Original Article

Correlation between Clinical and Haematological Assessment of Anaemia Among Pregnant Women: An Institutional-Based Study

Irinyenikan T.A.[1, 2], Folarin B.J.[1,2], Bade-Adefioye M.A.[2] Sani I.[3]

[1]Department of Obstetrics and Gynaecology, Faculty of Clinical Sciences, University of Medical Sciences, Ondo-City, Ondo State, Nigeria; [2]Department of Obstetrics and Gynaecology, University of Medical Sciences Teaching Hospital Complex, Akure, Ondo State, Nigeria; [3]Research Doctor with the World Health Organization at the University of Medical Sciences Teaching Hospital Complex, Akure, Ondo State, Nigeria

Abstract

Background: Anaemia in pregnancy is a public health problem with grave consequences on the mother and the baby if not diagnosed early and treated. Clinical assessment of the signs and symptoms the patient present with may be used to commence management while awaiting haematological confirmation in order to prevent its complications. This study was carried out to ascertain if there is a good correlation between clinical and haematological assessment of anaemia. **Methods:** It was a cross-sectional study carried out at the antenatal clinic of the University of Medical Sciences Teaching Hospital Complex, Akure in Ondo State Nigeria where 400 women were recruited by systematic sampling. Structured questionnaires were used to collect their data, they had physical examinations done and their blood samples were also collected at recruitment for laboratory assessment of anaemia. Data was analysed using SPSS version 22. Descriptive analysis was done for relevant variables, Chi Square test and Multivariate Logistic Regression Model were used to find if there is a correlation between clinical and haematological assessment of anaemia. The level of significance was set at $p<0.05$. **Results:** Most of the study participants had tertiary level of education (275,68.8%), were traders (161, 40.3%), were nulliparous (142, 35.5%) and in their third trimester of pregnancy (257,64.1%). Many were not pale clinically (361,90.1%) and had normal blood pressure (349,87.3%) and pulse rate (396, 99.0%). On laboratory assessment 240(60.0%) were not anaemic while 160(40.0%) were anaemic using WHO criteria of haematocrit of less than 33% as anaemia. Most of those who were anaemic had mild anaemia. There was a good correlation between clinical and haematological assessment of anaemia among the study participants with a Chi Square test, $X^2 =2.24$, $p=0.012$. The Multivariate logistic regression done to further ascertain a correlation between clinical and haematological assessment of anaemia showed statistically significant correlation among the tested parameters with $p=0.000$. **Conclusion:** The study showed a good correlation between clinical and haematological assessments of anaemia. This is re-assuring and confirms that with clinical diagnosis of anaemia one may commence management of anaemia before haematological results are available to reduce complications of anaemia that could be life threatening.

Keywords: Anaemia, Clinical Assessment, Haematological Assessment, Correlation

Corresponding Author

Theresa Azonima Irinyenikan,
Department of Obstetrics and Gynaecology,
Faculty of Clinical Sciences,
University of Medical Sciences, Ondo &
University of Medical Sciences Teaching Hospital Complex,
Akure, Ondo State.
Email: tirinyenikan2017@gmail.com

Introduction

The World Health Organization (WHO) defined anaemia as a condition in which the number of red blood cells especially their oxygen carrying capacity is insufficient to meet the physiological needs of a person[1]. It is a global health problem affecting about 1.6 billion people with a high prevalence among pregnant women [2]. It has been reported to be a major cause of maternal and perinatal morbidities and mortalities [3]. Anaemia alone is not a disease but a sign of an underlying pathology which if detected clinically will need haematological assessment for confirmation.

In pregnancy, anaemia can be relative or absolute with relative anaemia being because of an increased plasma volume resulting in dilutional anaemia [4]. Absolute anaemia occurs because of decreased red blood cell production or increased red blood cell destruction due to an underlying pathology [4]. Anaemia can morphologically be classified into three subgroups as macrocytic, normocytic, and microcytic hypochromic anaemias [5]. This classification is based on mean corpuscular volume (MCV) and mean corpuscular hemoglobin concentration (MCHC) of complete blood count (CBC) which can aid the physician to the diagnosis and monitoring of anaemia that can easily be cured such as iron deficiency anaemia [5].

Symptoms of anaemia include increased tiredness/fatigue, dyspnoea and reduced effort tolerance and the severity of symptoms depends on the degree of anaemia and the rate of decrease of haemoglobin [6]. To make a diagnosis of anaemia, detailed history is of paramount importance and often eliminates much of the speculation during investigation. The history should include duration of the problem, transfusion history, dietary history that could suggest the type of anaemia the patient may be presenting with, history suggestive of malaria and parasitic infections, history of bleeding which could suggest an acute loss, and change in bowel habits that could suggest inflammatory bowel disease. This is then followed by a physical examination noting features suggestive of anaemia. Systematic examination of the patient directs further investigations and may reveal the possible cause. Signs of anaemia include presence of pallor, angular stomatitis, glossitis which could be seen in cases of nutritional deficiencies and koilonychia which may be seen in cases of iron deficiency anaemia [6].

