Minimal criteria for the diagnosis of megaloblastic anaemia of pregnancy

I. RANNIE AND H. McTAGGART

From the Department of Pathology, King's College, University of Durham, and Royal Victoria Infirmary, Newcastle upon Tyne

SYNOPSIS The routine examination of buffy coat films is a valuable diagnostic aid to screening large numbers of specimens of blood and is applicable to hospital and general practice, provided that a bottle of sequestrinated venous blood can be examined in the laboratory within 24 hours.

The diagnosis of folic-acid deficiency anaemia of pregnancy can be made, in many cases, before the appearance of megaloblasts in the peripheral blood by finding macrocytes, polylobing of polymorphonuclear leucocytes, and 'out of step' haemoglobinization of normoblasts in the buffy coat film.

Accurate haemoglobin estimations at intervals throughout pregnancy, and particularly in the last three months, are an important and in some cases essential part of ante-natal care. Any haemoglobin found to be below 75% (11.1 g.%) should be followed by the examination of a series of buffy coat films while the anaemia is being treated.

It has been shown (Goodall, 1957) that an accurate diagnosis of megaloblastic anaemia of pregnancy can be made by examining films made from the buffy coat layer of centrifuged peripheral blood. Goodall's series was controlled by concurrent sternal marrow examination and he concluded that, although marrow examination was slightly more sensitive than the buffy film, the buffy film alone could supply the necessary information in most cases without subjecting the patient to the discomfort of a marrow puncture.

In this investigation an attempt has been made to discover the minimal information required for a diagnosis of megaloblastic anaemia of pregnancy, and so a record was kept of the haemoglobin, the reticulocyte count, the packed cell volume, and the appearance of the buffy coat film stained by the Leishman method.

The diagnosis of megaloblastic anaemia was not made until megaloblasts appeared in the peripheral blood but we now believe that the diagnosis can in fact be established before this time by taking into account the other haematological appearances and all relevant clinical findings.

Received for publication 10 December 1960.

MATERIALS AND METHODS

The examinations were carried out on venous blood taken from pregnant women at the ante-natal clinic or in the wards of the Princess Mary Maternity Hospital, Newcastle upon Tyne, over a period of 21 months, from November 1958 to July 1960 inclusive.

All the women in the series were delivered in the hospital although not all of them had received ante-natal care at the hospital clinic.

Specimens were collected in universal containers with Sequestrin (diamino-ethane-tetra-acetic-acid-dipotassium salt) as anticoagulant, and in most cases were not received in the laboratory until the following day, having been stored overnight either at room temperature or 4°C. and then transported by van.

When the blood specimen was received the haemoglobin was estimated by a cyan-methaemoglobin method using a modified Drabkin's solution (King and Wootton, 1956). If this was 75% (11.1 g.%) or below, or if the case was already being followed, the reticulocytes and packed cell volume were estimated and a buffy coat film was made.

The packed cell volume was estimated using a Hawksley micro-haematocrit centrifuge, after which the capillary tube containing the blood was cut and the buffy coat and some of the underlying red cells were used to make a smear which was stained with Leishman's stain and examined under a film of oil. We found that a buffy coat
film made in this way was a good representative sample of all the cells in the peripheral blood.

When examining the film several factors relating to the red cells and white cells were considered and recorded as being present or absent. No attempt was made at a quantitative estimation.

RED CELLS  The red cells were examined for anisocytosis, polychromasia, macrocytosis, Howell-Jolly bodies, and nucleated forms. The nucleated forms were further divided into normoblasts, megaloblasts, and cells in which the degree of haemoglobinization was in advance of nuclear maturation. These are referred to as ‘out of step’ normoblasts. Only nucleated red cells with some degree of haemoglobinization were considered (Goodall, 1957).

WHITE CELLS  White cells were examined for the presence of polylobing (hypersegmentation) of the nuclei of neutrophil polymorphonuclear leucocytes or giant forms of metamyelocytes and polymorphonuclear leucocytes. Hypersegmentation was taken to mean six or more clearly defined lobes in the nucleus.

