



## Effect on absolute neutrophil and lymphocyte count in various stages of treatment in sputum positive cases of pulmonary tuberculosis

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### ABSTRACT

Tuberculosis remains most important communicable disease of the world in which various blood changes occurs. Absolute WBC Count is one of the most important abnormality. Aim: To evaluate various blood changes associated with pulmonary tuberculosis and compare with normal controls to evaluate prognostic value of these blood changes. Material and methods: Absolute count, product of total WBC count times the percentage of WBC's seen on differential smear in 50 untreated sputum positive cases of pulmonary TB and after 2 months and 6 months of anti-tubercular treatment and of control groups were compared and analysed statistically. Result: 24 cases had absolute neutrophil count >6000/cumm of blood, 11 had absolute lymphocyte count <1500/cumm of blood during admission. 6 months after therapy all cases except 2 had absolute neutrophil and lymphocyte counts within normal range. Conclusion: In active stage of disease leucocytosis with neutrophilia and lymphopenia were seen although tuberculosis is a chronic infection. Blood abnormalities secondary to TB returned to normal with proper therapy.

### KEYWORDS

Tuberculosis, neutrophils, lymphocytes, WBC

### INTRODUCTION

Tuberculosis, an ancient disease of man remains the most important specific communicable disease in the world. Because of its high mortality and morbidity, it impacts a major health problem, despite modern methods of effective control programme. The high mortality and morbidity puts a great burden on country's economy and development. The World Health Organisation (WHO) statistics for 2015 give an estimated incidence figure of 2.2 million cases (23 percent of the global total) of TB for India out of a global incidence of 9.6 million<sup>1</sup>. In 2013, an estimated 9 million people developed TB worldwide, which is equivalent to 126 cases per 100,000 population<sup>2</sup>. In 2011, an estimated 12 million people were living with active TB, and 1.4 million died from it<sup>3</sup>. Tuberculosis is a gradually progressive debilitating disease. It may involve any part of body. The lungs are most commonly affected, but lesions may occur in the kidneys, bones, lymph nodes, meninges or disseminated throughout the body<sup>4</sup>. The victim becomes cachexic and shows continuous downhill course as a result of ill health and associated malnutrition till death, unless the process is stopped by proper therapy.

The diagnosis of pulmonary tuberculosis is based on clinical and radiological findings and can be categorised as mild, moderate or severe or as cavitary and non-cavitary lesions<sup>5</sup>. Treatment can be started even without microscopic confirmation<sup>6</sup>.

### MATERIAL AND METHODS

The study was approved by institutional ethical committee. The present work was carried out in department of Physiology, Rajendra Institute of Medical Sciences, Ranchi. Samples were collected from department of TB & Chest and Medicine, Rajendra Institute of Medical Sciences, Ranchi.

#### The present study was carried out in two groups:

(a) Study group: comprised of 50 patients of pulmonary tuberculosis which included 35 males and 15 females. Subjects for study were selected from various patients attending the RIMS outdoor, primarily presenting with complaints of cough and hemoptysis and also from various untreated sputum positive cases of pulmonary tuberculosis admitted to different wards of department of Medicine and TB & Chest, RIMS, Ranchi.

(b) Control group: This group comprised of 50 normal healthy

individuals of different age and sex groups. Only 20-70 years age group persons were included in the control group to maintain the uniformity with the study group. Control groups were medical students, family members, interns, PG medical students, nurses, security guards and para medical staffs of RIMS.

After thorough history taking and physical examination, sputum sample were examined for Acid Fast Bacillus and PA view chest X ray was done to determine the extent of lesion. The radiological findings were read according to the criteria set by Tuberculosis Association of India (1969). The lesion was classified as minimal, moderate and far advanced depending upon the extent of the lesions.

Total leukocyte count was done using Improved Neubauer ruling chamber using Turk's fluid<sup>7</sup>. Differential leukocyte count was done on peripheral smear examination using Leishman's stain<sup>8</sup>. The absolute count were the product of total white blood cell count times the percentage of the WBC seen on differential smear<sup>8</sup>. These tests was performed for each and every subject of both groups and analysed statistically. A written consent of every subject was taken for performing examination and collecting blood samples.

