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ALTERATIONS OF HAEMOGLOBIN, ERYTHROCYTE SEDIMENTATION RATE, TOTAL WHITE BLOOD CELL, AND DIFFERENTIAL COUNTS IN PATIENTS WITH CHRONIC PNEUMONIA IN IMO STATE

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Abstract: Chronic pneumonia is a condition characterized by ongoing inflammation of the lungs that lasts for an extended period. The study investigated alterations of haemoglobin, erythrocyte sedimentation rate, total white blood cell, and differential counts in patients with chronic pneumonia in Imo state. One hundred (100) subjects were recruited for the research study; 50 adult patients diagnosed with chronic pneumonia attending Federal University Teaching Hospital (FUTH), Owerri during the study period, and 50 apparently healthy non-chronic pneumonia subjects, who served as controls. Four milliliters of blood samples were collected aseptically, and prepared by standard methods prior to use. The estimation of erythrocyte sedimentation rate (ESR) was done by Westergren method, while that of haemoglobin, total white blood cell and differential white cell counts were done using haematology autoanalyzer. The study found that chronic pneumonia patients had a significantly higher mean Hb levels (11.67 ± 0.98) g/dl compared to non-chronic pneumonia patients (10.96 ± 0.78) g/dl (p=0.009) and a significantly lower mean ESR (26.03 ± 11.84) mm/hr compared to non-chronic pneumonia subjects (38.40 ± 24.49) mm/hr (p=0.021). Chronic pneumonia patients had a non-significant lower mean TWBC (13.08 ± 14.63) x109/L compared to the control group (13.17 ± 1.59) x109/L (p=0.977). Chronic pneumonia patients had a non-significant lower percentage of neutrophils (70.60 ± 11.6) and a non-significant lower percentage of lymphocytes (28.10 ± 12.66) compared to the control group (neutrophils: 76.65 ± 13.64, lymphocytes: 22.85 ± 12.67) (p=0.100, 0.157). There were no significant differences in the mean percentages of eosinophils and monocytes between the two groups. There was no significant difference in the mean values of Hb, ESR TWBC, neutrophils, lymphocytes, eosinophils and monocytes in chronic pneumonia patients when compared based on Sex. These findings suggest that haematological parameters may be useful in monitoring and managing chronic pneumonia patients and chronic pneumonia patients may be more likely to develop anaemia and have elevated ESR and TWBC.
Keywords: Pneumonia; Haemoglobin; Erythrocyte sedimentation rate; Total white blood cell; Differential counts

1 INTRODUCTION

Chronic pneumonia is a prolonged inflammatory condition of the lungs caused by persistent infections, immune responses, or certain environmental exposures [1]. The disease is a major public health challenge in Nigeria, with a high prevalence and mortality rate. It is estimated that over 10 million Nigerians suffer from chronic pneumonia, and it is the leading cause of death among children under the age of five [2].

Chronic pneumonia poses a significant health burden globally, affecting individuals of all ages and leading to substantial morbidity and mortality. The impact of chronic pneumonia on lung health is multifaceted. The persistent inflammation in the lungs can result in structural damage to the respiratory system, impaired gas exchange, and reduced lung function. Patients with chronic pneumonia often experience symptoms such as persistent cough, shortness of breath, fatigue, and recurrent respiratory infections. If left untreated or poorly managed, chronic pneumonia can lead to complications, including respiratory failure and an increased risk of other respiratory conditions [3].

Haematological parameters, such as haemoglobin levels, ESR, total white blood cell count, and differential count, play crucial roles in diagnosing and monitoring chronic pneumonia. Understanding the alterations in these parameters can aid healthcare practitioners in promptly identifying patients with chronic pneumonia, leading to timely interventions and improved treatment outcomes [4]. While numerous studies have investigated the clinical manifestations and management of pneumonia, there is a relative scarcity of research focusing specifically on the haematological changes occurring in patients with chronic pneumonia [5].