RESULTS

In the 21 months covered by the survey there were 3,741 births at the maternity hospital, and of that number 45 of the patients were diagnosed as having megaloblastic anaemia during or immediately after their pregnancy. Of the 45 patients, 38 had a single delivery including one who delivered a hydatidiform mole. Five had twin deliveries and two had triplets. Most of the patients were multiparous but nine of them were experiencing their first pregnancy and eight were pregnant for only the second time.

The maternal ages ranged from 21 to 44 years.

It will be seen from Fig. 1 that the haemoglobin level at the time of diagnosis was most commonly between 55% and 60% (8.1 and 8.9 g.%). In only one case was the haemoglobin over 75% (11.1 g. %); this estimation was made after a blood transfusion and gives a wrong impression.

Fig. 2 indicates the time of diagnosis in relation to parturition and it is shown that all the cases except one were diagnosed in the last trimester of pregnancy or the first week of the puerperium. The diagnosis made at 19 weeks was that in the case of molar pregnancy referred to previously. Twenty-two of the cases were diagnosed on the first occasion that a buffy coat film was examined.

ILLUSTRATIVE CASES

CASE 32 (MRS. M. W.)  This patient was 29 years old and in her fourth pregnancy. She was found to have megaloblasts in a buffy film at the thirty-third week of pregnancy on the first occasion that a film was examined (Fig. 3).

![Fig. 1. Histogram showing the haemoglobin level in the individual cases at the time of diagnosis. (Hb 100% = 14.8 g./100 ml.)](http://jcp.bmj.com/)

![Fig. 2. Diagram illustrating the relationship between megaloblastic anaemia of pregnancy and the week of pregnancy in which it was diagnosed.](http://jcp.bmj.com/)

![Fig. 3. The time scale is in days post partum so that the minus sign indicates days ante partum. O.S. = Normoblasts with haemoglobinization in advance of nuclear maturation.](http://jcp.bmj.com/)
She was treated with folic acid orally and by the time she reached her thirty-ninth week, the haemoglobin was 76% (11.3 g.%). Shortly after delivery it was 80% (11.8 g.%). No blood transfusion was required and there was no complication.

CASE 4 (MRS. E. A.) This patient, like the last, was 29 years old and in her fourth pregnancy. During the series it was found in several cases that the megaloblastic picture appeared after a course of intramuscular or intravenous iron injections. In this case (Fig. 4) a course of Imferon injections was followed by the appearance of megaloblasts in a specimen taken before delivery on the day of delivery. In spite of the Imferon the haemoglobin level had dropped slightly and the reticulocyte count remained at 1%. The anaemia was later treated with oral iron and folic acid.

CASE 39 (MRS. D. M.) This patient was 27 years old and was in her fourth pregnancy. On the first occasion that a buffy film was examined, more than six weeks before delivery, her blood picture was one which we came to recognize later as typical of folic-acid deficiency anaemia (Fig. 5). No megaloblasts were seen but the film showed macrocytes, polylobing of polymorphonuclear leucocytes, and 'out of step' haemoglobinization of normoblasts. During a course of Ferriovenin megaloblasts appeared, but only four days before the delivery and when the haemoglobin was 60% (8.9 g.%).

CASE 34 (MRS. C. W.) This patient is included as representative of the group of nine primiparae. She was 23 years old and was diagnosed in the first week post partum after having had a transfusion of 2 pints of blood at delivery. However, it is again seen that macrocytes, polylobing, and 'out of step' haemoglobinization were present in the peripheral blood a month earlier (Fig. 6) so that a diagnosis could have been made at the time.

There was one maternal death in our series of 45 patients. A woman of 21, who was pregnant for the first time, was admitted as an emergency with a fulminating pre-eclamptic toxaemia and died 12 days after delivery in renal failure, with a haemoglobin level of 35% (5.2 g.%). At necropsy it was considered that megaloblastic anaemia had played a part in the death.