Persons with bleeding disorders like patients having hemorrhoids, melena, peptic ulcer disease, menorrhagia, haematuria and various malignancies are excluded from the study.

The statistical comparison of absolute values at different stages of therapy in different categories of tuberculosis was calculated using MedCalc Statistical Software.

### OBSERVATION

The observations in this series of work comprises of a total of 50 untreated sputum positive cases of pulmonary tuberculosis and 50 healthy controls. Different blood changes in all these cases have been evaluated during pretreatment at the time of admission, after two months post admission and six months of proper treatment with anti-tubercular chemotherapy.

#### Table - I

Showing the **age and sex distribution** of these cases and controls.

Cases	Age in years	Male	Female	Total
	10 – 24	11	1	12
	25 – 39	14	6	20
	40 – 54	6	5	11
	55 – 69	3	2	5
	70 – above	2	0	2
	Sex distribution	36	14	50 (Total no. of cases)
<b>Control</b>		<b>35</b>	<b>15</b>	<b>50 (Total no. of cases)</b>

Out of 50 cases, 36 were males and 14 were females. The age range is varied from 10-70 years. The maximum number of patients were within the age range of 19-57 years. In control 35 were males and 15 were females.

**Table - II** Showing severity of disease according to chest roentgenogram (National Tuberculosis Association of India, 1969).

Age	Minimal lesion	Moderately advanced	Far advanced
10 – 24	2	9	1
25 – 39	1	11	8
40 – 54	2	3	6
55 – 69	0	1	4
70 – above	0	1	1
<b>Total</b>	<b>5</b>	<b>25</b>	<b>20</b>

Out of 50 cases 50% (25 cases) had moderately advanced, 40% (20 cases) cases had far advanced and 10% (5 cases) had minimal lesion in different age groups.

**Table - III** Showing types of cases according to chest roentgenogram (National Tuberculosis Association of India, 1969)

Age in years	Cavitatory lesion	Non-cavitatory lesion
10 – 24	7	5
25 – 39	15	5
40 – 54	8	3
55 – 69	4	1
70 - above	2	0
<b>Total</b>	<b>36</b>	<b>14</b>

Out of 50 cases of pulmonary tuberculosis 72% (36 cases) were with cavitatory and 28% (14 cases) were non-cavitatory lesion.

**Table – IV** Showing total leucocytes count at different stages of treatment in study group and control group :

Cases	Leucocyte count at different intervals of therapy	No. of cases	Total leucocytes count into x100/cumm			‘p’	‘t’
			Range	Mean	S.D. ±		
	At the time of admission	50	49-151	89.46	27.54	0.15 Non-significant	1.42
	2 months after therapy	36	62-132	85.00	17.82	0.62 Non-significant	0.5
	6 months after therapy	29	59-98	80.69	12.13	0.382 Non-significant	0.89
Control		50	58-117	83.32	13.22		

From the above table it is said that the test is non- significant at all times i.e at the time of admission (p=0.15), after 2 months of therapy (p=0.62), and after 6 months of therapy (p=0.382). So it can be said that **TLC value is not much altered in tuberculosis.**

‘Out of 50 cases, 37 cases had leucocyte count within normal limit. 13 cases were found with leucocytosis, 6 of which had far advanced, cavitatory lesion, 3 had moderately advanced cavitatory lesion 1 had Far advanced non-cavitatory lesion, 2 had moderately advanced non-cavitatory lesion and one had minimal non-cavitatory lesion.

2 months after therapy 3 cases with far advanced cavitatory lesion still had leucocytosis, but dropped to normal after 6 months of therapy.

Total leucocyte count in control cases (mean= 83.26).

