

SEDIMENTATION OF RED BLOOD CELLS*

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Editor's Note: This is the second of two papers by Dr. Mathieu on the subject of "Pregnancy Tests and the Value of Sedimentation of Erythrocytes in Gynecology and Obstetrics." The first division on "Pregnancy Tests" appeared in the November issue.

FAHRAEUS made observations on the phenomenon of the sedimentation of the red cells of the blood many years ago, but Linzenmeier was the first to publish concerning this test in its relation to gynecology and obstetrics. It is of relatively minor value as a test for pregnancy in that it can in no way clinch a diagnosis of pregnancy. Nevertheless, since after the third month of pregnancy there is an increase over the normal sedimentation distance, and since this sedimentation distance increases with each succeeding month of pregnancy, so that at the tenth month the average sedimentation distance is 35 mm. in one hour, one can readily see that it can be used as an aid in the diagnosis of pregnancy. Its significance is so great that special consideration will be given here to its general obstetrical and gynecological application.

The older test for "sedimentation time" consisted in the dilution of blood with one part to five of 2½% sodium citrate to inhibit clotting, and with the blood in a special tube, the determination of the time required for the solid contents of the blood to settle. The time was formerly the criterion of this test, but since the time test was so cumbersome Gippert conceived the idea of measuring speed, hence distance, in one hour,

with very simple tubes, and this no doubt will be the method universally used. In measuring sedimentation time, one might have to watch the tubes for several hours, while on the other hand the relative value of the test is as truly significant if the sedimentation is watched in this new type of tube and measured over a period of one hour.

Linzenmeier found the following sedimentation times:

Longest in newborn	24 hours for 18 mm.
Next in elderly man	4 to 8 hours
Next in elderly woman	3 to 6 hours
Next in pregnant woman	30 minutes

While the following are the standards of **distance** for one hour with the tubes shown in Figure 1.

Newborn	1 mm. in 1 hour
Elderly man	3 to 6 mm. in 1 hour
Elderly woman	4 to 9 mm. in 1 hour
Pregnant woman at term	35 mm. in 1 hr.
Fever or infection	35 to 38 mm. in 1 hr.

The tube (Figure 1) is a very simple one having only two marks, one for the citrate solution level and the other for the blood level. There are no marks on the tubes for reading sedimentation distance. This is done by using ordinary graph paper ruled in millimeter squares. With these tubes, very little blood is needed. The tube can be filled to the citrate marking by merely dipping it into the solution; then the blood is sucked in and up to the mark for the blood, and the two are mixed by sucking the blood and citrate solution back and forth in the tube several times. One must be sure that there are no air bubbles in the mixture. After the blood and citrate solution are well mixed, the lower end of the tube is plugged with common soap and the tube is stood up

*I have used, freely, notes gathered from lectures by Professor Walter Schiller of the Kermanner Clinic, Vienna.

in a rack where it can be watched. A hole in a cork or any such simple device is all that is needed to hold the tube in vertical position. The following are observations pertaining to technique, reading, and the significance of the test.

1. Blood sediments slowly at first but speeds up toward the end.

2. The shortest distance of all is noted in infectious disease when it drops to 35 mm.

mentation distance in health and it should remain so for that person. For this reason the test may be kept as a standard.

6. One may rule out active infections if the sedimentation distance is normal.

7. If the sedimentation distance is more than 8 mm. in one hour (which corresponds to one and a half hours of the old reading of sedimentation time) there is infection, except in pregnancy.

