Current Practice

NEW APPLIANCES

Clinical Haemoglobinometry: an Evaluation of a Modified Grey-wedge Photometer

Dr. S. M. LEWIS, senior lecturer in haematology, Postgraduate Medical School of London, and Dr. S. J. CARNE, general practitioner, London W.12, write: Many methods have been devised to try to develop a rapid and simple technique for estimating haemoglobin in general practice and in field surveys. In the laboratory the haemoglobin content of blood is usually measured by photoelectric colorimetry, but general practitioners and others without immediate access to a laboratory are not likely to have facilities for this method, which requires a relatively elaborate piece of equipment. The alternative is a visual method.

In general, visual methods which depend upon the matching of the colour of the blood (diluted or undiluted) with that of a coloured solution or glass standard are unreliable. It is preferable, in a visual method, to match light-intensity. The M.R.C. grey-wedge photometer was developed in order to match the density of light transmitted by a diluted blood sample against the light transmitted in an adjacent half-field by a rotating grey-wedge which had been calibrated as the equivalent of an oxyhaemoglobin standard (King *et al.*, 1948). In careful hands results could be obtained which were comparable with photoelectric methods (Macfarlane *et al.*, 1948 ; King *et al.*, 1951). The photometer was subsequently manufactured commercially by Keeler Optical Products Ltd. While it has undoubtedly proved of value in clinical use, the need for an instrument which is realistically portable, is reasonably priced, and which meets the requirements for haemoglobinometry of the International Committee for Standardization in Haematology (1965) had led to a modification of the original grey-wedge photometer.

The M.R.C. photometer estimates haemoglobin from 4 to 22 g./100 ml. By reducing the range of the grey-wedge to between 6 and 16 g./100 ml. it was possible to produce a simplified instrument, at half the cost, without any reduction in its accuracy, and small enough (approximately 16 by 6 by 6 cm.) to be truly portable. Illumination is by two flashlight batteries (type 1LP). The instrument has been named the Haemoscope. It seems likely that a patient whose haemoglobin is outside the narrower range will usually be investigated further by a haematologist with laboratory facilities, and in any event the Haemoscope can be used for accurate estimation of haemoglobin beyond this range by an appropriate alteration of the dilution of the blood.

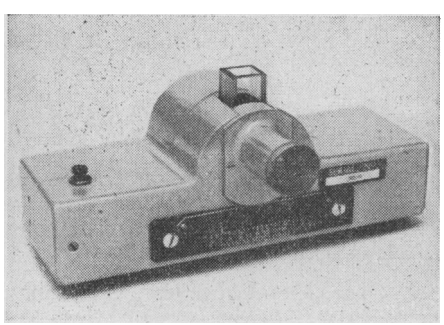

FIG. 1.—Prototype model of Haemoscope. (×⅓ approx.)

The Haemoscope has been constructed with two independent scales for use with blood diluted 1 in 200 as oxyhaemoglobin or cyanmethaemoglobin. To avoid confusion only one of the scales is visible at any one time, the other being covered by a removable plate (Fig. 1). The scales are precalibrated to conform to the cyanmethaemoglobin reference standard of the I.C.S.H., and the individual user is able to ensure that the scale calibrations are correctly aligned for him by the reading he obtains on the oxyhaemoglobin or cyanmethaemoglobin scale with a neutral glass standard or a cyanmethaemoglobin standard solution, respectively. Results are read directly as haemoglobin content in g./100 ml.

The purpose of this report is to describe a laboratory trial and to evaluate the Haemoscope for clinical haemoglobinometry.

The Haemoscope used for this study was a prototype manufactured by Keeler Optical Products Ltd. For the laboratory trial venous blood collected into E.D.T.A. (ethylenediamine tetra-acetic acid) was used. The blood was diluted 1 in 200 in 0.04% ammoniated water or in cyanide-ferricyanide solution. In the latter case the diluted blood was allowed to stand for 10 minutes at room temperature, and the solutions were then read on the Haemoscope by a single observer. The measurement recorded was the mean of three consecutive readings. When the scale reading was 16 g./100 ml. or apparently greater the blood was diluted 1 in 400 and the result corrected accordingly.

Results were compared with those obtained by the orthodox cyanmethaemoglobin method, read on a Unicam SP1300 colorimeter against a standard which conformed to the international reference standard.

In the field trial haemoglobin determinations were carried out by a single observer on patients seen in general practice. The diluent used was 0.04% ammoniated water, and the results obtained with the Haemoscope were compared with those obtained by a standard M.R.C. grey-wedge photometer.

Comparison of results of haemoglobin measurements as cyanmethaemoglobin by Haemoscope and photoelectric determinations is shown in Fig. 2. Two hundred blood samples were measured ; it can be seen that no results were more than ±10% different, and that in 90% of the measurements the results did not differ by more than ±5%.

