were encountered in a nine year period, which was an incidence of 0.59 per cent of all cases of chronic ulcerative colitis and of 1.5 per cent of cases occurring in patients under 30 years of age.

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MODIFICATIONS IN THE ROURKE-ERNSTENE SEDIMENTATION RATE METHOD

L. W. DIGGS, M.D.

The Rourke-Ernstene method[1] for determination of sedimentation rate measures the sinking velocity of erythrocytes during the period of most rapid fall. This method is considered to be more accurate than those that utilize a single one hour reading,[2] such as the Wintrobe, Cutler, and Westergren methods. Other advantages of the method are the following: A small volume of blood (1.5 ml.) is required, the volume of packed red blood cells can be determined, and correction for anemia

based upon the hematocrit reading can be calculated. The Rourke-Ernstene tube is preferred to the Wintrobe tube because it is longer and has a wider lumen. The greater length delays the "packing phase," and the increased width makes the tube easier to clean and to fill.

In the original Rourke-Ernstene method heparin was used as an anticoagulant. For this the dry potassium and ammonium oxalate mixture of Heller and Paul[3] has been substituted in the Cleveland Clinic, because the oxalated mixture is more economical, more dependable, and simpler to prepare. Various workers have shown that the results are comparable with those obtained with heparin.[2,4]

Rourke and Ernstene recommended recording the time-distance readings, constructing a curve from these readings, and calculating the fall of erythrocytes in millimeters per minute from the slope of the straight-line portion of the graph. Estimation of the sedimentation rate from graphs proved to be too time-consuming for clinical use. The modifications first made and for years used by our laboratory were (1) the determination of the time required for the top of the red cell column to reach successive 2 mm. marks on the tube and for the rate to become constant and (2) the computation of the sedimentation rate directly from these figures.

Ham and Curtis[2] estimated that there was an error of approximately 2 per cent in the sedimentation rate as determined by the Rourke-Ernstene method on duplicate specimens when only a few specimens were examined. In order to determine the accuracy of the procedure under clinical conditions when multiple tubes were simultaneously observed, venous bloods from 41 unselected clinic patients were placed in duplicate vials and sent to different laboratories for sedimentation rate estimation. Six or more tubes comprised each group. In 65 per cent of the tests the difference in final reading corrected for anemia was 0.2 mm. a minute or less, in 17 per cent the discrepancy in results was between 0.21 and 0.4 mm. a minute, and in 17 per cent 0.4 mm. a minute or more (table). Differences of this magnitude are not clinically significant when the sedimentation rate is very rapid, but in borderline cases such discrepancies lead to errors in interpretation.

The lack of correlation in readings made at 2 mm. intervals is in part due to the physical impossibility of focusing the eye on multiple points at the same time and of recording the exact moment when numerous falling columns, all proceeding at different rates, arrive at given lines. Other errors are due to failure to take fractions of a minute into consideration, to lack of sharp demarcation between plasma and top of erythrocyte column, to the thickness of the lines, and to reading the column a little above or below the line.

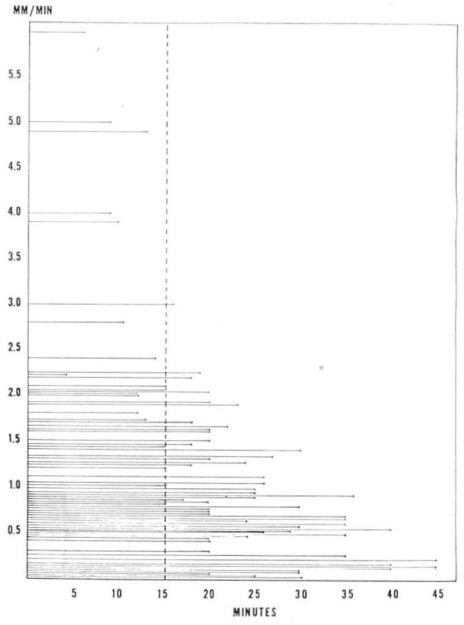

FIG. 1—Duration of "intermediate phase" of sedimentation rates in 70 specimens arranged according to uncorrected sedimentation rate.

Another disadvantage in making time-distance readings at 2 mm. intervals is that the technician has to watch the blood continuously from the time the tubes are filled until all tests are completed. During a given "run" she cannot perform other laboratory tasks.This leads to inefficient use of the technician's time. Because the test once started demands the technician's undivided attention, a group of tests cannot be started until multiple specimens have accumulated. This delay leads to error; for the sedimentation is retarded when blood is allowed to stand for several hours.

In order to maintain the advantages of the Rourke-Ernstene procedure and to make the testing more accurate and practical under conditions in which multiple tests have to be done, the results obtained from readings made at longer intervals were studied.

