following cough unless there is radiographic confirmation. Several cases with these symptoms have been seen in which there was no evidence of fracture or subsequent callus formation, and which must therefore be presumed to be due to some injury of the soft tissues.

It is unlikely that these fractures have any definite relation to pulmonary tuberculosis or pregnancy. The former combination has cough of increasing severity with advanced disease as a constant symptom and no obvious bony changes in the ribs; the latter combination also has been observed only in the presence of cough. Therefore, unless a high incidence of these fractures is found in the future, it seems unnecessary to postulate any other than a fortuitous association, especially as the condition is commoner in women.

The recognition of these fractures is usually of little practical significance except that strapping will relieve the pain if severe. However, if the rounded area of callus lies over the lung field it may be taken for an intrapulmonary shadow more easily than is generally realized. I have come across two instances in which callus round a fracture in a rib was temporarily diagnosed as disease in the lung.

Summary

Nine cases of cough fracture unassociated with pulmonary tuberculosis are reported.

Attention is drawn to the relative frequency of these fractures and to the difficulty in detecting them other than by the presence of callus formation.

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During the last 35 years the Rockefeller Foundation has granted fellowships to over 6,000 individuals from 75 countries, and by the end of 1950 the amount of money expended for this purpose was roughly $19,000,000. The Foundation has in addition made grants of about $9,500,000 to other organizations for their fellowship programmes. The *Directory of Fellowship Awards for the Years 1917–1950*, recently issued by the Foundation, lists 5,026 recipients of fellowships who are traceable. Name, country of origin, date of birth, highest degree, address, present position, and other details are given, making the directory a valuable addition to current biographies of the medical sciences. Some idea of the distribution of fellowships can be gauged from the fact that in 1950 the international health division awarded 2,566 (including 689 to nurses), the medical sciences division awarded 1,263, the natural sciences division 1,219, the social sciences division 823, and the humanities division 471. The directory is published from the office of the Foundation at 49, West 49th Street, New York.

WESTERGREN AND WINTROBE METHODS OF ESTIMATING E.S.R. COMPARED*

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The present investigation was conceived as a result of the observation by one of us (A. J. S.) that in two cases of acute tuberculosis the erythrocyte sedimentation rate (E.S.R.) when estimated by the Westergren method was considerably raised, whereas by the Wintrobe method it was within normal limits. It was decided, therefore, to make tests on a series of patients, male and female, by both methods, to see what measure of agreement was obtained.

Technique Employed

Wintrobe Tubes.—Test-tubes (3 by ½ in.—7.5 by 1.25 cm.) graduated with a mark at 2 ml. were coated with 4 mg. of Heller and Paul's anticoagulant mixture (three parts ammonium oxalate and two parts potassium oxalate) and stoppered with red rubber stoppers.

Westergren Tubes.—Similarly graduated (3 by ½ in.—7.5 by 1.25 cm.) tubes containing 0.4 ml. of 3.8% sodium citrate solution were used. These tubes were stoppered with black rubber stoppers.

The tests were made as follows. Blood samples were taken by venepuncture, dry-heat sterilized syringes and needles being used. A rubber tourniquet was lightly applied in most cases. As soon as enough blood had been withdrawn, the needle was removed from the syringe and blood was delivered to the mark in the Wintrobe collection tube and then into the Westergren collection tube. The two tubes were at once stoppered and the contents mixed by gentle shaking.

The tests were put up as soon as possible after venepuncture—the great majority within 30 minutes from the time of taking the blood. Before filling the sedimentation tubes each blood sample was mixed by hand-shaking for approximately two minutes. Care was taken to see that the spirit levels of the Wintrobe rack were correctly adjusted, and in the case of the Westergren tests a plumb-line was used to assist in setting the tubes to a vertical position. Variations in room temperature were not considered sufficient to warrant recording, the temperature being fairly constant at about 20° C.

The E.S.R. value recorded was the length in millimetres of the column of plasma above the packed red cells, read at the end of one hour.

Although corpuscular volume determinations were made in all cases which showed a raised E.S.R. value, no correction for low C.V. values was applied to the figures quoted in this article; doubts about the merits of applying a correction to the Wintrobe E.S.R. reading have within recent years been expressed and discussed (Sinton, 1948; Terry, 1950). Had a correction been

*The work for this paper was done in Winson Green Hospital, Birmingham, while we were respectively the deputy medical superintendent and the chief technician of the hospital.

applied, the number of significant differences between the Westergren and Wintrobe results would have been even greater.

Results

In this investigation the female findings were kept separate from the male ones in order to see whether sex had an influence on the difference, if any, found between the two sets of figures. The results are set out in Tables I–IV.

