocyte sedimentation rate had a tendency to go up during anaesthesia with a tendency to come towards control by the end. The haematocrit values showed a very slight fall (Table 2).

With Ether: The haemoglobin content showed an increase ranging between 10 to 30% during anaesthesia. This increase had a tendency to come towards the control value in four dogs; in two dogs it remained stationary at the anaesthetic reading and in one dog a further rise of 40% was observed.

The erythrocyte count showed a comparable rise of 8 to 25% which had a tendency to recover except in two dogs where a slight further increase was observed.

The white blood cells showed a progressive increase in the total count ranging from 10 to 40% during anaesthesia which tend to go down in the final reading. A polymorphonuclear leucocytosis was observed which tends to come down at the time of recovery.

In the erythrocyte sedimentation rate an insignificant change was observed and in the haematocrit a definite increase of 5 to 15% was observed (Table 3).

DISCUSSION

Chloralose produces a steady but disproportionate fall in haemoglobin percentage and R.B.C. count lasting through out the period of anaesthesia and upto the commencement of the appearance of consciousness. The decrease in haemoglobin at 1½ hour period and post anaesthetic period was found to be statistically significant (P less than 0.05) whereas the decrease in RBC Count was insignificant. This could be due to either haemodilution or to replacement of normal red blood cells in the circulation by hypochromic cells. The factor of haemodilution which can not be completely denied, appears to be least likely because of the disproportionate change produced in haemoglobin percentage, red blood cells count and haematocrit values. The fact that MCHC gradually declines throughout this period goes to confirm that there occurs a greater withdrawal of the red blood cells from the circulation than their replacement by hypochromic cells. Similar observations were also seen to occur under Nembutal, but at P 0.05 they were found to be insignificant.

Searles (4) experimenting with dogs observed a similar reduction in the cells by 20% using Sodium Amytal, another derivative of barbituric acid.

The findings of Graca and Garst (2) who worked on dogs using Pentobarbital anaesthesia also simulate the findings of present series. They observed a decrease in the erythrocytes by 16 to 17%. This level came back to normal in about two hours on an average. In this series also the final reading showed a tendency to normalcy except in two dogs where a further fall occurred. These authors have not done any statistical

analysis of their observations, and although the magnitude of change observed by these authors is similar to that observed in this study yet not much statistical significance can be attached to these results. A tendency to return to the resting values was never seen under Chloralose. This might be due to the extremely long time of appreciable recovery occurring under chloralose. At the same time it is true that to note the precise time of the appearance of the corneal reflex under chloralose is also very difficult, and apparently painless surgery can be done under chloralose anaesthesia even though corneal reflex may be present. Nembutal, though produced a fall both in Hb% and red blood cell count yet there was no appreciable decrease in the haematocrit value. This further confirms the contention that there occurs replacement of the red cells by hypochromic cells with the result that the MCHC decreased. Under ether anaesthesia there occurred a proportionate increase both in the red blood cell count and haemoglobin content. The haematocrit value also increased so that there was no appreciable change in the MCHC. In this case therefore extra normo-chromic cells seem to have been thrown into circulation. Under Chloralose and Nembutal the circulating red blood cells seem to be replaced by hypochromic cells but under ether there occurs an addition of normochromic cells. Searles (4) also observed a similar increase and found the spleen contracted. This further confirms the idea of a cellular release from a store probably spleen. The increase in cellular contents was not so marked in his series when fluids were administered intravenously. In this series no fluids were administered intravenously though oral fluids were not restricted in the preoperative period still an increase was observed but the value of P was found to be more than 0.05. However, under Chloralose and Nembutal mostly a leucopenia was observed and under Chloralose there also occurred a relative lymphopenia and eosinopenia, such a condition is usually found in states of stress when the spleen is known to respond by contraction though under these two anaesthetics the red blood cell count did not increase as was observed under Ether. On the contrary it decreased. Searles (4) however found a dilated spleen in his series of dogs under Sodium Amytal. In the present series the spleen were not examined. Nevertheless studies on blood volume change and spleen plethysmography shall throw fresh light on these problems.

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