The duration of the period of most rapid fall was analyzed using graphs of sedimentation rates of 70 patients, each graph being plotted from frequent time-distance readings.* This was done by noting the time between the end of the "aggregation phase," characterized by a sharp dip in the slope of fall, and the beginning of the "packing phase," characterized by flattening out of the curve. The duration of the "inter-

* Electrophoresis Laboratory, Dr. Lena Lewis.

mediate phase" is longest in slowly sedimenting bloods and shortest in rapidly sedimenting bloods (fig. 1). Readings must be made at 5 minute intervals or less to cover the entire range of sedimentation rates, but intervals of 15 to 20 minutes were found to cover the majority of cases with a rate of 1.5 mm. a minute or less.

The maximal sedimentation rate as determined by the standard Rourke-Ernstene method was compared with maximal rates determined from readings at 15 and 20 minute intervals. Graphs were analyzed of 115 unselected bloods from clinic patients. Scatter diagrams of the results obtained are given in figure 2. When the sedimentation rate is 1 mm. a minute or less, these show good correlation between the maximal rate obtained from readings at 15 minute intervals and from readings by the standard procedure. When the sedimentation rate is more rapid, the correlation is not so good, but this is of little clinical significance. The 20 minute interval readings correlated less satisfactorily with the standard readings than did the 15 minute interval readings (fig. 2).

The accuracy of sedimentation rate determinations using 15 minute interval readings was checked by having different technicians examine duplicate specimens. Six or more bloods were examined simultaneously. In 54 observations checks within 0.2 mm. a minute were obtained in

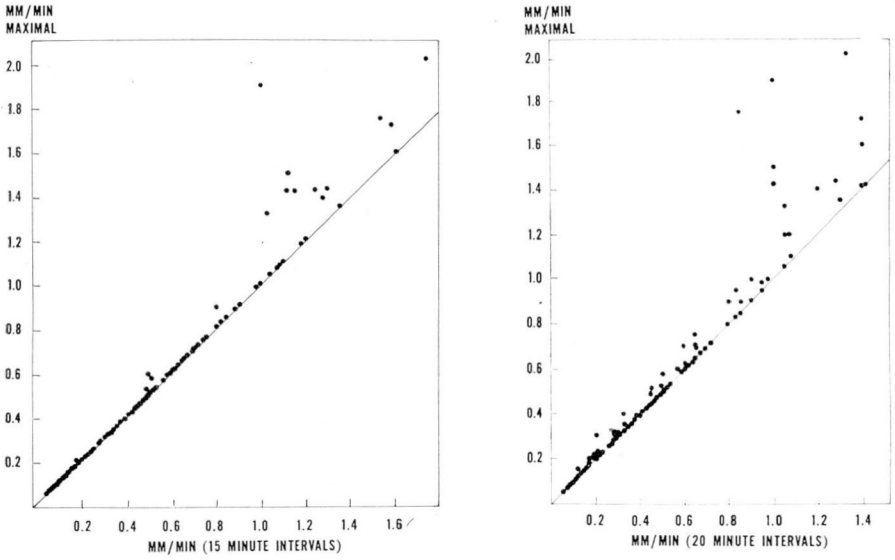

Fig. 2—Scatter diagram showing correlation between maximal sedimentation rate and rate calculated from maximal fall during 15 minute and 20 minute intervals.

80 per cent of the cases. In no case was the difference greater than 0.4 mm. a minute. These results were much better than those obtained from readings made at 2 mm. intervals (table).

TABLE—Variation in sedimentation rate corrected for anemia as determined by different technicians on duplicate specimens of oxalated blood. Rourke-Ernstene tubes used. Six or more bloods examined simultaneously.

Number of examinations	Method	Difference in sedimentation rate (% of total number)		
		0.0-0.2 mm./min.	0.21-0.4 mm./min.	0.4+ mm./min.
41	2 mm.-time readings until fall constant	65	17+	17+
54	Maximal fall/15 min. intervals	80	20	0

On the basis of these studies it seemed justifiable to modify the Rourke-Ernstene method for clinical use by making the readings at 15 minute intervals. Technicians who have had long experience with the standard method and who also have used the 15 minute interval method find the latter procedure much less exacting. They also have sufficient time between readings to clean pipets, to make centrifuge readings, to get out reports, and to perform other essential tasks.

METHOD

The method now used at the clinic for determining the sedimentation rate may be summarized as follows:

Equipment and Supplies

1. Rourke-Ernstene tubes, length 12 cm., internal diameter 4 mm., calibrated at 2 mm. (Macalaster and Bicknell, Cambridge).
2. Straight shell vials, 35 by 12 mm., with cork stoppers, calibrated by scratching side of tube at 1.5 mm. mark.
3. Capillary pipets with rubber bulbs for filling and cleaning tubes.
4. Anticoagulant mixture containing 2 Gm. potassium oxalate and 3 Gm. ammonium oxalate in 100 ml. distilled water; 0.06 ml. is placed in each vial and evaporated to dryness in the incubator.

