Clinical Medicine Research
2020; 9(1): 20-24
http://www.sciencepublishinggroup.com/j/cmr
doi: 10.11648/j.cmr.20200901.14
ISSN: 2326-9049 (Print); ISSN: 2326-9057 (Online)

Haematological Profiles of Patients with Extra-pulmonary Tuberculosis

Silas Anayochukwu Ufelle[1], Kenechukwu Chibuike Onyekwelu[2, *], Peter Uwadiegwu Achukwu[1], Augustine Chidi Ndubisi[2], Richard Chukwunonye Ezeh[3], Lorreta Nwakaego Nwokolo[2]

[1]Department of Medical Laboratory Sciences, University of Nigeria Enugu Campus, Enugu, Nigeria

[2]Department of Medical Biochemistry, University of Nigeria Enugu Campus, Enugu, Nigeria

[3]Department of Medical Biochemistry, ESUT College of Medicine, Parklane, Nigeria

Email address:

kenechukwu.onyekwelu@unn.edu.ng (K. C. Onyekwelu)

[*]Corresponding author

To cite this article:

Silas Anayochukwu Ufelle, Kenechukwu Chibuike Onyekwelu, Peter Uwaziegwu Achukwu, Augustine Chidi Ndubisi, Richard Chukwunonye Ezeh, Lorreta Nwakaego Nwokolo. Haematological Profiles of Patients with Extra-pulmonary Tuberculosis. *Clinical Medicine Research.* Vol. 9, No. 1, 2020, pp. 20-24. doi: 10.11648/j.cmr.20200901.14

Received: August 11, 2019; **Accepted**: October 23, 2019; **Published**: February 18, 2020

Abstract: Tuberculosis (TB) is a disease caused by bacteria called Mycobacterium tuberculosis. We aimed to evaluate the complete blood count (CBC) and erythrocyte sedimentation rate (ESR) of confirmed extra-pulmonary tuberculosis (EPTB) patients attending clinic at the University of Nigeria Teaching Hospital (UNTH), Ituku-Ozalla, Enugu. A total of 90 confirmed extra-pulmonary tuberculosis patients consisting of male (n = 38) and female (n = 52), aged 15 to 60 years attending clinic participated in this study. CBC and ESR were analysed using Haematological Auto Analyzer and Westergren method respectively. Haemoglobin and haematocrit values across the three age groups (15-30, 31-45, 46-60 years) were significantly lower ($p < 0.05$) than the control value in both male and female extra-pulmonary tuberculosis patients. Erythrocyte sedimentation rate, white blood count, platelet and neutrophil values across the three were significantly higher ($p < 0.05$) than the control values in both male and female extra-pulmonary tuberculosis patients. Extra-pulmonary tuberculosis was observed more in females than the males and was relatively higher in older patients (above 46 years) than younger patients (below 46 years). This study was able to show that different haematological parameters such as haemoglobin, haematocrit, Erythrocyte sedimentation rate, white blood count, platelet and neutrophil could serve as hallmark and help in early diagnosis of extra-pulmonary tuberculosis.

Keywords: Extra-pulmonary Tuberculosis, Comzplete Blood Count, Erythrocyte Sedimentation Rate

1. Introduction

Tuberculosis is an airborne infectious disease that most commonly affects the lungs where it is called pulmonary tuberculosis. When the infection occurs in any other parts of the body, it is called extra-pulmonary tuberculosis [1]. Tuberculosis is a major public health problem in Nigeria, a country of 169 million inhabitants, with the country currently ranking 10th among the 22 high TB burden countries of the world and fourth highest in Africa (after South Africa, Ethiopia and DR Congo) [2]. Overall case notifications have consistently increased in the country, but these seem to have plateaued since 2008 despite the more intensified control activities. Out of 97,853 notified TB cases in 2012, 52,901 (59%) were confirmed through smear-microscopy, 32,972 (37%) were based on a clinical diagnosis (smear-negative), and only 4,432 (5%) were extra-pulmonary TB. The overwhelming number of TB case notifications in 2012 (93%) were among patients who had not been treated previously [2]. TB case notification for all forms of TB in 2012 in South East Zone of Nigeria was 41 per 100,000 populations [3]. TB burden in Nigeria is further compounded by the high prevalence of HIV/AIDS of 4.1% among the general population. In 2012, 86% of registered TB patients were tested for HIV; of these, 23% were found to be HIV-positive [4]. TB still constitutes a serious public health problem in Nigeria, despite the implementation of the DOTS strategy since 1993 and subsequent adoption of

the WHO Stop TB strategy in 2006.

