Many, if not all, examples of this syndrome described in the past as being due to tuberculosis (e.g., Garland and Thompson, 1933) would probably now be classified as examples of sarcoidosis, while a study of the clinical features of those ascribed to syphilis leaves the impression that in many the syphilitic state may have been purely coincidental. Why Mikulicz's syndrome should be so rare when the pathological states which give rise to it are relatively so common does not appear to have been explained.

Summary

A record is presented of the findings in a case of Mikulicz's syndrome (enlargement of lacrimal and salivary glands) followed from the initial hospital admission until death 14 months later. Many of the features of chronic lymphatic leukaemia, including lymphocytic infiltration of the sternal marrow, were present, but the total leucocyte count was not raised during the period of hospital observation. Swelling of the lacrimal and salivary glands was treated by x-ray therapy with satisfactory though temporary results.

Brief reference is made to the more important literature on the subject.

I should like to express my thanks to Professor J. W. McNee, in whose wards the patient was investigated and treated, for permission to publish this account, to Professor D. F. Cappell for permission to include his report on the gland section, and to Miss M. M. Todd for the photographs.

REFERENCES

- Garland, H. G., and Thompson, J. G. (1933). *Quart. J. Med.*, n.s. **2**, 157.
Howard, C. P. (1909). *Int. Clin.*, 19th series, **1**, 30.
Mikulicz, J. (1888). *Berl. klin. Wschr.*, **25**, 759.
Schaffer, A. J., and Jacobsen, A. W. (1927). *Amer. J. Dis. Child.*, **34**, 327.
Thursfield, H. (1914). *Quart. J. Med.*, **7**, 237.

A SIMPLE EMERGENCY METHOD FOR ESTIMATION OF BLOOD SUGAR*

BY

A. L. LATNER, M.D., M.Sc., D.I.C., A.R.C.S.

AND

G. B. PENDLENTON, F.I.M.L.T.

(From the Section of Chemical Pathology, Department of Pathology, King's College, Newcastle-upon-Tyne)

A simple and accurate method for estimating blood sugar, either in the ward or in the patient's home, has long been required. The technique of Haslewood and Strookman (1939) as described by King (1946), when used in conjunction with some simple apparatus we have designed, would seem to satisfy these criteria. This apparatus can easily be made by any competent glass-blower. No colorimeter or photometer is necessary.

Apparatus

The following apparatus is required: (1) a number of clean and dry teat-end pipettes; (2) one blood pipette calibrated to contain 0.1 ml., for measuring the blood sample; (3) one pipette calibrated to contain 0.2 ml., for measuring the solution of 10% w/v sodium tungstate; (4) a 1-in. (2.5-cm.) glass funnel and a supply of 5.5-cm. Whatman No. 41 filter papers; and (5) four tubes as shown in the accompanying diagram.

Tube A has an internal diameter of approximately 10 mm. and is calibrated to contain 3.7 ml. It is fitted with a rubber bung.

Tube B has an internal diameter of approximately 13 mm. and is calibrated to contain 7 ml. at the lower mark and 14 ml. at the upper. It is fitted with a rubber bung.

Tube C has a narrow portion approximately 5 cm. long with an internal diameter of approximately 8 mm., and a wider portion approximately 16 cm. long with an internal diameter of approximately 13 mm. It is calibrated by ring markings to contain 1, 2, 5, 10, and 20 ml. The length between the 5- and 20-ml. calibrations is further subdivided into 24 equal portions by alternate short and long etched lines. The long lines from below upwards are marked 100,

The four tubes required. Figures shown at the sides of the tubes are etched on the reverse faces of the tubes.

120, 140, and so on up to 320, which coincides with the 20 ml. mark. These markings represent mg. of glucose per 100 ml. of blood.

Tube D is similar to tube C and of identical measurements. It also has ring calibrations at 1, 2, 5, and 10 ml., the length between its last two markings being subdivided into four portions. These are determined by adding calculated volumes of water, namely:

At calibration	70	the tube contains a total volume of	5.7 ml.
"	"	60	" " " " 6.7 ml.
"	"	50	" " " " 8 ml.
"	"	40	" " " " 10 ml.

Solutions Required.—These are exactly as described by King (1946). The standard solution contains 2 mg. of glucose per 100 ml. and is prepared fortnightly by suitably diluting the stock solution containing 0.1 g. of glucose per 100 ml. with saturated benzoic acid.

Method

Tube A is filled to the mark with the isotonic sodium-sulphate-copper-sulphate mixture by means of a teat-end pipette. Blood obtained by capillary puncture is collected in a tube of internal diameter about 8 mm., which contains a small quantity of neutral potassium oxalate to prevent coagulation.

The 0.1-ml. blood pipette is filled to the mark with this blood and the outside of the pipette carefully wiped free of blood with clean cotton-wool. The measured quantity of blood is delivered into the solution in tube A and the inside of the pipette rinsed into the solution by sucking some of the fluid into the pipette up to the mark and then blowing it back again. This is repeated twice. Tube A is gently shaken to ensure thorough mixing, and 0.2 ml. of 10% sodium tungstate is added. The tube is closed with a rubber bung and inverted several times to get thorough mixing. After standing a few minutes the precipitate which forms is filtered off through a dry 5.5-cm. No. 41 Whatman filter paper. Tube C is filled to the 1-ml. mark with this protein-free blood filtrate and tube D to the same mark with the standard glucose solution. For each of these manipulations separate teat-end pipettes are used which are long enough to deliver direct into the narrow ends of the tubes.