Similar comparison was made of results of haemoglobin measurements as oxyhaemoglobin by Haemoscope, and photoelectric

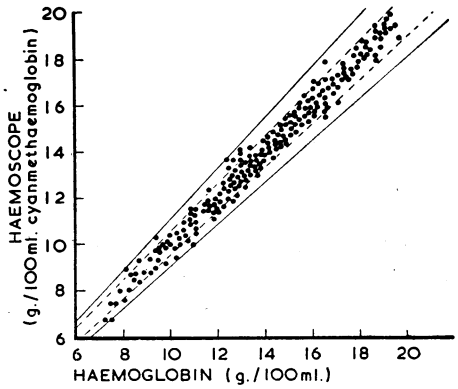

FIG. 2.—Correlation of haemoglobin measurements (as cyanmethaemoglobin) by Haemoscope and by photoelectric colorimeter. The interrupted lines indicate a variance of ±5%, and the continuous lines a variance of ±10% from the line of perfect agreement.

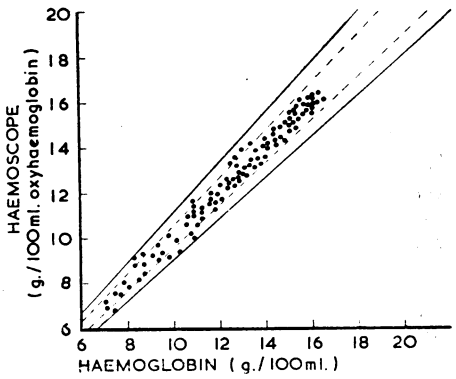

FIG. 3.—Correlation of haemoglobin measurement by Haemoscope (as oxyhaemoglobin) and by photoelectric colorimeter (as cyanmethaemoglobin). The interrupted lines indicate a variance of ±5%, and the continuous lines a variance of ±10% from the line of perfect agreement.

Consecutive Readings on Haemoscope, by Different Observers, of Blood Diluted 1:200 *(as Oxyhaemoglobin)*

Sample	1	2	3	4	5
Haemoscope readings	9·3	7·5	15·4	6·4	13·4
	9·2	6·9	15·8	6·0	14·2
	9·4	7·2	15·5	6·2	14·0
	10·0	7·6	15·5	6·2	13·8
	9·0	7·6	15·9	6·0	14·8
	9·9	7·7	16·0	6·4	13·2
	9·5	7·2	15·8	6·6	13·6
	9·2	8·2	15·8	6·0	13·8
	9·7	7·5	14·8	6·3	13·8
	9·4	7·5	15·3	6·0	13·5
	9·5	6·8	15·2	6·0	13·8
Mean	9·4	7·4	15·5	6·2	13·8
S.D.	0·31	0·39	0·36	0·21	0·43
Laboratory determination (by photoelectric colorimeter) as cyanmethaemoglobin ..	9·4	7·7	15·2	6·0	13·8

determination as cyanmethaemoglobin. The results in 100 samples of blood (Fig. 3) were similar to those in the previous comparison.

In order to determine whether there was any significant variation in readings by individual observers, a single dilution of a blood sample was read consecutively by a number of persons, some of whom were experienced and others who had little or no previous experience of visual photometry. The results are recorded in the Table

The field trials were mainly concerned with the practicability of the Haemoscope in use. The diluted sample was either measured first with the Haemoscope and then with the M.R.C. grey-wedge photometer, or vice versa. In no case was there a difference between the two methods greater than 1 g./100 ml.

In its present form the instrument includes modifications that were introduced after an initial trial. It appears to serve its purpose admirably, and is consistently reliable even in the hands of inexperienced users.

We are indebted to Mr. R. B. Sisson, of C. Davis Keeler Ltd., for his co-operation, and for making the Haemoscope available for this study.

REFERENCES

International Committee for Standardization in Haematology (1965). *Bibl. haemat.* (*Basel*), Fasc. 21, p. 213 ; *Brit. med. J.*, **1**, 645.

King, E. J., *et al.* (1948). *Lancet*, **2**, 971.

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ANY QUESTIONS ?

We publish below a selection of questions and answers of general interest.

Early Diagnosis of Herpes Zoster

Q.—*Is it possible to diagnose herpes zoster before the appearance of a rash ?*

A.—There are no distinctive signs and symptoms which make it possible to diagnose herpes zoster before the rash. There may be a certain amount of pain and irritation shortly before the rash appears, but it cannot be relied upon as a diagnostic sign.