Results from the national TB prevalence survey in Nigeria have provided a robust direct measurement of TB disease burden in the country for the first time. Before survey results became available, indirect estimates of TB disease burden were calculated based mainly on reported TB case notification data and expert opinion about the levels of under reporting and under diagnosis of cases. Case notification data were known to under estimate the true burden due to recognized problems with case detection [5]. The prevalence of TB disease varied geographically, and was considerably higher in urban compared with rural areas [6].

Accordingly, it was deemed necessary to conduct a study in order to obtain the haematological profiles of patients with extra-pulmonary Tuberculosis attending clinic at the University of Nigeria Teaching Hospital (UNTH), Ituku-Ozalla, Enugu, South-East, Nigeria.

2. Materials and Methods

This study adopted the survey design and was conducted at the University of Nigeria Teaching Hospital, Ituku-Ozalla, Enugu, Enugu State, Nigeria. Ninety confirmed extra-pulmonary tuberculosis patients consisting of male (n = 38) and female (n = 52), aged 15 to 60 years attending clinic at the UNTH and 30 apparently healthy age and gender-matched control subjects (made up of 15 males and 15 females), consisting of 5 subjects from each of three age groups (15-30, 31-45 and 46-60 years) participated in this study. The extra-pulmonary tuberculosis patients were identified and confirmed clinically by the clinicians. Standardized predesigned questionnaire was used to collect data about age, gender, life style, socio-economical status and education from all participants.

2.1. Sample Collection and Preparation

Sputum samples were collected from extra-pulmonary tuberculosis patients in a sterile container and smears were prepared stained with Ziehl Neelsen stain by using standard protocol [7]. Blood samples were collected from patient into EDTA containers and analyzed using haematological auto analyzer (Abacus Junior 5 Haematological Auto Analyzer) [8] for different haematological parameters. Erythrocyte sedimentation rate (ESR) was determined using Westergreen method [9].

2.2. Ethics

Ethical approval for the study was obtained from the Health Research and Ethical Committee of the University of Nigeria Teaching Hospital, Ituku-Ozalla, Enugu. Also, oral informed consents were obtained from the patients who participated in the study.

2.3. Statistical Analysis

Statistical analysis was done with statistical package for social science (SPSS) computer software version 21. Data were subjected to descriptive statistics and analyzed using student t-test and one-way analysis of variance. Probability value $p<0.05$ was considered statistically significant.

3. Results

A total of 90 confirmed extra-pulmonary tuberculosis patients and 30 healthy controls participated in this study. The age of the patients and controls were between 15-60 years. For the extra-pulmonary tuberculosis patients, 38 (42.2%) were male and 52 (57.8%) were female while for the control subjects, 15 (50%) were male and 15 (50%) were female (Figure 1).

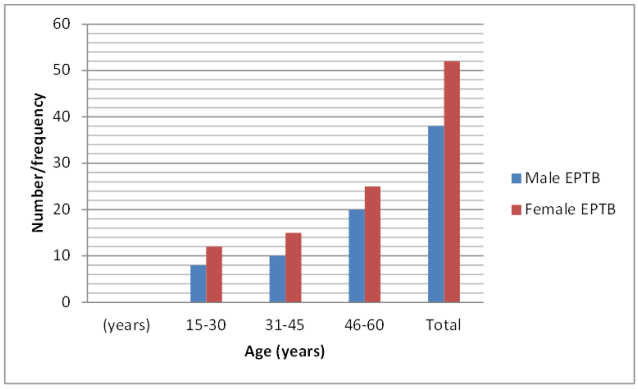

Figure 1. *Age and sex distribution of EPTB patients.*

Further analysis of the age and sex of the patients showed that 20 (22.2%) patients (8 males and 12 females) were within the age group of 15-30 years; 25 (27.8%) patients (10 males and 15 females) were within the age group of 31-45 years while 45 (50%) patients (20 males and 25 females) were within the age group of 46-60 years. Extra-pulmonary Tuberculosis occurred more between the ages of 46-60 years in both male and female subjects (tables 1 and 2).

