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Survey of Changes in the Erythrocyte Sedimentation Rate at the Different Stages of Therapy by Westergren Method in the Patients of Pulmonary Tuberculosis in the Malwa Region of Madhya Pradesh

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Abstract

Background: Tuberculosis, an ancient disease of man remains the most important specific communicable disease in the world caused by Mycobacterium tuberculosis. Tuberculosis continues to be the biggest public health problem in terms of morbidity & mortality.

Aims & Objective: To study the changes in erythrocyte sedimentation rate at the different period of therapy in Pulmonary tuberculosis.

Material & Method: A total of 50 untreated sputum positives well as negative cases of pulmonary tuberculosis admitted in TB chest department as well as out patients of Pulmonary Medicine department of Index Medical College Hospital & Research Centre, Indore were included. Under aseptic precautions 5ml of blood collected from sputum positive cases of pulmonary tuberculosis as well as sputum negative in EDTA vacutainers & erythrocyte sedimentation rate were analysed using westergren tube at different period of therapy.

Result: The study was conducted on 50 subjects of different age group. The sputum positive cases shows rise in ESR with different degree of mild, moderate & severe, While it decreases & comes to normal at different period of therapy as sputum negative cases which has already normal ESR range. So there was a significant post treatment improvement in ESR.

Conclusion: Blood changes in pulmonary tuberculosis are common in the form of increased ESR with degree of mild, moderate & severe rise at the beginning of therapy, Which decreases & comes to normal range at the different period of therapy, which can be used as a guide to assess the improvement of TB patients after therapy.

Keywords: *ESR, Pulmonary tuberculosis, Tb, Westergren, Mycobacterium.*

Introduction

Tuberculosis (TB) one of the earliest known diseases & still a major cause of mortality even today, has many manifestations affecting the blood, bone, central nervous system & many other organ system but it is primarily a pulmonary disease[1]. It is caused by a closely–related group of organism, all of which forms the Mycobacterium tuberculosis complex. These organism include M. tuberculosis, M. bovis, M. africanum, M. microfti & M. canetti[2]. Tuberculosis is a gradually progressive debilitating disease, it is a necrotizing bacterial infection with protein manifestations & wide distribution. It is an indicator of social organization & standard of living in the community[3].

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Pulmonary tuberculosis can present as (a) Cavitation, (b) Tuberculous pneumonia, (c) Tuberculous broncho-pleural fistula with empyema, (d) Pleurisy with effusion, (e) Post tuberculous pulmonary collapse, (f) Tuberculosis of bronchi, trachea & larynx, (g) Post tuberculous pulmonary fibrosis & (h) Miliary tuberculosis. The diagnosis is based on clinical & radiological findings & is not bacteriologically confirmed. Mode of chemotherapy & duration can be monitored with the help of X-rays & E. S. R[4]. Exact & fast diagnosis can lead to control the disease[5].

Haematopoietic system is another organ system adversely affected by tuberculosis[6]. A different type of haematological changes appears to be associated with different forms of pulmonary tuberculosis[7] & these blood changes act as a clue for the diagnosis, prognosis & response to treatment[8]. The rate of E. S. R. depends upon the interaction between opposing forces. Settling occurs because the density of the RBC is greater than the density of the medium.

Erythrocyte sedimentation rate is a time honoured investigation as an index of activity of disease that has alredy been recognized[9]. The study was undertaken to analyze the changes in the erythrocyte sedimentation rate i. e E. S. R. in patients according to severity & different forms of pulmonary tuberculosis at the time of admission with smear positive for AFB & to evaluate their diagnostic & prognostic significance[10].

Material & Method

A total of 50 untreated sputum positive as well as negative cases of pulmonary tuberculosis aged between (15-70) years attending to Pulmonary Medicine as well as out patients department of Pulmonary Medicine, Index Medical College Hospital & Research Centre, Indore were included. The biodata & medical history of these patients were obtained from their case notes. Pateints having haemorrhoids, peptic ulcer bleeding, menorrhagia, haematuria, malignancy & chronic suppurative pulmonary disease were not included in the study.

Clinical examination including General examination & Systemic examination with detailed examination of respiratory system were done at the clinical laboratory of Physiology department of this Institute were done. Other investigations including a)Routine & microscopical examination of urine, b) Routine examination of stool-occult blood, c)Radiological Investigation by taking Postero-anterior view of chest was taken, d) Blood-E. S. R. estimation using Westergren method, d) Sputum examination for Acid Fast Bacilli using Zeihl Neelsen.