The alkaline copper solution is now prepared by filling tube B to the lower mark with solution A and adding solution B to the upper mark. Again teat-end pipettes are used. The tube is closed with a rubber bung and shaken well to ensure mixing. Tubes C and D are further filled to the 2-ml. mark with the alkaline copper solution so prepared, using a clean teat-end pipette. The tubes are carefully shaken to ensure thorough mixing, are placed in boiling water for exactly 10 minutes, and then rapidly cooled by immersion in a relatively large volume of cold water or under the tap. Both tubes are filled with the phosphomolybdic reagent exactly to the 5-ml. mark, the open end is closed by the thumb, and the contents are mixed by inversion. The small amount of fluid adhering to the thumb is restored to the tube by wiping the thumb across its edge.

If the blood sugar is above 80 mg. per 100 ml. the blue colour in the wide portion of tube C below the 5-ml. mark will be darker than that in tube D. In this event small quantities of distilled water are added to tube C and the contents mixed by inversion after each addition, using the thumb technique already described. When the two colours match, the level of the bottom of the meniscus in tube C indicates the blood sugar. If the level has reached the top mark (320 mg. per 100 ml.) and the colour in tube C is still darker than that in tube D, the former tube is emptied exactly to the 10-ml. mark and further diluted until correct matching is obtained. In this case the final reading obtained must be doubled in order to give the correct blood sugar. In this way values up to 640 mg. per 100 ml. of blood can be determined. For higher levels the tube is again emptied to the 10-ml. mark and the final reading multiplied by four.

If the original blue colour in tube C is lighter than in tube D the blood sugar is less than 80 mg. per 100 ml. It can be determined by suitably diluting the fluid in tube D until the colours match and reading the calibrations on this tube.

Results

The accuracy of the method has been tested by the usual procedure of recovering known amounts of glucose added to blood, the blood sugar being determined before and after the addition. The results, shown in Table I, can be seen to be remarkably good.

The method has also been used on a number of blood samples by a medical graduate with no special chemical training. All matching was done by artificial light in order to simulate ward emergency conditions, as, for example, in the diagnosis and treatment of a patient in a diabetic coma admitted at night. A parallel series of determinations was also carried out by a trained laboratory tech-

TABLE I.—*Recovery of Glucose Added to Blood*

Blood Sugar (mg. per 100 ml.)	Added Glucose (mg. per 100 ml.)	Calculated Total	Found	% Error
85	100	185	185	0
85	200	285	290	+2
85	300	385	380	-1
85	400	485	500	+3
70	100	170	170	0
70	200	270	260	-4
70	300	370	380	+3
70	400	470	450	-4
120	100	220	240	+9
120	200	320	340	+6
120	300	420	420	0
120	400	520	490	-6
65	100	165	165	0
65	200	265	255	-4
65	300	365	390	+7
65	400	465	480	+3

TABLE II.—*Comparison with Laboratory Findings*

Blood Sugar (mg. per 100 ml.)		Blood Sugar (mg. per 100 ml.)	
Emergency Method	Laboratory Method	Emergency Method	Laboratory Method
107	120	115	125
104	115	140	140
195	190	70	70
110	120	250	280
70	85	240	260
120	135	235	250
180	180	70	65
210	210	240	220
225	220	400	420

nician, using the method of Herbert and Bourne (1930). The results are shown in Table II. The findings speak for themselves.

A sufficient degree of accuracy for most clinical requirements could no doubt be obtained by the provision of a dropping pipette which delivers 0.1 ml. of blood in a known number of drops. This, in conjunction with a similar method for delivering the sodium tungstate, would simplify the method still further.

Summary

With the use of easily constructed apparatus the method of Haslewood and Strookman has been converted to a simple dilution technique, requiring neither colorimeter nor photometer.

Estimations have proved accurate in the hands of a medical graduate with no special training in biochemical methods.

We wish to thank Dr. W. Jack, who carried out the determinations in Table II.

REFERENCES

- Haslewood, G. A. D., and Strookman, T. A. (1939). *Biochem. J.*, **33**, 920.
 Herbert, F. K., and Bourne, M. C. (1930). *Ibid.*, **24**, 299, 1787.
 King, E. J. (1946). *Micro-analysis in Medical Biochemistry*, p. 22. Churchill, London.

The housing progress summary for May, presented to Parliament as a White Paper (Cmd. 7723), shows that the number of permanent houses completed in Great Britain during May was 16,866, compared with 15,110 in April. This brings the number of permanent houses completed during 1949 to date to 84,688. The total number of houses completed since the war is 667,656 (510,408 permanent and 157,248 temporary). Of the permanent houses, 379,016 were built by local authorities and 86,492 by private enterprise. During May homes were provided by new building, repair of uninhabitable houses, conversion, and requisitioning for 18,469 families, compared with 16,587 in April. This brings the total number of families rehoused by these methods under the post-war programme to 957,113.