Haemoglobin and haematocrit values across the three age groups (15-30, 31-45, 46-60 years) were significantly lower ($p < 0.05$) than the control value in both male and female extra-pulmonary tuberculosis patients. Erythrocyte sedimentation rate, white blood count, platelet and neutrophil values across the three age groups were significantly higher ($p < 0.05$) than the control values in both male and female extra-pulmonary tuberculosis patients.

4. Discussion

Tuberculosis is a contagious bacterial infection that mainly involves the lungs, but may spread to other organs [10]. Extra-pulmonary tuberculosis constitutes about 15 to 20 per cent of all cases of tuberculosis in immunocompetent patients and accounts for more than 50 per cent of the cases in HIV-positive individuals. This study revealed more female extra-pulmonary tuberculosis patients than males (figure 1). This findings corroborates those of Shafee et al., 2014 [11], Ayaz et al., 2012 [12] and Baloch et al., 2013 [13]. This could be

attributed to the fact that women have less access to tuberculosis treatment and prevention services than men and are unlikely to undergo sputum smear examination. Women in some contexts have difficultly accessing TB services because male family members are unwilling to pay for these services, women's health may not be considered as important as that of male family members, or because TB in women is more stigmatized than in men. Women have a higher prevalence of extra-pulmonary tuberculosis than men, particularly genital TB [14], which is difficult to diagnose and has been identified as an important cause of infertility in settings with high TB incidence [15]. On the contrary, in a retrospective review by Chen et al., 2011 [16] in adult patients with hematological malignancies at National Taiwan University Hospital between 1996 and 2009, 53 of 2984 patients were diagnosed with tuberculosis disease; thirty-eight patients (72%) with non-disseminated pulmonary TB disease and 15 (28%) patients with extra-pulmonary disease. out of 15 patients with extra-pulmonary tuberculosis, 9 were male while 6 were female. Al-Hajoj et al., 2015 [17] also reported in his study that male patients were mostly infected with extra-pulmonary tuberculosis (58.8%), in contrary to the global trend.

In this study, extra-pulmonary tuberculosis occurred mostly in mature and productive age group of 46-60 years. This observation is in line with the studies carried out by Amin et al., 2011 [18] and Ullah et al., 2009 [19] which showed that majority of the patients (82%) were above/older than 40 years of age. One of the most recognized consequences of aging is a decline in immune function. The effects of aging on the immune system are widespread and affect the rate at which naive B and T cells are produced as well as the composition and quality of the mature lymphocyte pool. This could account for the high prevalence of extra-pulmonary tuberculosis within the age range of 46-60 years. Also, the risk of acquiring TB infection increases with age because of increasing number and higher frequency of contacts.

There was a high significant ($p<0.05$) decrease in the values of haemoglobin and haematocrit of both males and females subjects in comparison with the control (tables 1 and 2). This could be attributed to invasion of bacteria which leads to activation of T-lymphocytes and macrophages, which induce the production of the cytokines causing diversion of iron into iron stores in the reticulo-endothelial system resulting in decreased iron concentration in the plasma thus limiting its availability to red cells for hemoglobin synthesis [20, 21]. This finding is in agreement with Muhammad and Hayder 2011 [22] and Eyshi *et al*., 2009 [23].

Table 1. *Haematological parameters of male EPTB patients (n = 38).*

Age (Years)/Variables	15-30 n = 8	31-45 n = 10	46-60 n = 20	Control
Haemoglobin (g/dL)	11.3 ± 0.5*	11.5 ± 0.5*	10 ± 0.4*	13.3 ± 0.6
Haematocrit (%)	33 ± 1*	34 ± 1*	31 ± 1*	39 ± 2
RBC ($x10^{12}$/l)	6.02 ± 0.36	5.73 ± 1.50	5.35 ± 0.93	6.23 ± 0.55
MCV (Fl)	54.82 ± 0.50	59.34 ± 0.25	57.94 ± 2.32	62.60 ± 1.25
MCH (Pg)	18.77 ± 1.83	20.07 ± 0.45	18.69 ± 0.94	21.35 ± 0.77
MCHC (g/l)	34.24 ± 0.79	33.82 ± 1.50	32.26 ± 1.07	34.10 ± 1.42
ESR (mm/hr)	50 ± 3*	43 ± 2*	65 ± 5*	2 ± 1
WBC ($\times10^9$/L)	12.4 ± 1*	10.8 ± 0.5*	12.1 ± 0.5*	4.5 ± 0.5
Platelet ($\times10^9$/L)	225 ± 4*	230 ± 5*	228 ± 6*	137 ± 5
Neutrophil (%)	65 ± 5*	62 ± 3*	68 ± 2*	55 ± 2
Lymphocyte (%)	32 ± 2	35 ± 2	30 ± 3	42 ± 3
Monocyte (%)	1 ± 0.5	2 ± 1	1 ± 0.5	2 ± 0.5
Eosinophil (%)	2 ± 1	1 ± 0.50	1 ± 1	1 ± 0.5