DISCUSSION

While examining buffy films it became clear that folic-acid deficiency anaemia of pregnancy could be diagnosed, in many cases, before the appearance of megaloblasts in the peripheral blood. The presence of macrocytosis, polylobing of neutrophil polymorphonuclear leucocytes, and 'out of step' haemoglobinization of normoblasts was followed, in the absence of treatment with folic acid, by the full megaloblastic picture.

The advantage of using the other criteria when

---

**FIGS. 4, 5, AND 6.** The time scale is in days post partum so that the minus sign indicates days ante partum. O.S. = Normoblasts with haemoglobinization in advance of nuclear maturation.
Minimal criteria for the diagnosis of megaloblastic anaemia of pregnancy

The July 1961 Issue

The July 1961 issue contains the following papers:

- Studies on the folic acid activity of human serum by A. H. Waters and D. L. Mollin
- Conventional voltage electrophoresis for formimino-glutamic acid determination in folic acid deficiency by J. Kohn, D. L. Mollin, and L. M. Rosenbach
- The urinary excretion of assayable vitamin B₁₂ and radioactivity after parenteral ¹⁴Co B₁₂ in man by J. F. Adams
- A suggested schedule for the rapid investigation of acute haemostatic failure by G. J. C. Ingram
- Studies on the blood lipids and lipoproteins in thalassaemia and sickle cell anaemia by C. Choremis, V. Kyriakides, and E. Papadakis
- Hereditary elliptocytosis in two Maltese families by J. L. Grech, E. A. Cachia, F. Calleja, and F. Pullicino
- The significance of Howell-Jolly bodies and giant metamyelocytes in marrow smears by D. W. Dawson and H. P. R. Bury
- The rate of blood loss from skin punctures during the Iby bleeding time test by M. L. N. Willoughby and M. J. Allington
- Methicillin-resistant staphylococci by Mary Barber
- Coccidiosis in guinea-pigs by P. A. Ellis and A. E. Wright
- Rapid isolation of salmonellae from faeces by J. M. S. Dixon
- The estimation of magnesium in small biological samples by flame spectrophotometry by R. D. Montgomery
- The determination of magnesium in biological materials by flame photometry by J. K. Fawcett and V. Wynn
- Plasma magnesium in health and disease by Samir Hanna
- A sensitive method for the colorimetric determination of urea by R. N. Beale and D. Croft
- The use of tetramethylammonium hydroxide in the Zimmermann reaction by V. H. T. James and Mary de Jong
- Laboratory studies with the systemic trichomonacide by R. F. Jennison, P. Stenton, and Leslie Watt
- Paper tests for occult blood in faeces and some observations on the fate of swallowed red cells by R. G. Huntsman and J. Liddell

Technical methods

- Quantitative determination of A₂ haemoglobin by paper electrophoresis using tris buffer by R. T. S. Jim
- A method of rapid Rh typing employing the capillary tube technique and papainized incomplete anti-D sera by B. E. Gilbey
- The rapid slide agglutination test in the diagnosis of typhoid fevers and typhus by B. Z. Werbin and A. Kashner
- Haemoglobinometry by an automatic analytical procedure by M. G. Nelson and A. Lamont
- Improvement of the uric acid determination by the carbonate method for serum and urine by F. Eichhorn, S. Zelmanowski, E. Lew, A. Rutenberg, and B. Fanias

Book reviews

Copies are still available and may be obtained from the Publishing Manager, British Medical Association, Tavistock Square, W.C.1, price 17s. 6d.
Minimal criteria for the diagnosis of megaloblastic anaemia of pregnancy
I. Rannie and H. McTaggart

*J Clin Pathol* 1961 14: 536-539
doi: 10.1136/jcp.14.5.536

Updated information and services can be found at:
http://jcp.bmj.com/content/14/5/536

**Email alerting service**
Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

**Notes**

To request permissions go to:
http://group.bmj.com/group/rights-licensing/permissions

To order reprints go to:
http://journals.bmj.com/cgi/reprintform

To subscribe to BMJ go to:
http://group.bmj.com/subscribe/