

The Value of the Sedimentation Test in Obstetrics and Gynæcology.

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INTRODUCTION.

THE sedimentation test consists in the observation and measurement of the varying speed with which erythrocytes, in a specially constructed tube, separate from the plasma after the blood has been rendered non-coagulable.

The test is not one for a special disease but is believed, according to most observers, to be a delicate index of the presence and extent of any inflammatory process in the body.

The nature of the reaction. The reaction is a complex one. Fahreus,¹ Linzenmeier² and others have shown that the sedimentation is due to the agglutination of the erythrocytes. This agglutination is influenced by (1) their number (2) electrical charge^{3, 4} and (3) by the relative proportion of the plasma proteins^{5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15}. Fahreus showed that solutions of different protein fractions varied in agglutinating capacity, and he stated that serum albumin only caused aggregation to a small degree, while globulin produced a strong agglutination and fibrinogen was still more active.

Technique. Three chief methods are in use for the estimation of the sedimentation rate (S.R.) viz: (1) Fahreus's, (2) Westergren's and (3) Linzenmeier's. The method used in the present investigation was Morris's modification of Westergren's technique. Into a 2 c.c. Record syringe, containing 0.4 c.c. of a 3.8 per cent solution of sodium citrate, blood from an arm vein is drawn up to the 2 c.c. mark. After thorough mixing in a test-tube the fluid is drawn up into a 1 c.c. pipette graduated in hundredths and having an internal diameter of 2.5 mm. After the pipette is filled to the 1 c.c. mark a rubber cap is applied to the tip and the tube is placed vertically in a stand. The rate of sedimentation is estimated by the depth of the clear fluid on the top of the red cells.

This reading is taken at the end of one hour and is given as a percentage of the total column, viz. if the clear fluid reaches 0.05 c.c. the reading is five. At the beginning of the present investigation we took readings at the end of one, two and 24 hours, but later we did not consider it necessary to take more than the first hour's reading. The present investigation was undertaken to determine whether any information, either of diagnostic or prognostic value, could be obtained by the routine use of the test on ante-natal, puerperal and gynæcological cases.

The test was performed 1,030 times—27 normal non-pregnant women, 452 ante-natal, 423 puerperal and 128 gynæcological cases being investigated.

RESULTS.

1. *Normal non-pregnant women.* As stated above the test was carried out on 27 normal non-pregnant women. The average S.R. was two, the range was two to four. This corresponds with the normal figure found by other observers.

2. *Normal ante-natal cases.* The test was carried out 348 times. The blood was taken at the patient's first visit to the clinic or on admission to the ward when the routine Wassermann test was being done.

Duration of pregnancy in weeks.	Number of Cases.	Sedimentation Rate.		Cases with normal Sedimentation rate.	
		Average per cent.	Range per cent	Number.	Percentage.
up to 12	12	2.5	1—4	12	100
13 „ 16	10	5.6	2—10	3	30.0
17 „ 20	32	7.5	2—24	11	34.3
21 „ 24	67	10.0	1—23	15	22.4
25 „ 28	129	10.2	1—25	33	25.5
29 „ 32	60	14.6	3—45	6	10.0
33 „ 36	28	18.5	7—32	0	0.0
37 „ term	10	14.0	4—27	2	20.0
up to 40	348	10.3	1—45	82 cases	23.5

It is apparent that the S.R. is increased after the 12th week of pregnancy, but only by one, and that a definite increase does not occur until after the 20th week. Further, there is a definite percentage of cases in each month with a normal S.R. Linzenmeier¹⁶ in a series of 300 ante-natal cases and Geppert,¹⁷ Wacholtz,¹⁸ Würzburger,¹⁹ and Haselhorst²⁰ arrived at similar conclusions. Falta²¹ found an increased S.R. constantly after the fourth month and Baer

and Reis²² found it unreliable during the first three months. In Fahreus's¹ series the average S.R. is higher than in the present series and he found an increase after the second month, but his series is small—33 in all—and he included cases admitted with symptoms of abortion.

3. *Pregnancy with complications—104 tests.*

(a) *Pyelitis*, eight cases. The S.R. was above the average in all cases—the range was 17 to 75. The case with the S.R. of 75 was severe and had an associated anæmia.

(b) *Cervicitis*, six cases. Three cases were above the average, and three below.

(c) *Positive Wassermann Reaction*, 13 cases, of which 10 cases were above the average and three below. Molnar,²³ Popper and Wagner²⁴ and Linzenmeier and Hirsch¹⁶ obtained a similar result in syphilis. Neumann²⁵ in a series of 52 cases of syphilis in pregnancy found an increased S.R. in 11 per cent, further, he found no relationship between the S.R. and latent and active syphilis.

(d) *Bronchitis*, five cases. Two were below and three above the average.