Sputum collection & slide preparation: Sputum sample from all the suspected TB patients were collected in sterile container & smears were prepared and all smears were stained with Ziehl Neelsen stain by using standard protocol[11].

(I) Radiological Investigation: Postero-anterior viewofchest was taken. In some cases In som caseslatera view wes also taken. The radiological findings were according to the criteria set by tuberculoclous Association of India.

Extent of disease:

(a) Minimal Lesion–The lesion involving a small part of one or both lungs, the total extent of which (regardless ofthedistribution) doesnot exceedthe volume of lung on oneside from apex upto the level of lowest point of tesecnd costochondral junction.

(b) Moderately advanced Lesion-Lesion involving one lung or both lungs, but not exceeding the volume of lung on one side from apex upto the level of the lowest point of fourth costochondral junction.

(c) Severely advanced Lesion–Lesions are extensive than moderately advanced lesions.

(II) Blood collection & Erythrocyte sedimentation rate (E. S. R.) estimation by westergren method[12]: Blood samples were collected from patient into EDTA containers. The recommended tube is a westergren tube which is a straight glass tube 30 cm. in length & 2.55 (±0.15) mm in diameter. The bore must be uniform to 0.05 mm throughout. A scale graduated in mm extends over the lower 20 cm. Mix the blood thoroughly & then draw it up to 200 mm mark by means of a teat or a mechanical device, mouth suction should never be used. The tube exactly placed vertical & leave undistributed for 60 minutes, free from vibration & draughts & not exposed to direct sunlight. Reading was to be taken of the height of the clear plasma above the upper limit of the column of sedimentating cells to the nearest mm. This measurements in mm is the E. S. R. (Westergren/hour). A poor delination of the upper layer of redcells, so called " Statified sedimentation " has been attributed to the presence of many reticulocytes. The range were derived from several publications. The values are means ±2 SD.

E. S. R. range in Health

Men aged years	E. S. R. (mm/1 hr)	Upper Limit (mm/1 hr)
15-50	4 ± 3	10
51-60	6 ± 3	12
More than 60	6 ± 4	14

Women aged years	E. S. R. (mm/1 hr)	Upper Limit (mm/1 hr)
15-50	6± 3	12
51-60	9 ± 5	19
More than 60	10 ± 5	20

In childhood & adolescence the E. S. R. is the same as for normal men with no differences between Boys & Girls[13].

Ethical Approval: Approval from Institutional Ethical Committee was obtained.

Statistical Analysis: All values were expressed as mean ± standard deviation. The bivariate correlation between variables were evaluated by Pearsons correlation. Statistical analysis was done using the Statistical Package for Social Sciences (SPSS) version-22.

Results: The present study was done on 50 cases, out of which 84% were males &16% were females of age varied from 15-70 years as shown in Table No-1. The maximum incidence of the disease was observed between third to fourth decade of life in both the sexes.

Table No. 1 The age & sex distribution of the cases studied

Age in Years	Male	Female	Total
15-24	6	1	7
25-39	22	4	26
40-54	12	2	14
55-64	1	1	2
65-70	1	0	1

Among the study population the Table-2 shows that 58% had moderately advanced, 30% of cases has far advanced & 12% cases had minimal lesion on different age groups.

Table No. 2: Severity of diseases according to chest Roentgenogram

Age in years	Minimal lesion	Moderately advance	Far advanced
15-24	2	8	1
25-39	3	14	5
40-54	1	6	7
55-64	-	1	1
65-70	-	-	1
Total	6	29	15

Among the study population the Table-3 depicts that out of 50 cases of pulmonary tuberculosis, 72% showed cavitation of different sizes wheras 28% did not shows any cavity formation.

Table No. 3: Types of cases according to cavitatory & non-cavitatory lesion

Age in years	Cavitatory lesion	Non-Cavitatory lesion
10-24	4	5
25-39	18	5
40-54	10	4
55-64	3	0
65-70	1	0
Total	36	14

Among the study population the Table-4 depicts that all cases irrespective of extent of disease had abnormally raised E. S. R.. In follow up, after two months of therapy, six cases had attained normal E. S. R, those had minimal lesion. The E. S. R. values decreased after two months of therapy, While in cases with very high E. S. R. initially & after six months of therapy 14cases had still slightly raised E. S. R. Those cases were found to have far advanced lesion.