The presence of symptoms and signs of anaemia usually drive haematological assessment for confirmation and to address the possible underlying cause. Sometimes the degree of severity of anaemia can manifest as tachycardia, hypotension, leg swelling, breathlessness or orthopnoea suggesting anaemic heart failure [6]. Accurate clinical assessment of anaemia and complicated cases of anaemia may be lifesaving before haematological results are available especially in low-resource countries with lack of facilities.

This study was carried out to find out if there is any correlation between a clinical assessment of anaemia using the signs presented by the patient with the haematological assessment, this can allow prompt management of patients thereby preventing life threatening complications that are associated with anaemia. This study was the first of its kind that will be carried out in Ondo State and in Southwest Nigeria to ascertain if there is a correlation between clinical and haematological assessment of anaemia.

Materials And Methods

Study design: It was a cross- sectional study carried out in the antenatal clinic of the University of Medical Sciences Teaching Hospital Complex in Akure, Ondo State, Nigeria. This teaching hospital is part of the hospitals being used in the state for the training of undergraduate students at the University of Medical Sciences and for the training of resident doctors in different specialties. The teaching hospital provides services to the people in the state and its environs. It serves as a major referral hospital for government owned and privately owned hospitals in Ondo State and the surrounding states.

Sample Size: This was calculated using Kish Leslie formula for cross sectional studies. Using a prevalence of anaemia reported in Nigeria as 60% [7], P=0.6, q=0.4, d which is the degree of accuracy desired was put at 5% giving a value of 0.05, Z the standard normal deviate usually set at 1.96 corresponds to the 95% confidence interval and N the required sample size.

Therefore,

$N = Z^2 Pq/d^2 = (1.96)^2 \times 0.6 \times 0.4 / (0.05)^2 = 369$, this was approximated to 400.

Patient recruitment: The study was conducted over 16weeks from 16th of August 2022 to 16th of December 2022. A total of 1,600 women were anticipated to present for antenatal clinic during the study period based on the previous antenatal clinic records where an average of 100 patients were seen every week with a total of 4,800 patients in the previous year. The antenatal clinic is run twice in a week because of the patients load. Using a sample size of 400, the patients were recruited by systematic sampling technique as 1,600/400=4, thereby every 4th patient was then selected from the list of the antenatal clinic attendees to give a total of 25patients per week.

Inclusion criteria: This included only the women who have been attending antenatal clinic at the facility and who consented to participate in the study.

Exclusion criteria: Women who did not give consent, who have been transfused in the index pregnancy for anaemia and those presenting for booking were excluded.

Data Collection: Data were collected over a period of sixteen weeks and during this period 400 pregnant women were recruited. The women were interviewed with copies of a structured questionnaire administered by trained research assistants who also helped in the collection of the blood samples. From each of the recruited woman, 3mls of venous blood was collected from the antecubital vein using plastic disposable syringes into sample bottles containing ethylene diamine-tetra acetic acid (EDTA) and the bottles labelled accordingly before they were sent to the haematology laboratory of the hospital. The doctors performed the clinical assessment for anaemia in the study participants while the packed cell volume and red cell morphology were carried out in the haematology laboratory of the hospital.

Ethical Approval: Ethical approval for the study was obtained from the University of Medical Sciences Teaching Hospital Complex, Ondo ethics committee.

Consent: Consent was taken from each patient recruited into the study. Those who gave consent and participated in the study had the opportunity of getting their results and those who had low packed cell volume were treated accordingly.

Data Analysis: Data obtained were analysed using the Statistical Package for Social Sciences (SPSS Version 22). Descriptive statistics were computed for all relevant variables and the correlation between the clinical and haematological assessment of anaemia was tested using the Chi square test and Multivariate logistic regression. The level of significance was set at $P < 0.05$.

Results

The results showed that most of the women had tertiary level of education, 275(68.8%) but were mostly traders 161(40.3%). They were mostly nulliparous 142 (35.5%) and in their third trimester of pregnancy 257(64.1%). This is as shown in Table 1.

Table 2 showed the physical examination findings of the study participants, from their conjunctival pallor assessment, 361(90.1%) were not pale, 37(9.3%) had mild pallor, 1(0.3%) had moderate and severe pallor respectively. Many of them did not have fever as normal temperature recording was reported in 336(84%). Most of them had normal pulse rate ranging between 60 to 100 beats/ minute, 396(99%) and normal blood pressure 349(87.3%).