**Table – V** Showing absolute neutrophil and lymphocyte counts at different stages of treatment in study group and control group:

Cases	Absolute neutrophil and lymphocyte counts at different intervals of therapy	No. of cases	Absolute neutrophil and lymphocyte count x 100/cumm			“p”
			Range	Mean	SD+/-	
Control 5	At the time of admission	50				
	Neutrophil		27.93-120.80	62.94	24.32	0.0013 significant
	Lymphocyte		11.66-46.02	24.21	09.47	0.005 Significant
	2 months after therapy	36				
	Neutrophil		26.66-76.56	49.79	13.47	0.99 Non-Significant
	Lymphocyte		19.22-51.48	33.14	08.26	0.0097 Significant
	6 months after therapy	29				
	Neutrophil		37.17-61.38	47.10	08.83	0.35 Non-Significant
	Lymphocyte		15.93-36.10	28.87	4.12	0.94 Non-Significant
	Neutrophil		20.38-88.40	49.79	14.14	
Lymphocyte		12.10-46.90	28.97	06.36		

From the table it is said that in case of absolute neutrophil count , the test was significant at the time of admission (p=0.0013) , but the test was non-significant (p=0.99)after 2 months of therapy and after 6 months (p=0.35).

In case of absolute lymphocyte count, test was significant (p=0.005) at admission, and even at 2 months (p=0.0097) , but was non-significant after 6 months of therapy (p=0.99).

So it can be said that lymphocyte values are more de-arranged in tuberculosis.

The absolute neutrophil count in 24 cases (48%) showed neutrophils more than 6000/cumm of blood, 14 (25.8%) of them had far advanced, 9 had moderately advanced and one minimal

lesion. Lymphocyte count in 11(22%) cases showed lymphocytes below 1500/cumm of blood, 8 of them had far advanced and 3 had moderately advanced lesion, Majority (6 cases) had cavitory lesion.

After 2 months of therapy only 7 cases had neutrophil more than 6000/cumm and 5 case had lymphocyte more than 4000/cumm, all had far advanced lesion.

After 6 months of therapy all cases except 2 had neutrophil counts and lymphocyte counts within normal range.

**Table – VI**

Showing statistical comparison among absolute neutrophil and lymphocyte counts at different stages of therapy in:

**(a) Cavitory lesion of pulmonary tuberculosis.**

Absolute neutrophil and lymphocyte counts at different intervals of therapy	No. of cases	% of cases	Absolute neutrophil and lymphocyte counts x 100/cumm	
			Range	Mean
<b>At the time of admission</b>	36	72		
Neutrophil			27.93-120.80	62.1
Lymphocyte			11.66-46.02	23.78
<b>2 months after therapy</b>	28	56		
Neutrophil			26.66-76.56	50.65
Lymphocyte			19.22-51.48	35.15
<b>6 months after therapy</b>	22	44		
Neutrophil			37.17-61.38	48.73
Lymphocyte			15.93-36.10	29.79

**(b) Non-cavitory lesion of pulmonary tuberculosis**

Absolute neutrophil and lymphocyte counts at different intervals of therapy	No. of cases	% of cases	Absolute neutrophil and lymphocyte counts x 100/cumm	
			Range	Mean
<b>At the time of admission</b>	28	72		
Neutrophil			29.64-72.32	60.5
Lymphocyte			11.66-34.34	25.29
<b>2 months after therapy</b>	8	16		
Neutrophil			33.48-62.31	46.04
Lymphocyte			19.22- 30.66	26.09
<b>6 months after therapy</b>	7	14		
Neutrophil			40.71-61.38	49.27
Lymphocyte			15.93-30.10	26.40

**(c) Minimal lesion of pulmonary tuberculosis.**

Absolute neutrophil and lymphocyte counts at different intervals of therapy	No. of cases	% of cases	Absolute neutrophil and lymphocyte counts x 100/cumm	
			Range	Mean
<b>At the time of admission</b>	5	10		

Neutrophil			42.09-72.32	49.35
Lymphocyte			22.08-33.20	27.07
<b>2 months after therapy</b>	4	8		
Neutrophil			37.23-59.22	46.97
Lymphocyte			24.14-30.66	27.73
<b>6 months after therapy</b>	3	6		
Neutrophil			42.00-61.38	50.86
Lymphocyte			26.93-29.25	28.30

