Haemoglobin estimation in general practice

R. H. MORGAN, M.D., M.R.C.G.P.
Cambridge

SYDENHAM wrote " And so Hysterical Diseases are most commonly cured . . . but especially a Chlorosis, or Virgin's pale colour. I order some Chalybeate Remedy to be taken . . . for it raises a Volatile Ferment in the Vapid and Languid Blood, whereby the weak Spirits are raised . . . for as often as Steel is given in the Green-sickness, the Pulses are manifestly greater and quicker . . . and the pale and dead Countenance is changed and becomes fresh and lively". (Sydenham 1705)

He recognized chlorosis as a condition responding to iron but he also classed under hysteria a variety of symptoms and conditions, some possibly neurotic, but many now known to be organic in origin. This difficulty in differentiating between symptoms due to anaemia and those due to other conditions still exists (Beutler 1959). Wood and Elwood (1966) have recently stated that "no convincing evidence was found to support the view that symptoms are related to the haemoglobin level". It is not possible to decide by clinical examination whether a patient is anaemic unless the degree of anaemia is considerable (McAlpine 1957, French 1958, Rees 1969, Wood and Elwood 1966). It is essential for a general practitioner to have some accurate method of haemoglobin estimation easily available to him. This means that the apparatus must be in the surgery premises. If blood or patients have to be sent to a central laboratory, then the tendency is for the doctor not to bother himself or the patient, unless it seems really necessary. It is not possible to diagnose anaemia by inspecting the mucosae, and unless a sample of blood is examined then many cases will be missed. This is particularly true of the elderly where a stagnant peripheral circulation may conceal quite a profound anaemia.

As a screening procedure in general practice, blood from a finger prick is quite satisfactory. Although a venepuncture may be theoretically preferable, it takes more time and trouble than a finger prick, and will therefore be done less frequently. There are differences between capillary and venous blood but these are not great and are of little clinical importance in general practice (Haldane 1899, Lund 1951, Price Jones 1935, Bruckman 1941, Mackay 1931, M.R.C. 1945, Dreyer 1920, Andersen 1938).

It has been stated by some that finger prick samples are variable and innaccurate (Gibson 1909, Lund 1951) and that squeezing will produce erroneous results (McAndrew 1965). This has not been found by other workers (M.R.C. 1945, Bruckman 1941). As far back as 1887 Lloyd Jones stated that, although constriction of a finger produced a rise in specific gravity, there was "no important rise in the specific gravity of the blood by introducing the needle into the skin at the side of the nail and simply squeezing the parts quickly by the fingers of the operator" and that "if the skin does not become anaemic from the cold, no change in the specific gravity of the blood is found to occur". This is certainly true in clinical practice, where a finger that is white with Raynaudism may not bleed at all. If, however, there is no visible abnormality of the circulation, then results obtained from a finger prick seem to be reliable and consistent.

An EEL Colorimeter has been used in the author's practice for the past six years and has proved very satisfactory. It was chosen because of the author's previous experience with the machine and its wide use in hospital laboratories and other surveys (EEL, Kilpatrick 1961, Taylor 1969). It is preferable to have a photoelectric instrument. The visual matching of colour tones required by other machines, such as the Grey

Wedge and AO Spencer Haemoglobin meter, can be trying when the operator is busy, and an automatic machine is also more reliable when used by ancillary staff.

The EEL uses cylindrical curettes in the shape of a small test-tube to hold the specimen of diluted blood. These can be filled in batches and closed with a rubber bung, so that the dilution of the blood may be made directly in the curette. This is a distinct advantage of the EEL photometer which is not found in other instruments that use square curettes or chambers of special shapes, and enables a number of samples to be examined in succession with a minimum amount of manipulation. The tubes are supplied in matched sets by the manufacturers, although it is wise to check that all the tubes give the same reading, before taking them into use. The tubes are filled with 4 ml of ammoniated distilled water. A number of tubes can be filled and corked at the same time and may be kept on the bench indefinitely. They may also be carried in a bag or in a waistcoat pocket when out visiting. The blood is drawn up into a 20 cu mm Sahli pipette and then washed out into diluent. The galvanometer needle is adjusted to read zero with a tube of plain diluent in position using an Ilford 625 filter. The tube of plain water is replaced by the blood sample and the galvanometer reading can be made immediately. The solution of blood used is in the form of oxyhaemoglobin which is a stable pigment (McFarlane 1948). The diluted blood will show no change if kept for a day or two. There is no need to use the more sophisticated cyanmethaemoglobin solution used in international standards. The use of distilled water is more convenient than a cyanide diluent and there is no time lag before the specimen can be examined. The machine can be calibrated by using bloods of known strength, which can usually be obtained through the courtesy of a nearby haematology laboratory, or by using the Neutral Grey standard solution intended for standardizing the Grey Wedge Photometer (Keelers Ltd). The machine itself appears to be robust and has given no serious trouble while in use. Occasionally the galvanometer needle does not give a stable reading, but on all occasions so far this has been due to a lamp bulb not securely screwed in, or lamp filament that is burning out. It is also useful to have a 4 ml automatic pipette for filling the tubes (E-mil Ltd). This not only saves time, but means that the tubes can be filled by untrained staff. A few drops of ammonia are added to the reservoir of distilled water when it is filled, in order to haemolyse the blood sample. The Sahli pipettes are cleaned by sucking water through them, and then acetone followed by air for a few moments to dry them. It is convenient to have a laboratory tap and suction pump for this. Sterile disposable stylets for pricking fingers avoid the risk of transmitting hepatitis (Steriseal Ltd, Armour Ltd).