There is a dearth of research on haematological changes specific to chronic pneumonia in the context of Imo State. This study can bridge this gap and add to the existing body of knowledge, contributing to a more comprehensive understanding

of the disease. Therefore, this study was aimed at investigating the alterations of haemoglobin, erythrocyte sedimentation rate, total white blood cell, and differential counts in patients with chronic pneumonia in Imo state.

2 MATERIALS AND METHODS

2.1 Study Area

The research was conducted at the Federal University Teaching Hospital (FUTH), Owerri, Imo State, where a considerable number of pneumonia cases are managed. Federal University Teaching Hospital (FUTH), Owerri is a prominent tertiary healthcare institution located in Owerri, Imo State, Nigeria. It is a teaching hospital affiliated with federal university of technology, FUTO, dedicated to providing high-quality medical care, education, and research. The city is strategically situated, with good transportation links and access to various amenities. According to the 2006 census, the population of Owerri was reported to be approximately 402,912 inhabitants.

2.2 Research Design

This study employed a cross-sectional design, allowing for the assessment of hematological parameters in patients diagnosed with chronic pneumonia. The cross-sectional design was appropriate for this study as it involved data collection at a single point in time, without intervention or follow-up. The target population was made up of 50 adult patients diagnosed with chronic pneumonia attending Federal University Teaching Hospital (FUTH) Owerri, Nigeria and 50 apparently healthy, non-chronic pneumonia subjects who served as controls. These adults from different backgrounds were diagnosed with chronic pneumonia by qualified pulmonologists.

2.3 Ethical Clearance

Before commencing data collection, ethical clearance was obtained from the Ethics Review Committee of the Federal University Teaching Hospital, Owerri. Ethical clearance ensured that the study adhered to ethical guidelines and protected the rights and privacy of the participants. Additionally, informed consent was obtained from each participant who agreed to participate in the study.

2.4 Sample Collection

To assess hematological parameters, 4mls of blood samples were collected from each participant following standard aseptic procedures. The venous blood samples were drawn into EDTA anticoagulant tubes to prevent clotting and preserve the integrity of blood cells and used for estimation of haemoglobin, total WBC, differential white blood counts and ESR.

2.5 Selection Criteria

2.5.1 Inclusion criteria

The inclusion criteria for the study group were as follows;
(1)Diagnosis: Individuals diagnosed with chronic pneumonia.
(2)Age: Participants aged 18 years and above.
(3)Location: Individuals residing in Imo State, Nigeria.
(4)Gender: Both males and females.
(5)Control subjects: Age - matched apparently healthy subjects who served as controls
(6)Consent: Participants who provided their informed consent to participate in the study.

2.5.2 Exclusion criteria

Participants who met any of the following criteria were excluded from the study:
(1)Comorbidities: Individuals with significant comorbidities or underlying medical conditions that may affect haematological parameters.
(2)Age: Participants below 18 years of age.
(3)Recent Blood Transfusion: Individuals who have received blood transfusions within the past three months.
(4)Haematological Medications: Individuals currently on haematological medications that may influence haematological parameters.
(5)Inability to provide informed consent: Participants who are unable to provide informed consent for participation in the study.

2.6 Laboratory Analysis

The haematological parameters were determined using the haematology autoanalyzer, while the Erythrocyte sedimentation rate was estimated using the Westergren method.

2.7 Statistical Analysis

Data was analysed using descriptive and inferential statistics and a p-value < 0.05 was significant. The SPSS computer software was used for all data analysis.

3 RESULTS

The mean value of haemoglobin (11.67 ± 0.98) g/dl was significantly increased in chronic pneumonia patients when compared (t = 2.74, p = 0.009) to Non-chronic pneumonia patients (10.96 ± 0.78) g/dl. The mean values of ESR (26.03 ± 11.84) mm/hr was significantly decreased in chronic pneumonia patients when compared to non-chronic pneumonia (38.40 ± 24.4) mm/hr patients. (t=2.38, p=0.021) There was no significant difference in the mean values of TWBC (13.08 ± 14.63) x109 /L, Neutrophils (70.60 ±11.68) %, lymphocytes (28.10 ± 12.66) %, eosinophils (0.40 ± 0.89) % and monocytes (0.90 ± 2.02) %, in chronic pneumonia patients when compared to non-chronic pneumonia patient (13.17 ± 1.59) x109 /L, (76.65 ± 13.64) %, (22.85 ± 12.67) %, (0.45 ± 0.83) %, (0.80 ± 1.36) %. (t=0.03, p=0.977; t=1.68, p=0.100; t=1.44, p=0.157; t=0.20, p=0.843) and (t=0.19, p=0.847) (Table 1).

