

# Haematological and Urinalysis Parameters among Anaemic Patients with Gynaecological and Surgical Cancers at a Tertiary Hospital in Nigeria

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ABSTRACT

**Background:** Anaemia is a common complication of cancer, yet the major causes of cancer-related anaemia particularly in our setting remains unclear. This study assessed haematological and urinalysis parameters among anaemic patients with gynaecological and surgical cancers to better understand the aetiology of cancer-related anaemias.

**Methods:** This hospital-based descriptive cross-sectional study was conducted at the University of Benin Teaching Hospital between March 2016 and May 2017. Ninety-four anaemic patients (49 with surgical cancers, 45 with gynaecological cancers) were consecutively recruited. Laboratory assessments included full blood count, reticulocyte count, peripheral blood film, bilirubin assay, urinalysis and antibody screening via direct and indirect antiglobulin (Coombs) tests.

**Results:** The mean age of participants was  $52.3 \pm 1.4$  years while the mean haemoglobin  $\pm$  SEM of all participants was  $9.76 \pm 0.15$  g/dl. The majority of anaemia cases were mild or moderate, with no statistically significant difference between cancer types. Antibody screening revealed no positive cases (0.0%) for either direct or indirect Coombs tests. Burr cells, suggesting renal dysfunction, were found in 11(23.5%) participants. Most anaemias were microcytic-hypochromic. Urinalysis findings showed a subset of patients had proteinuria (23 (24.5%) participants) or haematuria (20 (11.3%) participants), particularly those with burr cells—supporting possible renal impairment.

**Conclusion:** Cancer related anaemias (CRA) are a leading cause of hospitalization amongst cancer patients and the use of basic haematological and urinalysis parameters can serve as a cheap and effective screening tool to determine the aetiology of CRAs. The inappropriate reticulocyte response, the red cell morphologic findings on PBF examination, evidence of proteinuria and haematuria on urine analysis, and the absence of red cell autoantibodies all suggest that diverse mechanisms, such as chronic inflammation, nutritional deficiencies, bone marrow infiltration, or renal dysfunction, are more likely to underlie anaemia in these patients. It also almost rules out an autoimmune basis to CRAs in solid tumours.

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**Keywords:** Cancer-mediated anaemia, gynaecological cancer, surgical cancer, Coombs test, Nigeria.

## INTRODUCTION

Cancer is a major cause of death, responsible for nearly 10 million deaths in 2020. This amounts to

about one in six deaths worldwide (Ferlay et al., 2020). By 2050, the global cancer burden is expected to rise to 35.3 million cases and 18.5

million deaths, marking a 76.6% increase from the estimated 20 million cases in 2022 (Bizuayehu et al., 2024). This increase will likely hit the developing world the hardest as cancer incidence and mortality are projected to triple, however developed nations will only see a modest rise in incidence of cancer (Bizuayehu et al., 2024).

Sub-Saharan Africa has experienced a significant surge in cancer cases, with gynecological and surgical cancers making up about 75% of all cases in Nigeria (Abdulkareem, 2009; Ezenkwa et al., 2024). Anemia is a common complication among cancer patients, affecting up to 50% of individuals, many of whom remain undiagnosed (Hikmat & Abdel-Razeq, 2004; The University of Texas MD Anderson Cancer Center, 2024). It is also a frequent cause of hospital admissions and consultations, and the causes of cancer-related anemia are complex and multifaceted ranging from nutritional deficiencies and bone marrow suppression/infiltration to haemolysis and renal insufficiency (Saba, 1998; Abu-Shakra et al., 2001). A simple review of basic haematological parameters can help determine the major causes of cancer-related anaemia.

Similarly, urine analysis plays a relatively underappreciated role in cancer management as it helps to provide insights into systemic effects of malignancy as findings of haematuria, proteinuria, pyuria and bacteriuria may reflect renal impairment or metastatic disease (Bauer, 2012; Okoye, 2021). Therefore, urinalysis can be used as a screening and diagnostic tool for identifying potential issues like haematuria, proteinuria and urinary tract infections in cancer patients. These findings may in one way or the other be implicated in the aetiology of cancer-related anaemias (Bezinque et al., 2017).