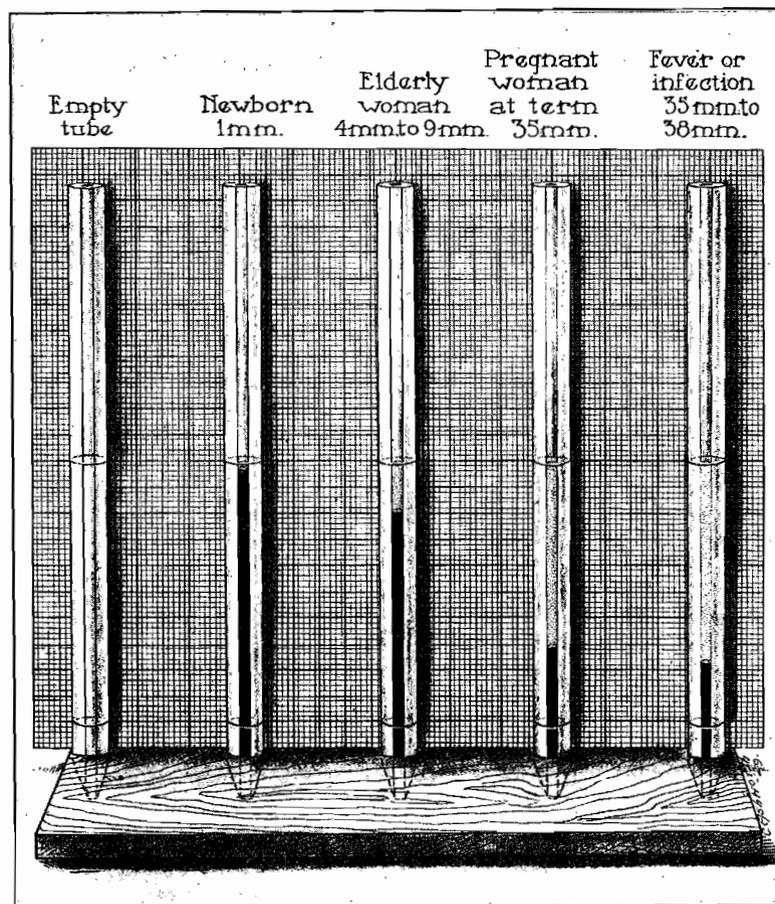


Figure No. 1. Sedimentation distances in selected types. Readings are made from background of millimeter scale (paper).

3. In the post-partum stage, the sedimentation distance returns to normal in six to ten weeks after delivery if everything else is normal.

4. During pregnancy the test is of no value except that as the pregnancy advances the distance of sedimentation increases until it reach 35 mm. in the tenth month.

5. Every person has a normal sedi-

8. The sedimentation distance test is more delicate than the leucocyte count and is to be accepted in preference to the leucocyte count. This test can be used in appendicitis with even more confidence than is now placed on the leucocyte count.

9. Normal blood shows a straight line at the top, as in Figure No. 1, while path-

ological blood separates out in a shady manner.

10. The sedimentation distance is altered by malignancy, especially degenerating cancer. In cancer the distance is usually about 20 to 25 mm. If any operation is successful, the sedimentation distance will be normal in six weeks and if not there probably still remain remnants of dead tissue or infectious material.

11. In inflammation there are two components:

A. Exudative Component:
Exudation,
Hyperemia,
Swelling, etc.

B. Productive Component:
Granulation,
Scar,
Cirrhosis,
Healing, etc.

During the period of predominance of the Exudative component, the sedimentation distance acts as it would during infection or inflammation; that is, the distance is prolonged.

During the period of predominance of the Productive component, the sedimentation distance is normal or rapidly approaching normal.

12. Decomposition of tumors alters the sedimentation distance as does the x-ray treatment of cancer. It increases in mm. per hour.

13. Foreign protein substances also increase the sedimentation distance such as:

Pregnancy,
Tumors,
Inflammation,
Protein Injections
Milk
Peptone
Etc.

14. The sedimentation distance test has little value in ectopic pregnancy except in the differential diagnosis between ectopic pregnancy and acute and sub-acute salpingitis. (The distance is long

in infections of the tubes and short in ectopic pregnancy.) It is too early for the test in the seventh or eighth week of ectopic pregnancy and at three months it shows no difference from cystic tumors and adnexal tumors. These tumors vary in sedimentation distance as does ectopic pregnancy and one cannot make a differential diagnosis by this test.

15. If the sedimentation distance increases after abortion or confinement, this is significant of infection or retention.

These observations are only tentative and may be subject to alteration after further study.

The sedimentation distance is increased in one physiologic condition—pregnancy. In this condition, after the second month, sedimentation distance increases with each succeeding month of pregnancy until the distance is approximately 35 mm. at term. Various workers have used the sedimentation (time or distance) of the red blood cell in many different ways—each using different tubes and a different technique. Results, therefore, have been varied. Nevertheless, these workers have all agreed that the test has marked clinical value. Cutler uses it particularly in the estimation of activity of tuberculous infection. Three years ago, Dr. Theodore Adams instituted the use of sedimentation time in the Gynecological Service of the Multnomah Hospital, and has written admirably on his work there. Ever since that time we on the Gynecological Service at the Multnomah Hospital have made this test a very prominent criterion as to when to operate in salpingitis. Formerly we allowed our salpingitis patients to “cool” and would not operate on them until the temperature and leucocyte count had been normal from ten to fourteen days. Then we included the sedimentation as the predominant criterion—not choosing to operate until the sedimentation time became normal. We learned that certain

patients with a normal temperature and apparent inability to maintain a protective leucocytosis still had abnormal sedimentation rates indicative of some degree of activity. We have reached the conclusion, absolutely corroborated by our records, that it is best to wait until the temperature, leucocyte count and sedimentation distance have reached normal for a period of at least ten days. Since acquiring these criteria as to when to operate, our mortality rate in this type of infection has been zero.

Since this work was done I have adopted the modified Westergren technique and tubes worked out by mem-

bers of the Bio-chemistry Department of the University of Oregon Medical School for use with oxalated venous blood. This method was demonstrated as a part of their Uniform System of Hematologic Methods in the Scientific Exhibit at the July meeting of the American Medical Association in Portland and will be published before long. This method is giving great satisfaction. A full report of extensive studies in sedimentation distance being made in conjunction with the originators of the modified method, will appear later.

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