Storage of Sterile Instruments

Q.—*What is the best solution in which to store sterilized instruments so that they are available for immediate use ?*

A.—There is no suitable solution for the storage of sterile instruments. The disinfectants used in the past do not kill all organisms and spores, and in some bacteria (notably the Pseudomonas group) can multiply even in quite strong solutions.[1 2]

Cutting instruments and needles can be sterilized by dry heat at 160° C. for one hour, and other instruments by the same method or by autoclaving, all being suitably packed to remain sterile until required for use. Instruments which are damaged by such treatment can be sterilized just before use by chemical disinfection. Immersion for two minutes in 0.5% alcoholic chlorhexidine solution or for fifteen minutes in 2% aqueous glutaraldehyde, followed by rinsing in sterile water, are effective methods.[3]

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2 Report by Public Health Laboratory Service Committee on Testing and Evaluation of Disinfectants, *Brit. med. J.*, 1965, **1**, 408.
3 Rittenbury, M. S., and Hench, M. E., *Ann. Surg.*, 1965, **161**, 127.

Crude Coal Tar in Psoriasis

Q.—*Is the treatment of psoriasis with crude coal tar ointment effective, and how is it carried out ?*

A.—Treatment of psoriasis with crude coal tar ointment is effective, but usually not as speedily as with dithranol pastes. However, sometimes patients who no longer respond to dithranol may benefit from a change to tar ointments or pastes. The main disadvantages of tar are its smell and the messy appearance it gives to the patient's skin and clothing.

There are a number of treatment regimens, of which the following is a useful example. The patient has a hot bath (100 litres) to which are added 100 ml. of liquor picis carbonis. As many scales as possible are gently removed and the patient is then exposed to ultra-violet irradiation, a gentle transient erythema (so-called first-degree erythema) resulting during the following 24 hours. Exposure to the carbon arc or mercury-vapour lamp is followed by the thorough application of 5–10% crude coal tar in Lassar's paste or petrolatum. The treatment can be repeated once or twice during the day, but ultra-violet irradiation is usually given only once each day.

Crude coal tar applications to the scalp are unacceptable to most patients, but the following tar pomade is effective without being messy:

Liq. picis carb., 6%
Salicylic acid, 2%
Tween "20," 1%
Ung. emulsificans ad 100.

If patients develop an irritant skin reaction to tar it is unwise to persevere with it even in lower concentrations.

Vaccination and Eczema

Q.—*A boy now aged 7 was successfully vaccinated against smallpox in infancy. Since the age of 5 he has had two or three outbreaks of small, localized patches of eczema which have responded to treatment. His sister aged 2½ should be vaccinated, and another 8-month-old sister will need to be fairly soon. Neither of the girls shows any signs of eczema, although there is a fairly strong family history of it. What is the risk to the boy, and is the risk justified ? What precautions could be taken to protect him from any untoward results ?*

A.—There is some risk, however small, of eczema vaccinatum from vaccination, deliberate or accidental, in any individual with minimal eczema, and even after eczema has clinically cleared. To assess the risk numerically it would be necessary to know what proportion of the total population is eczema-prone, including even to the mildest transient attacks, and how many of this "population at risk" have been exposed to contact with vaccinia. I am not aware of a published comprehensive survey of this kind, but there are, however, a number of very informative papers on this subject, including those by Mande *et al.*,[1] and Copeman and Wallace.[2]

The boy aged 7 has been effectively vaccinated only in infancy, and his immunity to smallpox must now be doubtful. If he is not likely to travel abroad where a vaccination certificate is mandatory the low risk of contracting smallpox in this country probably does not justify vaccinating him while he still has active eczema. If vaccination is essential now it should be undertaken only with the following precautions. Intensive treatment of his eczema should be carried out and any remaining localized areas should be covered with an occlusive dressing like a "Cortacream" bandage. Vaccination should be done as far away as possible from sites of persisting eczema, and as soon as the vaccine has dried into the scarified skin a non-adherent dressing should be applied to the vaccination site, and it should be kept covered with a dressing and crêpe bandage for the entire duration of the reaction—i.e., until the skin has soundly healed. As an added precaution immune gamma-globulin may be given.

So far as the boy's sisters are concerned, it is impossible to foretell with certainty whether they are likely to develop eczema, but in its absence their own risk of developing eczema vaccinatum is probably negligible. If they are being vaccinated their vaccination sites should be kept covered as described to prevent accidental vaccination of their elder brother's eczema.

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1 Mande, R., Thermond, Cl., and Donat, N., *Ann. Pédiat.*, 1962, **9**, 83.
2 Copeman, P. W. M., and Wallace, H. J., *Brit. med. J.*, 1964, **2**, 906.

Giles–Archer Test for Colour Vision

Q.—*What is the Giles–Archer test for colour vision which helps to determine whether a person can interpret such things as colour-coded electrical wires ?*

A.—The Giles–Archer test[1] consists of a lantern with different coloured filters and three apertures. A person with normal colour vision can name all the colours