Table 1. Socio-demographic and Obstetric Characteristics of the Study Participants

Characteristics	Frequency (n)	Percentage (%)
Education		
Primary	8	2.0
Secondary	113	28.2
Tertiary	275	68.8
Occupation		
Unemployed	36	9.0
Civil Servants	118	29.5
Traders	161	40.3
Artisans	68	17.0
Others	17	4.2
Parity		
0	142	35.5
1	117	29.2
2	92	23.0
3	34	8.5
≥ 4	15	3.8
Gestational Age		
≤ 13weeks	9	2.4
14-26weeks	134	33.5
≥ 27weeks	257	64.1

Table 2: Clinical Parameters of the Study Participants

Variables	Frequency (n)	Percentage (%)
Conjunctival Pallor		
Not Pale	361	90.1
Mild Pallor	37	9.3
Moderate Pallor	1	0.3
Severe Pallor	1	0.3
Temperature ^{0}C		
< 36	61	15.3
36-37.5	336	84.0
>37.5	3	0.7
Pulse beats/minute		
<60	4	1.0
60-100	396	99.0
Blood Pressure mmHg		
< 90/60	17	4.2
90/60 - 140/90	349	87.3
>140/90	34	8.5

The haematological indices of the participants showed that 160(40%) were anaemic and 240 (60%) were not anaemic using WHO classification of anaemia. Among the anaemic participants, 124(77.5%) had mild anaemia while 36(22.5%) had moderate anaemia, none of them had severe anaemia as shown in Table 3 below.

Using the Chi square to find if there is a correlation between clinically identified pallor with haematological assessment for anaemia showed that most of the participants who were reported not to be pale were not anaemic, 216 in the not anaemic and 145 in the anaemic group. Similarly, one of those with moderate pallor was anaemic and this was not present among the anaemic group. This was statistically significant, $X^2 = 2.24$ and p=0.012. This is shown Table 4.

Table 3: Haematological Indices of the Study Participants

Indices	Frequency (n)	Percentage (%)
Haematocrit (PCV/Hb)		
Anaemic PCV <33%	160	40.0
Not Anaemic PCV >33%	240	60.0
Severity of Anaemia		
Mild Anaemia	124	77.5
Moderate Anaemia	36	22.5
Severe Anaemia	0	0.0
Mean Corpuscular Volume (MCV) fl		
80-89	2	0.5
90-99	398	99.5
Mean Corpuscular Haemoglobin (MCH)		
<30 pg/cell	336	84.0
30-35pg/cell	64	16.0
Mean Corpuscular Haemoglobin Concentration (MCHC)		
<32.4g/dl	368	92.0
32.4-35.2g/dl	32	8.0

Table 4: Association between Conjunctival Pallor and Haematocrit of the Study Participants

Conjunctival Pallor	Anaemic Status using Haematocrit (PCV/Hb)		Chi Square X^2	P value
	Anaemic	Not Anaemic		
No Pallor	145 (90.6%)	216 (90%)	2.24	0.012
Mild Pallor	14 (8.8%)	23 (9.6%)		
Moderate Pallor	1(0.6%)	0 (0%)		
Severe Pallor	0 (0%)	1(0.4%)		

Table 5: Multivariate Logistic Regression Model to ascertain the correlation between clinical anaemia and the red cell indices.

Red cell indices	Odds Ratio	95% CI	P value
PCV/Hb	2.11	1.04-4.23	0.000
MCH	3.11	1.99-4.86	0.000
MCHC	4.51	3.26-6.35	0.000
MCV	1.31	2.28-7.52	0.000

A Multivariate Logistic Model was used to assess if there is any possible correlation between clinically diagnosed anaemia and haematological red cell indices using the non-anaemic as the reference category. Only those with mild anaemia diagnosed clinically showed statistically significant correlation with the haematological red cell indices while there was no statistical correlation among those with moderate anaemia and severe anaemia. This is shown in Table 5.

Discussion

Anaemia is a reduction in red cell haemoglobin concentration and the commonest nutritional deficiency that occurs in pregnancy globally[8]. It is a major public health problem that can cause adverse pregnancy outcomes for both the mother and the baby[9]. According to WHO and the Centre for Disease Control and Prevention, anaemia in pregnancy is regarded as haemoglobin concentration of less than 11 g/L or a packed cell volume of less than 33% [10,11]. Based on this definition many women in sub-Sahara Africa will be classified as been anaemic.