**(d) Moderately advanced lesion in pulmonary tuberculosis.**

Absolute neutrophil and lymphocyte counts at different intervals of therapy	No. of cases	% of cases	Absolute neutrophil and lymphocyte counts x 100/cumm	
			Range	Mean
<b>At the time of admission</b>				
Neutrophil			27.93-81.81	51.46
Lymphocyte			11.66-46.02	25.63
<b>2 months after therapy</b>	18	36		
Neutrophil			26.66-66.33	47.02
Lymphocyte			19.22-39.78	30.37
<b>6 months after therapy</b>	14	28		
Neutrophil			37.17-59.52	47.21
Lymphocyte			15.93-33.84	27.93

**(e) Far advanced lesion in pulmonary tuberculosis.**

Absolute neutrophil and lymphocyte counts at different intervals of therapy	No. of cases	% of cases	Absolute neutrophil and lymphocyte counts x 100/cumm	
			Range	Mean
<b>At the time of admission</b>	20	40		
Neutrophil			40.02-20.80	30.8
Lymphocyte			14.24-34.34	20.83
<b>2 months after therapy</b>	14	28		
Neutrophil			28.08-76.56	60.74
Lymphocyte			19.88-51.48	35.69
<b>6 months after therapy</b>	12	24		
Neutrophil			37.95-60.76	50.64
Lymphocyte			27.06-36.10	30.33

From this table it is observed that absolute neutrophil count is slightly more in far advanced and cavitory lesion than in minimal or moderately advanced and non-cavitory lesion. After 2 months and 6 months of therapy, although the absolute neutrophil count did not show much variation in cases with minimal or moderately advanced and non-cavitory lesion, but absolute neutrophil count definitely dropped in far advanced and in cavitory lesion. Similarly absolute lymphocyte count is slightly less in far advanced than other groups. After 2 months of therapy all groups showed increased level of absolute lymphocyte count but more so in far advanced or moderately advanced and in cavitory lesion.

In cases with far advanced, moderately advanced and in cavitory lesion after 6 months of therapy the absolute lymphocyte slightly decrease than previous values but definitely not less than the count

observed before treatment.

Statistically the decrease in neutrophil and increase in lymphocytes are not significant in minimal moderately advanced and in non-cavitatory lesion, at different intervals of therapy. But decrease in neutrophil count is significant and increase in lymphocyte count is highly significant in far advanced and in cavitatory lesions at different intervals of therapy.

## DISCUSSION

In this series, 50 untreated sputum positive cases of pulmonary tuberculosis and 50 controls were studied for different blood changes, patients were given appropriate antitubercular therapy and again followed up after 2 months and six months. 14 cases did not turn up for haematological study after 2 months and 21 cases after six months.

The age range of these 50 cases varied from 10 to 70 years. The maximum number (72%) of these patients were within the age range of 25 to 69 years. 72% (36 cases) were male and 28% (14 cases) were female with male: female ratio 3:1 approximately. Khan et al (1977) observed that the male: female ratio being 76:12. This study therefore differs slightly from that conducted by Khan et al. In control group 70% (35 cases) were males and 30% (15 cases) were females with male:female ratio of 2.3:1.

Out of 50 cases, 5 cases (10%) had minimal lesion, 25 cases (50%) and moderately advanced lesion and 20 cases (40%) had far advanced lesion. Again of the total cases, 36 (72%) had cavitatory and 14 (28%) had non-cavitatory lesion. Kailsam et al (1985) observed that out of 511 patients studied, 47(9.2%) had minimal lesion, 299(58.5%) had moderately advanced lesion and 167(32.3) had far advanced lesion. The present study mimics the observations brought about by Kailsam et al.