(e) *Psoriasis*, three cases. Two cases of very extensive psoriasis had S.R.'s of two and three, the third case which was less extensive, had a S.R. of 25.

(f) *Acute Bartholinitis*. One case in which the S.R. was normal.

(g) One case of active pulmonary tuberculosis with raised temperature and pulse rate, had a S.R. of 56.

(h) *Eclampsia*, six cases. With one exception the S.R. was increased in all cases—the average was 36.6 and the range four to 57. The exception was the mildest case of eclampsia. Neumann²⁵ examined nine cases and found increased S.R. in two, the remaining seven cases were within normal limits. Friedlander²⁶ says eclamptics show the same S.R. as ordinary pregnancies, while Fahreus and Linzenmeier found the S.R. often reduced in cases of eclampsia.

(i) *Pre-eclampsia*, five cases. Three were above the average and two were normal, the range was from four to 25. The most severe cases, blood pressure 200 m.Hg., urine (catheter specimen) solid albumin had a S.R. of four.

(j) *Accidental hæmorrhage*, three cases—all had accompanying

albuminuria. One case had a S.R. of 15, the second had a S.R. of 18 on admission, 89 five days later and 82 on the sixth day. This patient died on the sixth day and postmortem examination showed an acute cortical necrosis of both kidneys. The third case had a S.R. of 62 but had an associated anæmia.

(k) *Recurrent toxæmia*, four cases. Two were above and two below the average.

(l) *Albuminuria*, 30 cases. All the cases except two were above the average. Urea nitrogen, non-protein nitrogen, uric acid, cholesterol and sugar estimations were made in all the toxæmic cases at the same time as the S.R. but no constant relationship was found.

(m) *Abortion and miscarriage*, 24 tests (21 cases). There were nine cases of incomplete abortion and 12 of complete abortion or miscarriage. In 11 cases (four cases of incomplete and seven cases of complete abortion) the S.R. was normal, i.e., below four, and in all these cases temperature, pulse rate, and convalescence were normal. Three cases of incomplete and three cases of complete abortion had S.R. of 10, 14, 24, 10, 19, and 14 respectively and had an apyrexial convalescence. The three cases of incomplete abortions were admitted to hospital with a history of vaginal hæmorrhage and passage of clots. The case with the S.R. of 24 had normal temperature and pulse rate during her convalescence, but five days after the placenta was removed there was œdema of left leg. The case of complete abortion with S.R. of 14 had tuberculosis of the lung. The raised S.R. in the two cases of complete abortion cannot be explained. The remaining four cases (two incomplete and two complete abortions) had an associated pelvic peritonitis with raised temperature, increased pulse rate and leucocytosis. The S.R. in these cases was 43, 22, 16 and 15. The highest S.R. (43) occurred in a case of incomplete abortion with pelvic peritonitis and pelvic abscess. The day after the abscess burst into the rectum the S.R. fell to 38 and ten days later, on the patients discharge from hospital, was five. Details of a second case are of special interest :—

E. H., aged 30, para 0, was admitted with threatened abortion; last menstrual period was 12 weeks before. Bleeding *per vaginam* and severe abdominal pain had been present for five hours. On admission the patient was obviously ill, face was cyanosed, temperature 99.2 pulse rate 124. The abdominal wall did not move with respiration and there was marked rigidity over whole of lower abdomen. *Per vaginam* the uterus was enlarged to the size of

a 12 weeks pregnancy, cervix closed and soft; no blood stained discharge. The S.R. was ten. Laparotomy revealed an extensive purulent general peritonitis. The bacillus coli was isolated on culture from the peritoneal fluid. Convalescence was complicated by thrombosis in the left leg. S.R. four weeks after operation was five. The patient was discharged well six weeks after admission to hospital.

From the findings in these two cases we can conclude that although a high S.R. usually indicates some inflammatory condition, the height of S.R. and the extent of the inflammation are not always parallel. The range in cases of apyrexial abortion was one to 24, average 8.9, and the range in febrile cases 15 to 43, average 24.

We can conclude from this series of cases of pregnancy with complications that by routine use of the S.R. no information can be gained which could not be learned by other methods.

4. *Puerperal cases, 423 tests.*

Fahreus¹ found that the S.R. decreased gradually after confinement and was still above normal at the end of the second month. Friedlander²⁸ found a raised S.R. in the first ten days and a return to normal after the first month if no infection was present. According to Linzenmeier,¹⁶ Höber³ and Falta²¹ there should be a decrease of the S.R. from about the tenth day and a return to normal about the middle of the third week. Neumann²⁵ investigated 200 puerperal cases and found that the S.R. showed an increase in the puerperium up to the seventh day and then a gradual decrease. The majority of his cases reached a normal S.R. at the end of the seventh week.