This study showed that most of the participants were educated and gainfully employed which may suggest that they would have access to information and can adequately take care of themselves and their babies. However, it is still surprising that up to 40.0% of the women were anaemic even though they were booked patients and would probably have been placed on haematinics. The reason for this high prevalence could have been because they live in malaria endemic region and some of the women could have had malaria infection which has been reported as the commonest cause of anaemia in pregnancy [12].

Though majority of the women had mild anaemia (124, 77.5%) which may be less life threatening, but this can still cause some degree of incapacitation in their daily activities and should also be addressed. The mild anaemia reported among the participants could be because of previously treated malaria infection and some cultural beliefs surrounding dietary intakes in pregnancy which have been reported in a similar study [13].

Evaluation of patients with anaemia require both clinical and haematological assessment for confirmation and to possibly give a clue to the underlying cause. Physical assessments are often done by checking for pallor and features that could suggest severity such as blood pressure and the pulse rate of the patient. In this study, most of the anaemic patients were noticed to have mild pallor and normal blood pressure and pulse rate which further confirmed that they were not suffering from the complications of anaemia[6]. The haematological parameters also showed that the study participants had mild anaemia which was in keeping with the clinical assessment. Therefore, when a diagnosis of anaemia is made, large number of other specific tests may be requested to confirm the clinical findings and the underlying aetiology [14].

The Chi square test and the multivariate logistic regression done further confirmed there is a correlation between clinical and haematological assessments of anaemia among the participants. This finding suggests that with comprehensive clinical evaluation using the patient's history and physical assessment one can make a diagnosis of anaemia and institute management while awaiting haematological reports, this is life saving and can help prevent life threatening complications of anaemia.

Conclusion

This study showed that there is a good association between the clinical assessment of anaemia and haematological assessment. Therefore, while a comprehensive laboratory evaluation is essential for definitive diagnosis and management of anaemia, the history and physical examination of the patient can also indicate the presence of anaemia, this can be lifesaving in low resource countries where facilities for complete haematological assessment of patients with anaemia may be lacking.

Acknowledgement

The authors appreciate all the pregnant women that participated in this study and the management of the hospital for allowing us to use their patients.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. World Health Organization. The Global Prevalence of Anaemia in 2011. Geneva: WHO, 2015.
2. D*e*Benoist B, McLean E, Ines E, et al. Worldwide prevalence of anaemia 1993 - 2005. Geneva: WHO, 2008.
3. Townsley DM. Hematologic complications of pregnancy. Semin Hematol.2013;50(3):222–31.
4. Geelhoed D, Agadzi F, Visser L. "Severe anaemia in pregnancy in rural Ghana: a case-control study of causes and management," *Acta Obstetricia et Gynecologica Scandinavica*. 2006; 85 (10): 1165-1171.
5. Ebru DY, Abdullah T. Laboratory Approach to Anaemia. Chapter from the book Current Topics in Anaemia Downloaded from: http://www.intechopen.com/books/current-topics-in-anemia http://dx.doi.org/10.5772/intechopen.70359
6. Alli N, Vaughan J, Patel M. Anaemia: Approach to diagnosis. Afr Med J 2017;107(1):23-27. DOI:10.7196/SAMJ.2017.v107i1.12148
7. Anorlu RI, Oluwole AA, Abudu OO. "Sociodemographic factors in anaemia in pregnancy at booking in Lagos, Nigeria." *Journal of Obstetrics and Gynaecology*. 2006; 26(8): 773-776.
8. World Health Organization: Global nutrition targets 2025: anaemia policy brief. 2014.
9. Brabin BJ, Hakimi M, Pelletier D. An analysis of anemia and pregnancy related
10. maternal mortality. J Nutr. 2001;131(2):604S–15S.
11. Koyuncu K, Turgay B, Ukur YE, Yıldırım B, Ates C, Oylemez FS. Third trimester anemia extends the length of hospital stay after delivery," *Journal of Turkish Society of Obstetric and Gynecology*. 2017 vol. 14, no. 3, pp. 166–169.
12. World Health Organization (WHO), Centre for Disease Control and Prevention. Assessing the iron status of populations. 2007.].
13. Lee AI, Okam MM. Anaemia in pregnancy. *Hematol Oncol Clin North Am*. 2001; 25: 241-259. doi: 10.1016/j.hoc.2011.02.001
14. De-Graft A A. Food Beliefs and Practices During Pregnancy in Ghana: Implications for Maternal Health Interventions. Health Care Women Intern. **2014**, 35, 954–972.
15. Hillman R, Ault K, Leporrier M. Red blood cell disorders. In: Hillman R, editor. Hematology in Clinical Practice. 5th ed. USA: McGraw-Hill Education; 2010. pp. 10-26. DOI: 978001766531.