Disposable 20 cu mm capillary tubes have recently become available, (Harshaw Ltd, Gallencamp Ltd) and, although the running costs of using them are higher than those of conventional Sahli pipettes, they obviate the need for cleaning and the inconvenience of providing a suction pump. Blood is taken up into the capillary. This is then snapped off at the calibration mark and the tube dropped into the curette of diluent. The presence of the capillary tube in the curette makes a slight, but insignificant, difference to the galvanometer reading. This is a very useful technique for use when out visiting, but is rather expensive for routine work.

Until recently each member of the partnership has been in the habit of taking blood himself, making the dilution in the consulting room and walking a few paces to the treatment room to read the result. The nurse is responsible for cleaning the Sahli pipettes and tubes and refilling them ready for use. It saves time to have sufficient glassware to allow several day's cleaning and refilling to be done at one session. The next development will be for the nurse herself to take blood and perform the haemoglobin estimation herself, reporting back to the doctor when this falls below a level of 12 G per cent. This has now begun to take place in our own practice, but not to any great extent, because in many cases it is simpler to estimate the haemoglobin oneself

than to issue intructions for the nurse to do it.

Iron deficiency is by far the commonest cause of anaemia in general practice and other types of anaemia occur relatively infrequently. In some cases the iron deficiency is due to blood loss and is usually associated with gastro-intestinal symptoms or menorrhagia which will prompt further investigations. However, in the majority of cases there is no obvious cause for the anaemia. This is also the finding in many other surveys. It is reasonable, therefore, to treat anaemia empirically with oral iron. This is widely done in general practice and appears to be an economical and safe procedure (Kilpatrick 1969). One may well follow French's advice that any haemoglobin level that has not returned to normal after six weeks on oral iron requires further investigation (French 1960) and, as Scott has pointed out, a patient treated with parenteral iron may show a significant rise in the haemoglobin level after a week or ten days. This compares favourably with the four or five days that may elapse before the results of more elaborate investigations are returned from the laboratory (Scott 1956).

It is the author's practice to follow these precepts, and although when patients present with anaemia a failure to respond to empirical treatment has led to a diagnosis of organic disease, there have been no cases in the author's experience where any harm has arisen by handling a case in this way. In many cases the recognition of the fact that a patient was anaemic has led to a diagnosis of an underlying serious disease more quickly than would otherwise have been the case. Far more serious consequences have arisen from a failure to recognize that a patient is anaemic at all, and a haemoglobin estimation has not therefore been made until late in the disease.

At present with a practice of 11,000 patients and four doctors we are doing an average of 23 haemoglobin estimations a week. It is hoped that when more is delegated to the nurse we shall be more efficient at screening for new cases and supervising the treatment of patients, both with iron deficiency and other types of anaemia.

REFERENCES

Andersen, M. I., and Mugrage, E. R. (1938). *American Journal of Clinical Pathology.* **8,** 46.
Beutler, E. (1959). *Annals of Internal Medicine.* **50,** 313.
Bruckman, G. (1941). *Journal of Laboratory and Clinical Medicine.* **27,** 487.
Dreyer, G., Bazett, H. C., and Pierce, H. F. (1920). *Lancet.* **2,** 588.
French, D. G. (1958). *British Encyclopaedia of Medical Practice.* Interim Suppl. **190,** 2.
French, D. G. (1960). *Postgraduate Medical Journal.* May, 331.
Gibson, A. G. (1909). *Quarterly Journal of Medicine.* **3,** 52.
Haldane, J., and Smith, J. L. (1899). *Journal of Physiology.* **25,** 332.
Kilpatrick, G. S., and Hardisty, R. M. (1961). *British Medical Journal.* **1,** 778.
Kilpatrick, G. S. (1969). The early diagnosis of anaemia. London. Office of Health Economics.
Lund, C. J. (1951). *American Journal of Obstetrics and Gynaecology.* **62,** 948.
Lloyd-Jones, E. (1887). *Journal of Physiology.* **8,** 1.
Mackay, H. (1931). MRC Special Report No. 157. *Nutritional anaemia in infancy.*
M.R.C. (1945). Special Report Series. No. 252. *Haemoglobin levels in Great Britain.* 97.
McAlpine, S. G. *et al.* (1957). *British Medical Journal.* **2,** 983.
McAndrew, G. M., Ogston, D., and Palmer, K. N. V. (1965). *Lancet.* **1,** 207.
McFarlane, R. G. (1948). *Lancet.* **1,** 282.
Price Jones, C. (1935). *Journal of Pathology and Bacteriology.* **40,** 503.
Rees, E. G., Moore, R. M. A., and Wycherley, P. A. (1969). *Journal of the Royal College of General Practitioners.* **17,** 155.
Scott, J. M. (1956). *British Medical Journal.* **2,** 635.
Sydenham, T. (1705). *The Whole Works of that Excellent Practical Physician Dr Thomas Sydenham.* London. R. Wellington. Fourth edition. Corrected from the original Latin by John Peachey M.D.
Taylor, A. J. and Gill, G. M. (1969). *Journal of the Royal College of General Practitioners.* **17,** 91.
Wood, M. M., and Elwood, P. C. (1966). *British Journal of Preventive and Social Medicine.* **20,** 117.