THE COLOUR INDEX OF THE BLOOD IN DIABETIC COMA

BY

R. D. LAWRENCE, H. A. LUCAS, AND
R. A. McCANCE

(From the Pathological Department, King's College Hospital)

We have recently observed in three cases of diabetic coma an extremely high colour index, which has not to our knowledge been previously recorded. The recognized cytological changes in the blood during coma are: (1) Concentration of all the formed elements of the blood, including the plasma proteins, due to the dehydration usually present before treatment. This, *per se*, results in an increased red cell count and haemoglobin percentage, but a normal colour index. (2) A leucocytosis, often of considerable magnitude, accompanied by a shift to the left in the Schilling count, suggesting an increased activity of the bone marrow, but inadequately explained. A severe ketosis, apart from coma, may produce this latter change. The high colour indices now recorded should, if confirmed by others, be of interest to haematologists. As opportunities of studying diabetic coma are becoming increasingly rare, we hope this preliminary communication may lead others to study the blood picture when favourable opportunities arise.

These observations were made in the course of an intensive chemical study of the anuria or oliguria which sometimes occurs in diabetic coma: they will be published separately. The significance of the haematological picture was not fully appreciated at the time, and our investigations in this respect are sadly incomplete. The size of the blood cells and the Price-Jones curve were not investigated. However, the blood counts were carefully done and checked by independent observers; their general trend was indubitable. The general aspect of these coma cases is kept as short as possible as they will be fully reported elsewhere. The haemoglobin was estimated by Haldane's method.

HISTORY OF CASES

CASE I

Male, aged 52, admitted and seen for first time on November 18th, 1931, in complete coma due to omission of insulin. Severe ketosis and acidosis were present. He developed extensive gas gangrene four days later, spreading from the site of a subcutaneous saline infusion. This no doubt accentuated and prolonged the anaemia, which is always observed as the blood becomes diluted with the fluids given during treatment. Treatment: insulin, carbohydrate, and salines for the coma; no therapy for the anaemia. Complete recovery. The plasma proteins (always between 6 and 5.4 per cent.) showed no evidence of anhydraemia. The gastric acidity was normal.

Blood Counts

Date	R.B.C. Millions per c.mm.	W.B.C. Thousands per c.mm.	Hb per cent.	Colour Index
18/11/31	4.700*	—	122	1.3
26/11/31	2.300	5.200	62	1.4
4/12/31	1.900	2.400	52	1.37
9/12/31	2.080	2.800	62	1.49
14/1/32	2.752	2.800	78	1.42
18/2/32	5.000	—	94	0.94

* On admission before treatment.

CASE II

Female, aged 55, very debilitated and in complete coma due to the prolonged omission of insulin. Treatment: as in Case I. The ketosis was removed within twenty-four hours. The first blood count was not done until fourteen hours after

admission. On the first day the plasma proteins were 6.5 per cent., and later fell to the constant figure of 5.8. Complete achlorhydria after histamine was present.

Blood Counts

Date	R.B.C. Millions per c.mm.	W.B.C. Millions per c.mm.	Hb per cent.	Colour Index
22/2/32	4.420	—	100	1.14
25/2/32	2.800	—	90	1.6
27/2/32	3.540	—	94	1.54
7/3/32	3.020	—	70	1.16
14/3/32	2.750	—	60	1.09
28/3/32	3.100	—	52	0.83

CASE III

Female, aged 60, seen for first time in profound coma due to prolonged omission of insulin. Treatment: as in the other two cases, except that bicarbonate was given. Dehydration and ketosis were rapidly removed, but death from circulatory collapse took place thirty-six hours later. Necropsy showed chronic myocardial degeneration and renal sclerosis. She showed the leucocytosis frequently present in severe ketosis. The halometer reading was 4.3 per cent., suggesting megalocytosis.

Blood Counts

Date	R.B.C. Millions per c.mm.	W.B.C. Thousands per c.mm.	Hb per cent.	Colour Index
27/4/32	3.79	23.8	86	1.14
28/4/32	2.636	17.8	65	1.19

DISCUSSION

Since we have begun to study the complete blood count in coma three successive cases have shown a high colour index, and two have been extremely high. This high index has persisted in two cases for a considerable time and through considerable variations in the total count, but has returned to normal without any specific therapy.

The immediate explanation of the high index would seem to lie in a true megalocytosis. Diabetic dehydration would not *per se* affect the index, nor would the increased water content and swelling of the red cells in acidosis. Unfortunately our observations do not include any reliable study of the size of the red cells, which we hope may be undertaken by ourselves and others as such cases occur.

The ultimate explanation of a true megalocytosis, if such occurs, is at present speculative, but is probably to be referred to a change in the activity of the bone marrow. This view is supported by the leucocytosis that frequently occurs in severe ketosis, from which we know that the bone marrow is certainly affected by acetone bodies. The leucocytosis is rapid, but changes in the red cell picture are probably more slowly produced. Perhaps it may be observed initially only when the patients, as these did, have progressed slowly into coma, giving the exciting cause time to act. The persistence of the high colour index in our cases suggests that the disappearance of the abnormality is also a slow process. A search of the existing literature has not disclosed any records of such high indices in diabetic coma or in conditions of non-diabetic dehydration and acidosis. Asche, however, records a slightly high index in some cases of renal failure, presumably with acidosis.

We are indebted to different members of the pathological department, King's College Hospital, for various emergency blood counts, and to Dr. L. J. Witts for his critical interest and assurance that this blood picture is new to haematology.

¹ Asche, B.: *Arch. Int. Med.*, 1924, xlv, 506.