Previous research found that the most common cancers in Nigeria are gynecological and surgical Jedy-Agba et al., 2012; Omosun et al., 2022). Abdulkareem et al. (2009) reported that surgical- and gynecological- cancers account for about 75% of cancers in Nigeria, with breast, cervical, prostate, liver, and colorectal cancers being the most frequent types. Following a 3year review of gynecological cancers in Kano, Nigeria, cervical cancer was found to be the most common with 48.6% of cases, followed by ovarian cancer at 30.5%, endometrial cancer at 11.3%, and choriocarcinoma at 9.2%. Vulvar and vaginal cancers are rare (Yakassai et al., 2013).

The knowledge of haematological and urinalysis parameters in cancer patients presenting with anaemia may help elucidate more on the major causes of cancer-related anaemia particularly in

our setting. There is however paucity of local data describing haematological and urinalysis parameters among Nigerian patients with gynaecological and surgical cancers; particularly those presenting with anaemia.

The objective of the study was to evaluate haematological and urinalysis parameters among anaemic patients with gynaecological and surgical cancers at a tertiary hospital in Nigeria.

**Citation:** Idubor NT (2026). Haematological and Urinalysis Parameters among Anaemic Patients with Gynaecological and Surgical Cancers at a Tertiary Hospital in Nigeria. *Nig J Med Dent Educ*; 8(1):84-91.

## MATERIALS AND METHODS

### Study Design

This hospital-based descriptive cross-sectional study was carried out at the University of Benin Teaching Hospital (UBTH) in Benin City, Nigeria, from March 2016 to May 2017.

### Study Population

94 anaemic patients with confirmed cancer diagnoses were recruited consecutively—49 with surgical cancers and 45 with gynaecological cancers. They were chosen from both the Consultant Outpatient Clinics and inpatient wards.

### Inclusion Criteria

- Age 18 years or older
- Confirmed diagnosis of gynecological or surgical cancer.
- Anaemia at presentation, defined by WHO criteria (Hb concentration less than 12.0 g/dL) World Health Organization, 1998).
- Treatment-naïve.
- No history of blood transfusion in the last 3-4 months.

### Exclusion Criteria:

- Age less than 18 years
- Lack of confirmed cancer diagnosis.
- Presence of liver disease, autoimmune disease, or history of multiple transfusions.
- Recent blood transfusion within the last 72 hours.
- Passive immunization with anti-D IgG or intravenous immunoglobulin in the past 3 months.
- Positive history of transfusion within the last 3-4 months.

### Ethical Considerations

Ethical approval was granted by the UBTH Ethical Review Committee (Protocol #: ADM/E 22/A/VOL. VII/257). Informed consent was obtained voluntarily from participants or from a proxy or

next of kin when necessary. Confidentiality and anonymity were upheld throughout the study.

#### Sample Collection and Laboratory Analysis

Venous blood samples (to analyse selected haematological parameters) were collected for:

1. Complete Blood Count (CBC): Conducted using an automated hematology analyzer.
2. Reticulocyte Count and Corrected Reticulocyte Count.
3. Peripheral Blood Film (PBF): To evaluate red cell shape and identify hemolysis.
4. Serum Bilirubin Assay.
5. Antibody Screening: Using direct and indirect Coombs tests.
6. Antibody Elution and Identification: For those with positive direct Coombs tests.

Urine samples were also collected for urine analysis (Urinalysis) to check for bilirubin, urobilinogen, proteinuria, and hematuria.

#### Data Collection:

Patient data, including demographic information, clinical history, and lab results, were gathered through a structured questionnaire administered by an interviewer and a review of medical records.

All data were safely stored and anonymized for analysis.

#### Data Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 20.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics (means, standard deviations, medians, and percentages) were calculated. Results were presented using tables and figures. Univariate and bivariate analyses were performed using Chi-square tests, Fisher's exact test, and Student's t-test where appropriate. A p-value of less than 0.05 was considered statistically significant.

#### RESULTS

94 patients with established cancer diagnosis (49 with surgical cancers and 45 with gynaecological cancers) were recruited for this study. The mean age  $\pm$  SEM (standard error of the mean) of the participants were 52.29  $\pm$  1.40 years, 53.55  $\pm$  2.15 years and 50.91  $\pm$  1.76 years and the median age of the participants were 56 years, 53 years and 55 years for the total study population, surgical- and gynaecological- cancer study groups respectively (see Table 1).

Table 1: Sociodemographic data of study participants.