As stated above, the sedimentation test was carried out 423 times in the puerperium—65 of these were morbid and these will be considered separately. Twenty-six (7.3 per cent) of the 358 remaining cases had a normal S.R. during the first ten days of the puerperium.

An analysis of our puerperal cases shows:

1. 186 normal cases, average S.R., 15.5. The S.R. was highest on second, third, and eighth days.
2. 70 cases with repair of perineum as only complication, average S.R. 28.5.
3. 38 cases of instrumental or assisted delivery, average S.R. 18.2.
4. Of the 358 normal puerperal cases 153 had S.Rs. above the average, and in 27 per cent of these 152 cases no cause for the high S.R. was found. In 14 cases the high S.R. was associated

with engorged breasts and in 11 cases with anæmia. In neither of these two conditions was the S.R. found below the average. There were 15 cases of subinvolution (not septic) above the average and eight below. Seven cases of cervicitis were above the average and six below. Two cases of positive Wassermann reaction were above the average and three below. Three cases where prematurity was the only complication were above the average and three below.

The raised S.R. in cases of engorged breasts and in cases of repair of the perineum are the interesting factors in the puerperal results. Newmann²⁵ found that perineal tears had no influence on the S.R.

Morbid puerperium, 65 cases. 36 cases of sepsis, 21 cases of pyelitis and nine cases in which the rise of temperature was due to some other inflammatory condition, e.g., influenza. With two exceptions the S.R. was increased in every case.

(a) *Sepsis*, 36 cases. Baer and Reis²⁷ claim that the S.R. is of great clinical and diagnostic significance in puerperal sepsis. Frosch²⁸ thinks that the S.R. is of aid in the diagnosis of septicaemia in the puerperium. Most observers say that the condition in which increased S.R. occurs *par excellence* is sepsis and that the most rapid rates occur when there is acute inflammation associated with pus formation. The S.R. was increased in all our cases of sepsis but in 50 per cent of the 65 cases the height of the S.R. did not exceed that found in non-septic complications of the puerperium, viz., engorgement of the breast and torn perineum. The following two cases illustrate this point. (1) A case of fatal hæmolytic streptococcal septicaemia had S.Rs. of 21 and 25 on the sixth and third days before death. Post-mortem examination showed extensive peritonitis, parametritis, endometritis, thrombosis of both iliac veins and septic emboli in lungs. (2) a case of hæmolytic streptococcal intrauterine infection associated with temperatures of 103° to 104°F. for 10 to 12 days had S.Rs. of 31, 29 and 30 on three successive occasions—four days interval between each. This patient was discharged well on the 32nd day after delivery. In the first case the comparatively low S.Rs. may have been due to the absence of resistance in the patient, but in the second case the S.Rs. cannot be explained in this way for there was marked leucocytosis and the patient recovered.

In only a small percentage of these cases of puerperal sepsis did the S.R. correspond with the clinical picture and in these cases, it did not, in our opinion, have any diagnostic value.

(b) *Pyelitis*, 21 cases. The S.R. was raised in all the cases—it ranged from 21 to 64. The rates found in the cases of pyelitis

were generally higher than those met with in cases of puerperal sepsis—two of the 21 cases of pyelitis had S.Rs. below 25 while 12 of the 36 cases of sepsis were below this figure. The height of the S.R. appeared to correspond with the severity of the case. One case of pyonephrosis had a S.R. of 51 two days before death.

(c) Nine cases of morbid puerperium with extra uterine cause of raised temperature. There were three cases of influenza—the S.Rs. were 58, 47 and 20 respectively and corresponded to the severity of the condition in each case; two cases of breast abscess with S.Rs. of 36 and 20; one case of acute tonsillitis with S.R. of 62; one case of acute gonococcal arthritis with S.R. of 74—there were three joints involved in this case and the temperature was 104°F. for three days; and one case of acute otitis media with a S.R. of 33 and one week later 11 when the acuteness of the otitis media had subsided.

5. *Gynæcological*—128 cases.

The greatest practical significance is claimed for the S.R. in gynæcology. The question is whether the S.R. can ensure a definite diagnosis in every case in which it is difficult to determine clinically whether the swelling felt is inflammatory or non-inflammatory, e.g., in the differential diagnosis of ectopic pregnancy and pelvic abscess? There were four cases in our series in which the diagnosis of ectopic pregnancy was made. The first case had a normal S.R. of two and an unruptured tubal pregnancy was found at operation; the second case had a S.R. of 17 and a ruptured tubal pregnancy with hæmatocele was found at operation; the remaining two cases had S.Rs. of one and two respectively. They were both cases of early intrauterine pregnancy—the first case was complicated by a small ovarian cyst and the second case by a small fibroid, the size of a horse chesnut, on the lateral border of the uterus. We have shown already that the S.R. is not increased in the first twelve weeks of normal pregnancy. Friedlander²⁶ says: "ectopics show the same sedimentation time as ordinary pregnancies. Ruptured ectopics with fresh blood in the abdominal cavity have a quick sedimentation time within the range of infected cases." Linzenmeier and Hirsch,¹⁶ Falta,²¹ Neumann,²⁵ Iwanow,²⁸ Rocher,³⁰ Wacholtz¹⁸ and other workers have reported similar findings. They conclude that the S.R. can only be used in conjunction with the strict consideration of all other factors. The cases which present the greatest difficulty in diagnosis are usually those of tubal rupture with hæmatocele in which, as in the case quoted above, we have a raised S.R., but in cases of subacute pelvic peritonitis from which