* $p < 0.05$ (Significant)

Table 2. *Haematological parameters of female EPTB patients (n = 52).*

Age (Years)/Variables	15-30 n = 12	31-45 n = 15	46-60 n =25	Control n =15
Haemoglobin (g/dL)	9.7 ± 0.6*	11.9 ± 0.3*	11.8 ± 0.5*	12.2 ± 0.3
Haematocrit (%)	29 ± 1*	35 ± 2*	33 ± 1*	36 ± 1
RBC ($x10^{12}$/l)	4.57 ± 0.22	5.8 ± 0.6	5.50 ± 0.85	6.11 ± 0.6
MCV (Fl)	63.46 ±2.20	60.34 ± 0.6	60.00 ± 0.83	58.92 ± 1.5
MCH (Pg)	21.23 ± 0.75	20.52 ± 0.4	21.36 ± 0.55	19.97 ± 0.8
MCHC (g/l)	33.45 ± 0.53	34.00 ± 1.3	35.61 ± 1.12	33.89 ± 1.2
ESR (mm/hr)	45 ± 3*	58 ± 2*	65 ± 5*	5 ± 1
WBC ($\times 10^9$/L)	12.4 ± 2*	14.1 ± 2*	13.8 ± 3*	4.5 ± 0.5
Platelet ($\times 10^9$/L)	225 ± 10*	230 ± 8*	228 ± 4*	155 ± 8
Neutrophil (%)	68 ± 3*	65 ± 3*	70 ±2*	55 ± 3
Lymphocyte (%)	29± 2	32± 2	27 ±3	42 ± 2
Monocyte (%)	1 ± 0.5	1± 0.5	2 ±0.5	1 ± 0.5
Eosinophil (%)	2 ± 1	2± 0.5	1 ± 0.5	2 ± 0.5

*$p < 0.05$ (Significant)

In this study, it was found that the values of erythrocyte sedimentation rate (ESR) for both males and females patients with extra pulmonary tuberculosis were highly significantly increased ($p < 0.05$) more than the control. This is in line with the study carried out by Anju, 2011 [24] in which ESR was raised in 82–95% of patients. On the contrary, ESR which is usually expected to be raised in a patient with extra pulmonary tuberculosis, was < 30mm/hr in first hour in about 14% and >30 mm/hr in first hour in about 86% cases [25].

The platelet count of both extra-pulmonary tuberculosis male and female patients was highly significantly increased ($p < 0.05$) more than the control. This may be attributed to the reactive thrombocytosis which is found in a number of clinical situations including infectious diseases such as tuberculosis [26].

5. Conclusion

Extra-pulmonary tuberculosis was present more in females and was relatively higher in older patients. Different haematological parameters like Erythrocyte sedimentation rate (ESR), platelets, leukocytes and toxic granulated neutrophilia work as hallmark and help the clinicians in early diagnosis of the disease. The common risk factors contributing to the dissemination of the tuberculosis in the target area population include malnutrition, smoking tobacco, living in shared houses, illiteracy and poverty.

References

[1] World Health Organization (2013). Definitions and reporting framework for tuberculosis: 2013 Revision (updated December 2014). Geneva: World Health Organization.

[2] Global Tuberculosis Report (2013). Geneva: World Health Organization. Available at: http://www.who.int/tb/publications/global_report/en/ Accessed 22 November 2016.

[3] National Tuberculosis and Leprosy Control Programme, Annual Report 2008. Abuja: NTBLCP; 2009.). Available at: http://www.ntbltc.org/reports/Annual%20Report%202008%20NTBLCP.pdf Accessed 10 December 2016.

[4] Nigerian National HIV Sero-Prevalence Survey, 2010.

[5] Joint external mid-term evaluation of the Nigeria national tuberculosis and leprosy control strategic plan 2010–2015.