	Surgical cancer n=49 (%)	Gynaecological cancer n=45 (%)	Total n=94 (%)
<b>Age group (years)</b>			
<30	3 (6.1)	0 (0.0)	3 (3.2)
30 – 39	5 (10.2)	10 (22.2)	15 (16.0)
40 – 49	11 (22.4)	9 (20.0)	20 (21.3)
50 – 59	11 (22.4)	16 (35.6)	27 (28.7)
60 – 69	13 (26.5)	8 (17.8)	21 (22.3)
$\geq$ 70	6 (12.2)	2 (4.4)	8 (8.5)
Range	18-83	31-75	18-83
<b>Sex</b>			
Female	19 (38.8)	45 (100.0)	64 (68.1)
Male	30 (61.2)	0 (0.0)	30 (31.9)
<b>Occupational Class</b>			
I	4 (8.2)	3 (6.7)	7 (7.4)
II	5 (10.2)	5 (11.1)	10 (10.6)
IIIM	6 (12.2)	3 (6.7)	9 (9.6)
IIIN	14 (28.5)	18 (40.0)	32 (34.1)
IV	11 (22.4)	7 (15.6)	18 (19.1)
V	9 (18.4)	9 (20.0)	18 (19.1)

Breast- (11; 22.4%), colonic- (7; 14.3%), nasopharyngeal- (5; 10.2%) and prostatic- (4; 8.2%) cancers were the major surgical cancers (Table 2) while the major gynaecological cancers were cervical- (20; 44.4%) and ovarian- (12; 27.6%) cancers (Table 3).

A majority of subjects in both groups (26 (53.1%) with surgical- and 24 (53.3%) with gynaecological-

cancers) had mild anaemia (Hb concentration=10.0-11.9g/dl), while 21 (42.9%) with surgical- and 17 (37.8%) with gynaecological-cancers had moderate anaemia (Hb concentration=7.0-9.9g/dl). 2 (4.1%) participants with surgical- and 4 (8.9%) with gynaecological-cancers had severe anaemia (Hb concentration= $<$ 7.0g/dl).

Overall, 61 (64.9%) subjects had symptomatic anaemia, comprising 34 (69.4%) and 27 (60%) of surgical- and gynaecological- cancer subjects respectively (see Table 5). There was a statistically

significant relationship between anaemic symptoms and stage of disease (p value 0.008) (see Table 4).

Table 2: Pattern of Surgical Cancers Seen.

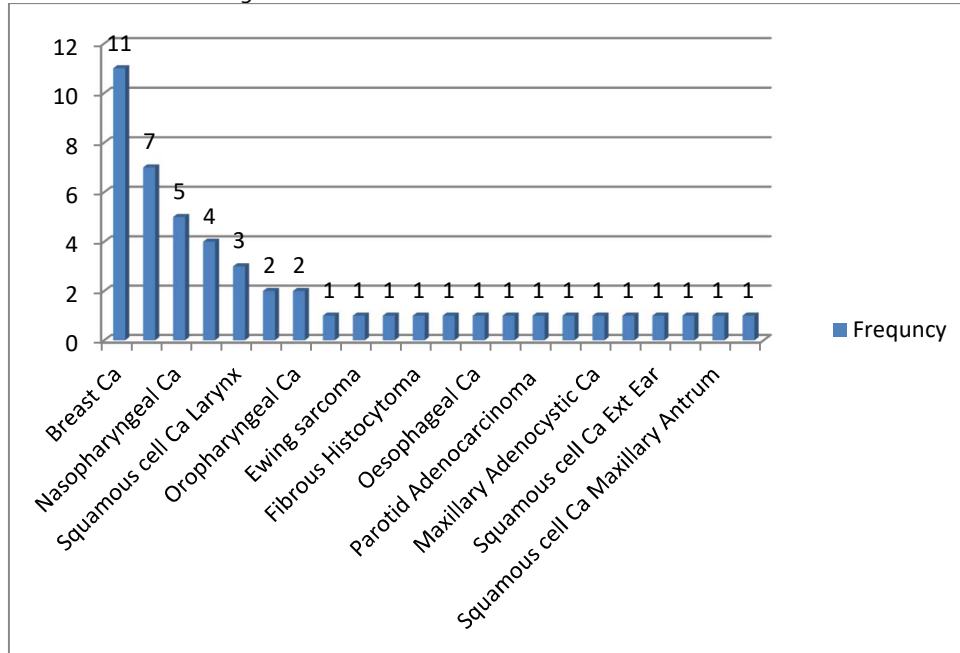


Table 3: Pattern of Gynaecological Cancers Seen.