we wish to differentiate the ruptured tubal mole the S.R. is also raised about the same amount.

Twenty-two cases of pelvic inflammation were investigated. Eight cases of chronic pelvic peritonitis with normal temperature and pulse rate (three gonorrhœal) had a normal S.R. All the cases of acute pelvic peritonitis had raised S.Rs. The S.R. corresponded with the acuteness of the condition and fell gradually as the condition cleared up. There were two cases of tubo-ovarian abscess in which the possible diagnosis of ectopic pregnancy had to be considered. Case I, aged 28 years, 2-para: complained of abdominal pain, mass size of an orange in left fornix: temperature 98.2; pulse rate 78; S.R., 12. Case II, aged 30 years, 1-para, complained of severe abdominal pain of sudden onset; mass felt in left fornix, temperature 100, pulse rate 82, S.R., 13. These two cases show that the S.R. is not of value in the differential diagnosis between pelvic peritonitis and ruptured tubal pregnancy.

Our highest rates were met with in cases of acute pelvic peritonitis with abscess formation. Mrs. W. aged 40 years 5-para, history of miscarriage six weeks previously, large abscess in pouch of Douglas temperature 103.6, pulse rate 110, S.R. 53; a fortnight later, two days after the abscess had evacuated into the rectum, temperature 98.6, pulse rate 80, and S.R. 21 and four weeks later on the patient's discharge from hospital the S.R. was 15.

Much work has been done in America and Germany on the S.R. in connexion with pelvic inflammation. Schmitz,³¹ Cherry,³² and Neumann²⁵ think the test is of no value, but the majority of observers consider it of great value. Linzenmeier¹⁶ studied 100 cases, Friedlander²⁶ 1,500, Baer and Reis²⁷ 100 and Polak and Tollefson³³ 650 cases, and they all conclude that the test is valuable in diagnosis and prognosis and especially in estimating the time of safe operability. Frosch²⁸ thinks that a decreasing S.R. indicates a good prognosis and Bronnikoff³⁴ confirms that opinion. Schumacher and Vogel³⁵ and Nitschmann³⁶ think that the test should be combined with the leucocyte count in order to find its true value.

The S.R. was normal in all, except five of the non-inflammatory cases examined—uncomplicated fibroids, ovarian cysts, malpositions of the uterus and sterility. The five exceptions were—two cases of hydatidiform mole with rates of seven and 22—the higher rate was in a patient who had pre eclamptic symptoms and marked albuminuria. In one case of twisted ovarian cyst the S.R. was 10. A case of uterine prolapse in which extensive pyorrhœa

and dental caries were present, had a S.R. of 38 and an apyrexial convalescence. The normal results found in this series correspond with the findings of other observers.

Carcinoma, 12 cases were examined, seven inoperable and five operable. The S.R. was normal in the five operable and in two of the inoperable cases, while it was raised in the remaining five inoperable cases with no evidence (clinically) of metastases or of pelvic infection. The number of cases is too small to allow deductions to be drawn, but several other observers, who have investigated a larger number of cases, think that the test is not very reliable in this disease. Falta²¹ thinks that the S.R. is definitely increased in malignant tumours and that in many cases it is increased in direct proportion to the extension of the disease, but Schmitz³¹ does not think the test is of any value in this disease. Würzburger³⁷ got normal results in some cases of carcinoma and he thinks that an increased S.R. usually indicates metastases. Cardauns³⁸ and Smiley¹¹ could not discover any constant relation between the increase in S.R. and the extent of the disease.

CONCLUSIONS.

1. The S.R. is raised in normal pregnancy after the fourth month.
2. The S.R. is raised during the normal puerperium; only 6.2 per cent of the cases examined had a normal S.R. within the first ten days.
3. The S.R. is raised in cases of acute pelvic inflammation but the degree of inflammation and the height of the S.R. are not parallel in all cases.
4. The test is of no value in the differential diagnosis between pelvic abscess and ectopic pregnancy.
5. The test is of no value in the diagnosis of malignancy.

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