Table 1 Mean Values of Hb, TWBC, Neutrophils, Lymphocytes, Eosinophils and Monocytes in Chronic Pneumonia Patients Vs Non-Chronic Pneumonia (Mean ± SD)

Parameter	Chronic pneumonia	Non-chronic pneumonia	t-value	p-value
Hb (g/dl)	11.67±0.98	10.96±0.78	2.74	0.009
ESR (mm/hr)	26.03±11.84	38.40±24.49	2.38	0.021
TWBC (x10^9/L)	13.08±14.63	13.17±1.59	0.03	0.977
Neu (%)	70.60±11.68	76.65±13.64	1.68	0.100
Lym (%)	28.10±12.66	76.65±13.64	1.68	0.100
Eos (%)	0.40±0.89	0.45±0.83	0.20	0.843
Mon (%)	0.90±2.02	0.80±1.36	0.19	0.847

KEY: Hb: Haemoglobin; ESR: Erythrocyte sedimentation rate; TWBC = Total white blood cell; Neu = Neutrophils; Lym = Lymphocytes; Eos = Eosinophils; Mon = Monocytes

There were no significant differences in the mean values of Hb (12.02±1.02)g/dL, ESR (22.42±6.62)mm/hr, TWBC (17.33±22.92) x109 /L, neutrophils (70.33±9.29)% lymphocytes (28.17±10.32)%, eosinophils (0.17±0.38)% monocytes (1.33±2.57)% in male chronic pneumonia patients when compared to females Hb (11.44±0.94)g/dL, ESR (28.47±14.41) mm/hr, TWBC (10.16±2.01)x10/L, neutrophils (71.29±13.51)% lymphocytes (27.47±14.51)%, eosinophils (0.59±1.12)% monocytes (0.65±1.62)% (Table 2).

Table 2 Mean Values of Hb, TWBC, Neutrophils, Lymphocytes, Eosinophils and Monocytes in Chronic Pneumonia Patients based on sex (Mean ± SD)

Parameter	Male	Female	t-value	p-value
Hb (g/dl)	12.02±1.02	11.44±0.94	1.58	0.126
ESR (mm/hr)	22.42±6.62	28.47±14.41	1.35	0.188
TWBC (x10^9/L)	17.33±22.92	10.16±2.01	1.29	0.207
Neu (%)	70.33±9.29	71.29±13.51	0.21	0.833
Lym (%)	28.17±10.32	71.29±13.51	0.14	0.888
Eos (%)	0.17±0.38	0.59±1.12	1.25	0.224
Mon (%)	1.33±2.57	0.65±1.62	0.88	0.385

There was a non-significant positive correlation of haemoglobin with ESR, TWBC, Neutrophils, Lymphocytes, Eosinophils and Monocytes in chronic pneumonia patients. (r=0.16, p=0.385; r=0.01, p=0.977; r=0.11, p=0.580; r=0.09, p=0.607; r=0.16, p=0.387 and r=0.07, p=0.728) (Table 3).