[6] Tuberculosis prevalence surveys (2010): a handbook. Geneva: World Health Organization (WHO/HTM/TB/2010.17). Available at: http://www.who.int/tb/advisory_bodies/impact_measurement_taskforce/resources_documents/thelimebook/en/

[7] Purohit MR, Mustafa T, Wiker HG, Morkve O, Sviland L (2007) Immunohistochemical diagnosis of abdominal and lymph node tuberculosis by detecting Mycobacterium tuberculosis complex specific antigen MPT64. Diagn Pathol. 2: 36

[8] Abacus junior B. Hematology Analyzer. Service Manual. 3.0 release. DIATRON Messtechnik Ges. m. B. H.. A-1141 Wien, Ameisgasse 49-51/2.

[9] Westergreen A (1957) Diagnostic tests: the erythrocyte sedimentation rate range and limitation of the technique: Triangle 3 (1); 20–5.

[10] Sauders E (2007) Robbins Basic Pathology 8th Edition Cambridge Press, London. Pages 516–520.

[11] Shafee M, Abbas F, Ashraf M, Mengal MA, Kakar N, et al. (2014) Hematological profile and risk factors associated with pulmonary tuberculosis patients in Quetta, Pakistan. Pak J Med Sci; 30 (1): 36-40.

[12] Ayaz S, Tahira N, Khan S, Khan SN, Rubab L, et al. (2012) Pulmonary Tuberculosis: Still Prevalent in Human in Peshawar, Khyber Pakhtunkhwa. Pak J Life Soc Sci.; 10 (1): 39-41.

[13] Baloch S, Devrajani BR, Rahman AA (2013) The prevalence of smear positive pulmonary tuberculosis in Hyderabad, Sindh, Pakistan. Elixir Human Physio.; 60: 16447-16450.

[14] World Health Organisation (WHO) 2002 Gender and Tuberculosis', WHO, Geneva.

[15] Chow TW, Lim BK, Vallipuram S (2002) The masquerades of female pelvic tuberculosis: case reports and review of literature on clinical presentations and diagnosis, J Obstet Gynaecol Res; 28: 203–10.

[16] Chen CS, Wang-Huei C, Aristine T, Woei H, Shang-Yi T, et al. (2011) Clinical characteristics and outcomes of Mycobacterium tuberculosis disease in adult patients with hematological malignancies. BMC Infectious Diseases 11: 324.

[17] Al-Hajoj S, Shoukri M, Memish Z, AlHakeem R, AlRabiah F, et al. (2015) Exploring the Sociodemographic and Clinical Features of Extrapulmonary Tuberculosis in Saudi Arabia. PLoS ONE 10 (2): e0101667. doi: 10.1371/journal.pone.017

[18] Amin S, Khattak MI, Shabbier G, Wazir MN (2011) Frequency of Pulmonary tuberculosis in Patients With diabetes Mellitus. Gomal J Med Sci 9 (2): 163–165.

[19] Ullah H, Iqbal Z, Ullah Z, Mahboob A, Rehman M (2009) Frequency of pulmonary tuberculosis in patients presenting with diabetes. Pak J Chest Med 15 (4): 1–7.

[20] Means RT (2003). Recent developments in the anemia of chronic disease. Current Hematology l Rep., 2: 116-121.

[21] Nemeth E, Rivera S, Gabayan V. (2004). IL-6 mediates hypoferremia of inflammation by inducing the synthesis of the iron-regulatory hormone hepcidin. Journal of Clinical Investigations, 113: 1271-1276.

[22] Muhammad OA, Hayder GA (2011) Studying Some Hematological Changes in Patients with Pulmonary Tuberculosis in Babylon Governorate. Medical Journal of Babylon 8; 4.

[23] Eyshi A, Rahimi E, Gharabaghi N (2009). Anemia and Peripheral Blood Changes in Pulmonary Tuberculosis. Scientific Journal of Hamadan University of Medical Sciences and Health Services, 16 (2): 510.

[24] Anju J (2011) Extra Pulmonary Tuberculosis: A Diagnostic Dilemma. Ind J Clin Biochem; 26 (3): 269–273

[25] Wasim H, Azizul H, Salma AB, Saifuddin E, Fazlur R (2004) Extrapulmonary Tuberculosis: Experience in Rajshahi Chest Disease Clinic and Chest Disease Hospital. TAJ; 17 (1).

[26] Nsal E, Aksaray S, ksal D, Ipit T (2005) Pulmonary tuberculosis thrombocytosis and acute phase response in Potential role of interleukin 6 in reactive. Postgraduate Medical Journal, 8: 604–607.