In the vial is placed 1.5 ml. venous blood, which is thoroughly mixed with the dried oxalate. The specimen is sent to the laboratory with an identifying slip. The specimen is vigorously agitated for at least one

minute. The blood is then taken up by means of the capillary tube, and the Rourke-Ernstene tube is filled to the 0.0 mark. Care is taken to avoid air bubbles. Laboratory request slip is numbered to correspond to number on tube.

The tubes are hung in a special rack made of a sheet of stainless steel with a series of ¼ inch holes suspended over a viewing box. This has an opaque glass window and indirect lighting supplied by a linear fluorescent light (fig. 3).

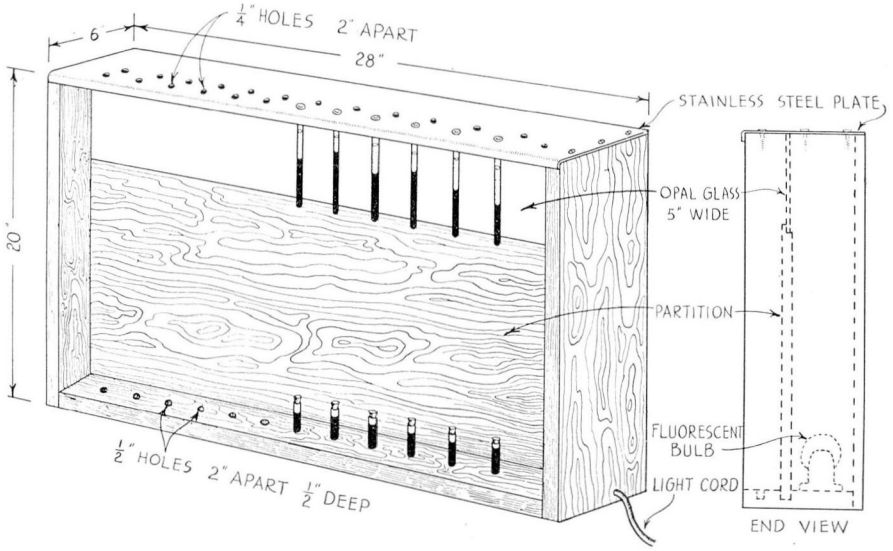

Fig. 3—Illuminated suspension rack for Rourke-Ernstene tubes.

Readings are made every 15 minutes, four readings being made on each tube. The most rapid fall during any 15 minute interval is considered representative of that sample. The millimeter fall during this most rapid quarter hour interval divided by 15 gives the rate in millimeters per minute. Since the sedimentation rate is usually most rapid in the third and the fourth and seldom in the first interval, and since the point of beginning the observation in relation to the filling of the tube is arbitrary, no attempt is made to note the time of filling each tube. The tubes are filled as soon as possible after the blood arrives at the laboratory, but readings are made every 15 minutes, preferably on the hour and 15, 30, and 45 minutes after the hour.

After the sedimentation rate has been noted, the tubes are placed in a centrifuge and spun to a constant pack. The volume of packed cells is read, and the sedimentation rate corrected for anemia according to

the Rourke-Ernstene chart.[1] The final report includes the uncorrected and the corrected sedimentation rate in millimeters per minute and the hematocrit reading.

SUMMARY

1. The Rourke-Ernstene sedimentation rate method is made more practical and, under conditions where multiple tests have to be performed simultaneously, more accurate by the following modifications now used at the Cleveland Clinic:

a. Substitution for heparin of the dry potassium and ammonium oxalate mixture of Heller and Paul.

b. Estimation of the sedimentation rate from readings at 15 minute intervals rather than from graphs of time-distance readings or from direct calculations made from 2 mm.-time readings.

c. Use of an illuminated rack for suspending Rourke-Ernstene tubes.

2. When 54 duplicate specimens of blood from unselected clinic patients were examined, the sedimentation rate calculated from readings at 15 minute intervals and corrected for anemia checked within 0.4 mm. a minute.

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PRIAPISM IN LEUKEMIA

Report of Two Cases

W. E. LOWER, M.D., AND L. A. CHRISTOFERSON, M.D.

True priapism is a pathologic erection of the penis characterized by persistence, pain, and absence of libido. It has been recognized as an occasional symptom and complication of leukemia since Jadioux[1] reported the first case in 1845. Additional reports appeared sporadically, and by carefully reviewing the literature up to 1914, Hinman[2] collected a total of 45 cases with a definite relation to leukemia.