TABLE I.—*Wintrobe–Westergren Comparison (Females)*

(1) No. examined	468
(2) No. with Wintrobe of 20 mm. and over	140 (30%)
(3) Proportion of (2) with Westergren of 8 mm. and over	140 (100%)

TABLE II.—*Westergren–Wintrobe Comparison (Females)*

(1) No. examined	468
(2) No. with Westergren over 12 mm.	180 (38%)
(3) Proportion of (2) with Wintrobe under 20 mm.	49 (27%)
(4) Proportion of (2) with Wintrobe under 15 mm.	19 (10·5%)
(5) Proportion of (2) with Wintrobe of 12 mm. and under	12 (6·5%)

TABLE III.—*Wintrobe–Westergren Comparison (Males)*

(1) No. examined	267
(2) No. with Wintrobe of 10 mm. and over	82 (31%)
(3) Proportion of (2) with Westergren of 6 mm. and over	82 (100%)

TABLE IV.—*Westergren–Wintrobe Comparison (Males)*

(1) No. examined	267
(2) No. with Westergren of 6 mm. and over	110 (41%)
(3) Proportion of (2) with Wintrobe under 10 mm.	31 (28%)

Table V gives examples of discrepancies obtained between the two methods in cases with obvious physical disease.

TABLE V.—*Discrepancies Between the Westergren and Wintrobe Methods in Known Cases of Physical Disease*

Case No.	Disease	Sex	E.S.R. (mm. in one hour)	
			Westergren	Wintrobe
1	Active pulmonary tuberculosis	F	33	18
2	,, ,, ,,	F	37	12
3	Suspected ,, ,,	F	37	16
4	Recent caesarean section	F	24	17
5	Bronchiectasis	F	15	12
6	Suspected pulmonary tuberculosis	F	16	18
7	Acute pulmonary infection	F	23	10
8	G.P.I. (untreated)	M	26	3
9	,, ,,	M	11	4
10	,, ,,	M	7	1
11	,, ,,	M	6	3
12	Cushing's disease	M	9	9

Discussion

It will be seen from Tables I and III that where there is a raised E.S.R. as estimated by the Wintrobe method (20 mm. and over in one hour being taken as abnormal for females and 10 mm. and over for males) the Westergren results are in complete agreement.

When the Wintrobe is compared with the Westergren, however, a very different picture is presented (see Tables II and IV). In the case of the females, even when only figures greater than 12 mm. Westergren are taken to be abnormal, a higher proportion of the total number examined are shown to have a raised E.S.R. (38% as against 30%). Of this proportion, those with a Wintrobe of under 20 mm. total 27%—a very big discrepancy. Those with a Wintrobe of under 15 mm. amount to 10.5%, and there are even 6.5% with a Wintrobe of 12 mm. and under.

The figures from the male series are also interesting. With 6 mm. and over being regarded as abnormal, there is again a higher proportion of the total number examined shown to have a raised E.S.R. (41% as against 31%). Of these abnormal Westergren results, those with a Wintrobe value of under 10 mm. total 28%. Two out of 62 cases having a Westergren of over 10 mm. had a Wintrobe value of under 10 mm., and both these were cases of untreated G.P.I.

The cases listed in Table V are instructive. Cases 1 and 2 were the ones which first drew attention to the discrepancy which seems to occur. Case 1 was one of pulmonary tuberculosis, proved radiologically and with tubercle bacilli present in the sputum. Although Case 2 died from active phthisis a few weeks after admission, her E.S.R. as estimated by the Wintrobe method was only 12 mm., whereas her Westergren reading was 37 mm. Case 7 was acutely ill physically on admission, and a pulmonary abscess was suspected. On admission her Wintrobe E.S.R. was 50 mm., whilst her Westergren was 112 mm. Two weeks later, when she was improved though yet far from well, the Westergren was still abnormal (23 mm.), as was only to have been expected, but the Wintrobe value (10 mm.) was well below the upper limit of normal.

It is interesting to note that all the male cases of G.P.I. admitted while the investigation was in progress, and examined before treatment, showed a slightly raised Westergren E.S.R., whereas in each case the Wintrobe was found to be normal. Case 8 was acutely ill physically on admission, and the Westergren figure in his case was much higher at 26 mm. than those figures obtained from the other cases of G.P.I., although some days later it had fallen to 12 mm. The Wintrobe E.S.R. was quite normal on both occasions.

Sinton (1948), making serial tests on female patients suffering from pulmonary tuberculosis, found the Westergren method of estimating the sedimentation rate more reliable than the Wintrobe method.

Our results show that not only do serious discrepancies exist between the two methods in cases of pulmonary tuberculosis, but that they also occur in other conditions. We have found that in a fairly large series of cases a raised Wintrobe figure was always accompanied by a raised Westergren; but a raised Westergren was not accompanied by a raised Wintrobe in as many as 27% of the female and 28% of the male cases.

We found also that, in the cases of some gravely ill patients, the Wintrobe method (only) gave normal—and therefore very misleading—results; or else it became normal after having given a high reading before the clinical condition of the patient, as judged by other standards, justified it.

Thus, when these results are related to clinical conditions, our findings clearly support the opinion that the Westergren method is more sensitive and more reliable than the Wintrobe method.

Summary and Conclusions

The Westergren and Wintrobe methods of estimating the E.S.R. are compared, and the results related to the clinical findings.

The Wintrobe method was found to be misleading in a few important cases.

We are of the opinion that as a screening test and as a pointer to organic disease the Westergren method is to be preferred.

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