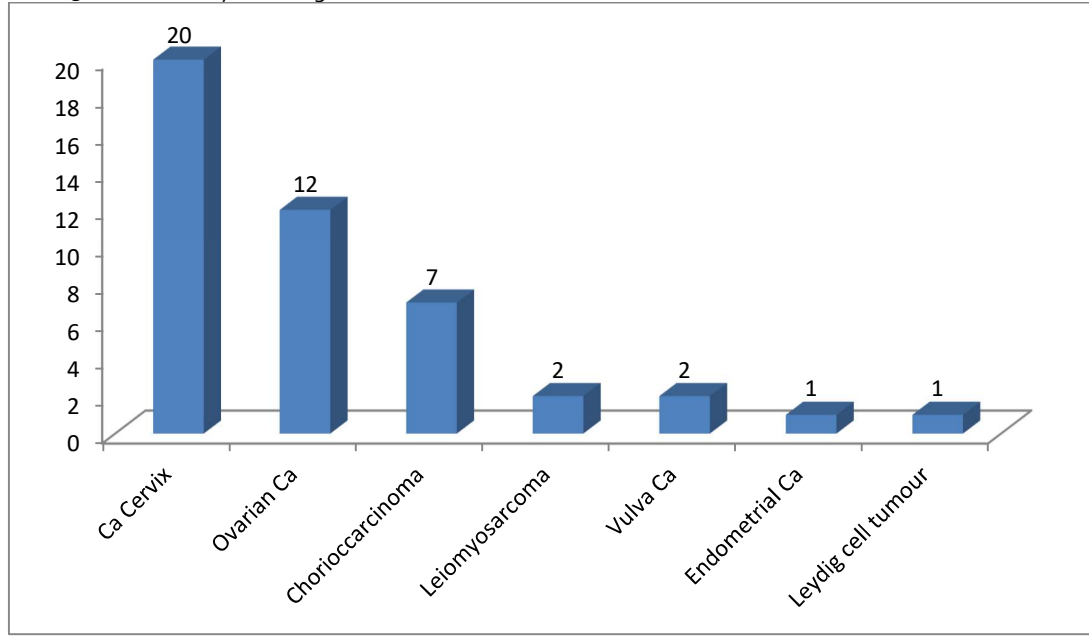


Table 5 shows the analysis of some haematological parameters (CBC and reticulocyte count) and serum bilirubin assay of participants. The mean haemoglobin ± SEM of all participants was 9.76±0.15 g/dl, while that of surgical- and

gynaecological- cancers was 9.73±0.19 g/dl and 9.81±0.24g/dl respectively. The mean ± SEM absolute reticulocyte counts for the general study population and for participants with surgical and gynaecological cancers were

1.33±0.08%, 1.42±0.14% and 1.23±0.10% respectively while the mean ± SEM corrected reticulocyte counts were 0.96±0.06%, 1.00±0.09 and 0.91±0.06% respectively. Ninety-three

(98.9%), forty-eight (98.0%) and forty-five (100%) participants in the general-, surgical cancer- and gynaecological cancer- groups respectively had inappropriate reticulocyte response.

Table 4: Association between anaemic symptoms and age group, sex, occupational class and stage of disease.

	Symptomatic (%) n=61	Asymptomatic (%) n=33	Chi-square	P value
<b>Age group (years)</b>			8.021	0.237
<30	1 (1.6)	2 (3.0)		
30 – 39	10 (16.4)	5 (15.2)		
40 – 49	11 (18.0)	9 (27.3)		
50 – 59	16 (26.2)	11 (33.3)		
60 – 69	15 (24.6)	6 (18.2)		
≥70	8 (13.1)	0 (0.0)		
<b>Sex</b>			0.504	0.478
Female	40 (65.6)	24 (72.7)		
Male	21 (34.4)	9 (27.3)		
<b>Occupational Class</b>			5.901	0.434
I	5 (8.2)	2 (6.1)		
II	6 (9.8)	4 (12.1)		
IIIM	6 (9.8)	3 (9.1)		
IIIN	17 (27.8)	15 (45.5)		
IV	15 (24.6)	3 (9.1)		
V	12 (19.7)	6 (18.2)		
<b>Stage of Disease</b>			7.065	0.008
Early	36 (59.0)	10 (30.3)		
Advanced	25 (41.0)	23 (69.7)		

Table 5: Haematologic parameters of study participants.