Table 3 Correlation of Haemoglobin concentration with ESR, TWBC, Neutrophils, Lymphocytes, Eosinophils and Monocytes in Chronic Pneumonia Patients

Variable	n	r	p-value
ESR (mm/hr)	50	0.16	0.385
TWBC (x10^9/L)	50	0.01	0.977
Neu (%)	50	0.11	0.580

Lym (%)	50	0.09	0.607
Eos (%)	50	0.16	0.387
Mon (%)	50	0.07	0.728

4 DISCUSSION

The study found that chronic pneumonia patients had a significantly higher mean Hb levels compared to non-chronic pneumonia patients. This result contrasts with some previous studies that have reported anaemia as a common feature in various respiratory infections, including pneumonia [6-7]. ESR in chronic pneumonia patients was significantly lower than in non-chronic pneumonia patients. This finding contradicts the general expectation that ESR tends to rise in response to inflammation and infections, including pneumonia [8]. The lower ESR in chronic pneumonia patients could be an intriguing area for further investigation. The study found no statistically significant difference in the mean value of TWBC between chronic pneumonia patients and non-chronic pneumonia patients. This result aligns with the understanding that the total white blood cell count may not always be a reliable indicator of chronic pneumonia, as it can vary widely based on individual factors and the stage of infection [9]. The study also showed a non-significant trend towards lower percentages of neutrophils and higher percentages of lymphocytes in chronic pneumonia patients compared to non-chronic pneumonia patients. While these differences were not statistically significant, they are consistent with the idea that chronic infections may induce a shift in the white blood cell differential count [10]. It found no significant differences in the percentages of eosinophils and monocytes between the two groups, which is in line with the understanding that eosinophils and monocytes may not exhibit substantial alterations in the context of chronic pneumonia [11]. This suggests that eosinophil and monocyte percentages may not be significantly affected by chronic pneumonia in this study. There were no significant differences in the mean values of Hb, ESR TWBC, neutrophils, lymphocytes, eosinophils and monocytes in chronic pneumonia patients when compared based on sex. The findings suggest that gender does not appear to be a significant factor influencing haematological parameters in chronic pneumonia patients. This is consistent with the notion that gender-related differences in haematological parameters are typically more pronounced in certain conditions or age groups and may not be a primary determinant in chronic pneumonia cases.

The correlation of haemoglobin concentration with various haematological parameters in chronic pneumonia patients, found a non-significant positive correlation between haemoglobin concentration and ESR in chronic pneumonia patients. This result suggests that changes in haemoglobin levels are weakly associated with changes in ESR but do not reach statistical significance. This finding aligns with some previous research that has reported weak or inconsistent correlations between haemoglobin and ESR in different clinical contexts [12]. Moreover, it found a non-significant correlation between haemoglobin concentration and TWBC in chronic pneumonia patients. This indicates that there is virtually no linear relationship between haemoglobin levels and TWBC in this patient group. This finding is consistent with the understanding that haemoglobin and total white blood cell count measure different aspects of the haematological profile and may not be strongly correlated [11]. The study also observed non-significant and weak positive correlations between haemoglobin concentration and the percentages of neutrophils, lymphocytes, eosinophils, and monocytes in chronic pneumonia patients. These findings suggest that haemoglobin levels are not strongly associated with the percentages of these white blood cell types in the differential count. In summary, the results from this study indicate that hemoglobin concentration is weakly and non-significantly correlated with various hematological parameters in chronic pneumonia patients. These findings are consistent with prior research that has often reported limited or inconsistent associations between hemoglobin levels and markers of inflammation or white blood cell counts. It's important to consider that hematological parameters are influenced by various factors, and their relationships can vary depending on the specific clinical context and patient population. Further research is needed to explore the clinical implications of these correlations in chronic pneumonia and to better understand the underlying mechanisms.

5 CONCLUSION

In chronic pneumonia patients, haemoglobin concentration ad ESR levels are altered. There were weak and non-significant correlations between haemoglobin concentration and other haematological parameters, such as Erythrocyte Sedimentation Rate (ESR), Total White Blood Cell Count (TWBC), percentage neutrophils, lymphocytes, eosinophils, and monocytes. These findings suggest that changes in haemoglobin levels are not strongly associated with changes in these haematological parameters in this patient population. The weak or non-significant correlations between haemoglobin and haematological parameters highlight the complex nature of the haematological response in chronic pneumonia. While haemoglobin levels are important for assessing anaemia and oxygen-carrying capacity, they may not serve as reliable markers of inflammation or specific white blood cell responses in chronic pneumonia cases.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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