Table No. 4: Estimation of E. S. R. at different stages of therapy by westergren method.

E. S. R. level at different intervals of therapy	No. of cases.	Average E. S. R. in mm/hr		
		Range	Mean	Standard Deviation (S. D.)
At the time of admission	50	22-135	51.2	±24.77
After two months of therapy.	42	12-58	27.34	±6.68
After six months of therapy	25	8-24	12.84	±6.03

Discussion

ESR is regarded as test f activity in pulmonary tuberculosis[14]. Elevated ESR to different level is one of the indicators of increased activity of disease & a prognostic device, as evident in our work. It elevates in those patient with rise in sputum positivity. Earlier studies also shows the elevated ESR as reported by Chakraborti AK et al[15], DeodhareSG[16]& Hungund BR et al[17].

In our study, 50 untreated sputum positive as well as negative cases of pulmonary tuberculosis were studied for changes in ESR estimated by westergren method & again follow up after two months & after six months. The age range of these 50 cases varied from 15 to 70 years. The mximum number of these patients (i. e 84%) were in the third & fourth decade of life in both sexes. 84% of them were male & 16% were female with male:female ratio 5:1 respectively. In support of our study Westergren[18] (1921) also observed that out of 60 cases studied 46 were within third & fourth decade of life in both sexes in his study group. While in contrast to our study Khan[19] et al observed that 37.5% of cases were below 40 yearsof age, 39.7% between 41-60 years of age & above 60 years were of 22.7%. The male & female ratio being 76:12 in their study group. So in this way this study differs from the present study.

Kailasam[20]et al (1985) observed that out of 511 patients studied 47 (9.2%) were of minimal lesion, 299 (58.5%) of moderately advanced lesion & 167 (32.3%) are of far advanced lesion. The present study mimicks the observations brought about by Kailsam[20] et al.

Out of 50 cases 72% os cases were of cavitatory lesion. All showed a very high level of ESR value by Wintrobes method. After two months of therapy, fall in ESR values were observed, but non-attained normal value. After six months of therapy 6 out of 21 cases showed normal ESR. Westergren SG[18] (1921) observed in his studies of 369 patients that majority of his patients were having cavitatory lesion in all age group ranging from 15-60 years. All except few cases showed a moderate to high rise of ESR While few cases showed a very minimal rise in ESR.

Pagel W[21] (1964) observed that the test is of no specific assistance in diagnosis in lesion of minimal extent. It frequently yields a nrmal value. In the present study, it was observed that the cases with minimal lesion showed a raised ESR pattern, although the rise wasnot very significant. Present observation was in accordance with Westergren SG[18] (1921) Who states that the rise of ESR was a indication of pathological process in the human body. In follow up all cases showed fall in ESRafter 2 months of anti-tubercular therapy irrespective of extent & type of lesion. While after 6 months of therapy all except few attained normal ESR. Westergren[18] (1921), Pagel W[21] (1964) & Khan[19] et al all have noticed fall in ESR during the course of treatment at frequent intervals & invariably attainednormal ESR after 6 month of therapy.

Conclusion

All cases had very high sedimentation rate but cases with minimal lesion had lower sedimentation rate than far advanced lesion. The ESR of patients with tuberculosis varies with the anti-tubercular theray durin different time interval.

After 2 months of therapy the ESR tends to fall gradually & in 2 cases out of 4 cases of minimal lesion returned to normal, While after 6 month of therapy 16 out of 25 cases studied showed increased ESR, as these cases were of far advanced lesion & 10 cases out of 18 were of moderately advanced lesion. Blood changes in pulmonary tuberculosis are common in the form of increased ESR. No blood abnormality is specific for pulmonary tuberculosis & there is not much difference in blood changes in cavitatory lesion or non-cavitatory lesions. But some cases of far advanced lesion in which the blood changes are more marked. All the blood abnormalities are secondary to pulmonary tuberculosis 7 returned to normal rang with proper anti-tubercular therapy.

So, E. S. R. is raised irrespective of lesion indicating activity of disease & should be repeated frequently to access the healing process with the different period of anti-tubercular therapy.

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