Variable	Surgical Group Mean± SEM	Gynaecological Group Mean ± SEM	P value
<b>Full Blood Count (FBC)</b>			
Haemoglobin (g/dl)	9.73±0.19	9.9.81±0.24	0.810
HCT (%)	29.76±0.59	28.54±0.74	0.488
RBC count( $10^{11}/L$ )	3.78±0.75	3.95±0.08	0.121
RBC indices			
MCV(fl)	79.66±7.21	77.52 ±9.06	0.325
MCH(pg)	25.62±2.73	24.81 ±3.60	0.414
MCHC(g/dl)	32.05±2.20	31.72 ±2.15	0.471
WBC ( $X10^9/L$ )	7.76 ± 4.33	7.86 ± 4.67	0.877
Platelet( $X10^9/L$ )	301.78 ±123.3	3.33.40±136.17	0.958
Reticulocyte count (%)			
Absolute	1.42 +/-0.95	1.23 +/-0.65	0.262
Corrected	1.00+/-0.64	0.91 +/-0.42	0.416
<b>Biochemical test</b>			
Total bilirubin (mg/dl)	0.52 +/-0.26	0.44 +/-0.19	0.086
Conjugated bilirubin (mg/dl)	0.35 +/-0.20	0.31 +/-0.18	0.265

There was no evidence of haemolysis in the PBFs of participants in both groups, however some participants i.e. 5 (10.2%) with surgical- and 6 (13.3%) with gynaecological- cancers showed the presence of burr cells (indicating renal

dysfunction). This correlated with the normal serum bilirubin levels noted above.

Using the PBF findings to morphologically classify anaemias, 31 (63.3%), 25 (55.6%) and 56 participants (59.6%) in the surgical, gynaecological

and general populations respectively had microcytic hypochromic anaemia. Conversely, only one person (2.2% and 1 % of persons in the gynaecological and general population respectively) had macrocytic anaemia.

29 (30.9%) participants in the general population, 14 (28.6%) in the surgical- and 15 (33.3%) in the gynaecological- group had normocytic, normochromic anaemia. A dimorphic blood picture was observed in the PBF of 8(8.5%), 4(8.2%) and 4(8.9%) participants in the general population, surgical- and gynaecological- groups respectively.

Urinalysis findings showed a subset of patients had proteinuria or haematuria, particularly those with

burr cells—supporting possible renal impairment (see tables 6).

54.5% (6 out of 11) of participants with burr cells also had haematuria as compared to 22.9% (19 out of 83) with haematuria in those without burr cells. This difference was statistically significant (P=0.026), suggesting a potential association between the presence of burr cells and haematuria.

#### ANTIBODY SCREENING AND ANTIBODY IDENTIFICATION FINDINGS:

Antibody screening done using the direct and indirect Coombs tests showed that none (0.0%) of the participants tested positive and hence the specificities of clinically significant erythrocyte immune antibodies could not be established amongst the participants.

Table 6: Urinalysis findings among study participants.

Urinalysis findings		Surgical n= 49 n(%)	Gynaecological n= 45 n(%)	Total n(%)	P value
Leucocytes	Negative	30 (61.2)	23 (51.1)	53 (56.4)	0.000
	Trace	6 (12.2)	11 (24.4)	17 (18.1)	
	Positive	13 (16.6)	11 (24.5)	24 (25.5)	
Nitrite	Negative	39 (79.6)	40 (88.9)	79 (84.0)	0.151
	Positive	10 (20.4)	5 (11.1)	15 (16.0)	
Urobilinogen	Normal	47 (95.9)	43 (95.6)	90 (95.7)	0.260
	Positive	2 (4.1)	2 (4.4)	4 (4.3)	
Protein	Negative	21 (42.9)	17 (37.8)	38 (40.4)	0.001
	Trace	17 (34.7)	16 (35.6)	33 (35.1)	
	Positive	11 (22.4)	12 (26.6)	23 (24.5)	
Occult blood	Negative	40 (81.6)	29 (64.4)	69 (73.4)	0.003
	Trace	1 (2.0)	4 (8.9)	5 (5.3)	
	Positive	8 (16.4)	12 (26.7)	20 (11.3)	
Bilirubin	Negative	49 (100.0)	45 (100.0)	94 (100.0)	
	Positive	0 (0.0)	0 (0.0)	0 (0.0)	
Glucose	Negative	42 (85.7)	43 (95.6)	85 (90.4)	0.209
	Trace	5 (10.2)	2 (4.4)	7 (7.4)	
	Positive	2 (4.1)	0 (0.0)	2 (2.1)	

#### DISCUSSION

This study set out to describe basic haematological and urinalysis parameters of patients with gynaecological and surgical cancers at the University of Benin Teaching Hospital, Nigeria. The mean age of participants corresponded with expected cancer demographics for the region, mirroring previous Nigerian data. The distribution of malignancies also matched established epidemiological trends<sup>4,12</sup>—breast, colorectal, nasopharyngeal, and prostate cancers predominated among the surgical cohort, while cervical and ovarian cancers were most prevalent in the gynaecological group.