In this study the leucocyte count is normal in 74% (37 cases) cases, and 26% (13 cases) cases had leucocytosis. In this study the absolute neutrophil count in 24 (48%) cases had count more than 6000/cumm of blood and another 11(22%) cases had absolute lymphocyte count less than 1500/cumm of blood. Out of these cases having raised absolute neutrophil count, 20 (40%) had cavitatory lesions, 14 cases (25.8%) had far advanced lesions.

It is also observed in this study that out of 11 (22%) cases with absolute lymphopenia at the time of admission, 6 cases (12%) had cavitatory lesion. Absolute lymphopenia was equally distributed between moderately advanced and far advanced lesion.

These above findings substantiated the contention of Pagel (1964) that a total leucocyte count of 9000 consisting of more than 6000 of neutrophils and less than 2000 lymphocytes was a septic picture and indicates ulceration<sup>9</sup>. He also explained that in far advanced lesion and ulceration in cavitatory lesion, there is increased body defence mechanism, hence increase in neutrophil counts<sup>9,10</sup>.

2 months after therapy all cases showed normal absolute neutrophil count except 7 cases, out of which 6 cases were of far advanced lesion showing slow recovery from infection. Lymphocytosis was observed in 5 cavitatory cases (case no. 3,17,21) after 2 months of therapy, who had normal lymphocyte counts before treatment, indicating a healing process. This observation is similar to that of Medlar (1935) who had opinion that lymphocytosis indicates healing process<sup>11,12</sup>. After 6 months of therapy all cases returned to normal.

In subacute infection in addition to leucocytosis often premature leucocytes are released to circulation<sup>13</sup>. After 2 months and 6 months of therapy peripheral smear of this patient became normal with no premature cells which was observed before therapy.

## SUMMARY AND CONCLUSION

The purpose of the study was to observe changes in absolute values of neutrophils and lymphocytes at various stages of treatment in pulmonary tuberculosis. An attempt had also been

made to correlate the severity of disease with the absolute levels. Both pretreatment values and values after 2 months and six months of antitubercular therapy without haematinics, different investigation were done in all cases. 24 cases(48%) had absolute neutrophil count more than 6000/cumm of blood and 11 cases(22%) had absolute lymphocyte count less than 1500/cumm of blood at the time of admission.

After 6 months of therapy all cases except 2 had absolute neutrophil counts and lymphocyte counts within normal range.

The findings were compared and effect of therapy were assessed. Absolute values abnormalities are secondary to pulmonary tuberculosis and returned to normal with proper antitubercular therapy.

Absolute values of neutrophils and lymphocytes seen in pulmonary tuberculosis have no prognostic value.

## REFERENCES

1. Global tuberculosis report 2015:1-2
2. Park. Textbook of preventive and Social Medicine. 23rd ed: 176-177
3. Harrison. Principles of Internal Medicine. 19th ed. Mc Graw Hill Medical Publishers; 2015:12
4. Mohajan, Haradhan Kumar. Tuberculosis is a fatal disease among some developing countries of the world. AJIDM 3. 1(2015): 18-31
5. Bates J.A. 1979. Diagnosis of tuberculosis, Chest (Suppl) 76:757
6. Cameron S.J & Horne N.W. 1971. The effect of tuberculosis and its treatment on erythropoiesis and folate activity, Tubercle, Lond 52, 37
7. Ghai C.L. A Textbook of Practical Physiology. 8th ed. Jaypee Brothers Medical Publishers (P) Ltd: 60-62
8. Ghai C.L. A Textbook of Practical Physiology. 8th ed. Jaypee Brothers Medical Publishers (P) Ltd: 69-77
9. Pagel W & Woolf A.C. 1949. On fulminant tuberculous septicaemia with leucopenia, Amer Rev Tuberc 59, 311
10. Pagel W 1964. Pul. Tuberculosis. p.279.
11. Meddler E.N. 1935. Further studies on the leucocyte reaction in tuberculosis. Am. Rev. Tubercle 31, 611
12. Medlar E.M. & Lotha A. J. 1940. Leucocyte count in tuberculosis, Amer Rev. Tuberc 42, 344
13. Wintrobe 1974. Clinical haematology.