Anaemia was frequently observed in both patient groups, most cases falling within the mild to

moderate range. This aligns with existing literature, which notes that up to half of cancer patients present with anaemia at diagnosis (Knight et al., 2003; Badheeb et al., 2023). Importantly, a significant association emerged between anaemic symptoms and advanced disease stage with a majority of cases in the general population and both study groups presenting symptomatic, underscoring the clinical relevance of anaemia and the necessity for prompt detection and intervention. The stage of disease at presentation was different in both groups aligning with other Nigerian studies (Adegbesan et al 2024; Offor et al., 2025).

Peripheral blood film analysis revealed the role of nutritional deficiencies in the aetiology of cancer-

related anaemias (CRA), even though it clearly showed (when reviewed together with the serum bilirubin findings) that haemolysis was not a typical cause of anaemia in these subjects. Instead, the identification of burr cells in a subset of patients suggested renal dysfunction, potentially leading to anaemia via reduced erythropoietin production. This finding together with urinalysis findings of pyuria (leucocytes in urine depicting urinary tract infection), proteinuria and haematuria further highlight renal impairment as a probable major contributor to cancer-related anaemia in this population as observed in other studies<sup>20</sup>. This study also revealed that study participants had inappropriate reticulocyte response.

Antibody screening (Coombs tests) was negative across all participants, indicating that warm autoimmune haemolytic anaemia is uncommon in solid tumours in this setting. This finding is consistent with prior reports that immune-mediated anaemia is infrequent in solid malignancies, being more common in haematologic cancers or as part of paraneoplastic syndromes (Puthenparambil et al., 2010; Tai et al., 2010).

The inappropriate reticulocyte response, the red cell morphologic findings on PBF examination and the absence of red cell autoantibodies all suggest that alternative mechanisms, such as chronic inflammation, nutritional deficiencies, bone marrow infiltration, or renal dysfunction, are more likely to underlie anaemia in these patients. This underscores the multifactorial and complex nature of CRA as stated in the Hikmat study (Hikmat & Abdel-Razeq, 2004).

By providing local data on basic haematological and urinalysis parameters in Nigerian cancer patients, this study addresses a notable gap in the literature. These findings emphasized the importance of basic haematological and urinalysis parameters in determining possible cause(s) of CRA when managing patients with solid tumours.

#### LIMITATIONS

Our inability to include investigations like Serum Hepcidine assay, Erythrocyte Sedimentation Rate (ESR) and/or C-reactive Protein (CRP) made it difficult to determine the role of inflammation in cancer related anaemia. Also, assays to further confirm nutritional deficiencies and renal pathology was not carried out in this study.

The study's cross-sectional design and relatively small sample size may limit the generalisability of these findings. Furthermore, exclusion of patients receiving cancer treatment restricts applicability to treatment-naïve individuals. Future research

involving larger cohorts, longitudinal follow-up and further confirmatory tests is warranted to further elucidate the pathophysiology of anaemia throughout cancer progression and therapy.

#### CONCLUSION

Cancer related anaemias (CRA) are a leading cause of hospitalization amongst cancer patients and the use of basic haematological and urinalysis parameters can serve as a cheap and effective screening tool to determine the aetiology of CRAs. The inappropriate reticulocyte response, the red cell morphologic findings on PBF examination, evidence of proteinuria and haematuria on urine analysis, and the absence of red cell autoantibodies all suggest that diverse mechanisms, such as chronic inflammation, nutritional deficiencies, bone marrow infiltration, or renal dysfunction, are more likely to underlie anaemia in these patients. It also almost rules out an autoimmune basis to CRAs in solid tumours.

Clinicians should prioritize comprehensive evaluation of anaemia's multifactorial causes in cancer patients to guide effective management. Further research is needed to explore the underlying mechanisms and improve anaemia care in cancer populations within similar settings.

#### Financial support and sponsorship

This work received no specific grant from any funding agency in the public, commercial or not-for-profit sectors

#### Conflicts of interest

The authors declare that they have no conflicts of interest.

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