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"Assessment of Anemia Profile, Nature, Severity and Quality of Life of Anemia Patients Diagnosed with Solid Malignancies using SF-36 Questionnaire: A Cross-Sectional Study"

Dr. Samarath Mittal, Dr. Navneet Saxena, Dr. Sunil Yadav, Dr.Sakshi Mittal
Medicine Resident, JNU Medical College and Hospital, Jaipur
Professor and HOD Nephrology, JNU Medical College and Hospital Jaipur
Medicine Resident JNU Medical College and Hospital Jaipur
M.D. (Radiodiagnosis), Jaipur

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ABSTRACT
Introduction: Anemia, defined as hemoglobin levels below 13 g/dl in men and below 12 g/dl in women, is prevalent in cancer patients, impacting their quality of life (QOL) and treatment outcomes. This study investigates the prevalence and type of anemia in patients with solid malignancies, alongside evaluating QOL using the SF-36 questionnaire. **Methodology:** This observational, cross-sectional study involved 50 treatment-naïve solid malignancy patients. Patients underwent comprehensive evaluations, including Complete Blood Count, Peripheral Blood Film, Serum Iron, Total Iron Binding Capacity, Serum Ferritin, Reticulocyte count, Serum Lactate Dehydrogenase, and Serum Vitamin B12 levels. Anemia severity was classified as per National Cancer Institute standards, and QOL was assessed using the SF-36 questionnaire. Statistical analyses were performed using SPSS. **Results:** The mean age of the participants was 55.74 ± 12.82 years with a male predominance (52%). The most common malignancies were lung (20%) and breast (16%). The mean hemoglobin concentration was 8.08 ± 0.804 g/dl, with no cases above 10 g/dl. Anemia was universal, with 60% having moderate anemia and 40% severe anemia. Iron deficiency was the leading cause (66%), followed by Vitamin B12 deficiency (16%). SF-36 scores indicated significant impairments in physical functioning, role limitations, and fatigue, with severe anemia correlating with lower QOL scores. **Conclusion:** Anemia is highly prevalent in solid malignancy patients, predominantly due to iron deficiency. It significantly impacts QOL, emphasizing the need for early detection and management to improve overall patient outcomes before initiating chemotherapy.

Keywords: Anemia, Quality of Life, Iron deficiency Anemia,

I. INTRODUCTION

Anemia, characterized by hemoglobin levels below 13 g/dl in men and below 12 g/dl in women,[1] is a common and debilitating issue in cancer, occurring at diagnosis and throughout treatment. It significantly impacts the well-being of cancer patients, with solid tumours also frequently associated with its occurrence, not just hematologic malignancies.[2] Anemia in cancer patients typically arises from multiple factors, including blood loss, increased destruction of red blood cells, and decreased production of functional red blood cells (RBCs).[3] Various conditions such as renal failure, nutritional deficiencies (particularly folate and B12 deficiency), coagulopathies, and severe inflammatory processes can exacerbate these mechanisms.[4] The cancer itself may act directly on the bone marrow by invasion and metastasis leading to suppression of erythropoiesis or indirectly through cytokine release leading to iron sequestration and dyserythropoiesis.[3,4] Additionally, cytotoxic chemotherapy can worsen anemia by impairing erythropoiesis or due to its nephrotoxic effects, especially with platinum-based regimens and taxanes, which are frequently associated with severe anemia.[5] Moreover, cytokine overproduction can alter iron availability, leading to functional iron deficiency (FID), where iron is trapped in macrophages and enterocytes, limiting its availability for erythropoiesis and triggering anemia.[6] Functional iron deficiency is the primary mechanism of iron deficiency in cancer, with prevalence ranging from 29 to 46% in oncology patients, and iron deficiency associated with anemia ranging from 7 to 42%.[7,12] The reduction in red blood cells and hemoglobin levels leads to decreased oxygen-carrying capacity, resulting in symptoms such as weakness, pallor,

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dyspnea, and fatigue.[10] Anemia can compromise the delivery of sufficient amounts of oxygen to all cells, including tumour cells. This hypoxic condition can worsen the results of radiotherapy and chemotherapy, because low tissue oxygenation is associated with reduced sensitivity of tumours to radiation and some forms of chemotherapy, contributing to the progression of cancer and reduction in survival. Furthermore, there is abundant evidence suggesting that hemoglobin levels of less than 12 g/dl result in worse quality of life and functional status for cancer patients.[13] Anemia appears to have a direct effect on health-related quality of life across the spectrum of many disease conditions. The presence of anemia has been linked to frailty, functional impairment, mobility impairment, and falls in older persons.[14] Most studies show the relationship of anemia in patients with solid tumours or leukemias after the start of chemotherapy, due to the above- mentioned mechanisms so the current study aims to find the prevalence, nature and type of anemia in patients diagnosed with malignant solid tumours prior to the start of chemotherapy and to evaluate the Quality of Life (QOL) using the SF-36 questionnaire and compare the outcomes in patients with and without anemia.

MethodologyStudy Design

An observational, cross-sectional, single-centred study was conducted among anemia patients for a duration of 12-24 months after approval from the Research and Ethics Committee. Demographic parameters including gender, age, place of residence, education, marital status, smoking and alcoholic status, monthly income, diabetes duration along with laboratory investigations including random blood glucose levels, fasting blood glucose, HBA1c levels, and complications (if present) were obtained from the diabetic patients. The anemia profile was evaluated by tests including Complete Blood Count (CBC), Peripheral blood film (PBF), Serum Iron, Total Iron Binding Capacity (TIBC), Serum Ferritin, Reticulocyte count, Serum Lactose Dehydrogenase (LDH), Serum Vitamin B12. The questionnaire and methodology for this study were approved by the Human Research Ethics Committee of Jaipur National University Institute of Medical Science and Research Centre (No. JNUIMSRC/IEC/2022/39). All the patients that came with treatment naive solid malignancies filling the study criteria were examined and detailed clinical history was taken and thorough physical examination was done.

The intensity of anemia was graded according to the National Cancer Institute Classification[178]: Table 1: Grading of anemia according to the National Cancer Institute classification

GRADE	SYMPTOMSEVERITY	HEMOGLOBIN VALUES
0	Within normal limits	12.0-16.0g/dl for women and 14.0-18.0 g/dl for men
1	Mild	10g/dl to levels within normal limits
2	Moderate	8.0-10.0g/dl
3	Serious/severe	6.6-7.9g/dl
4	Life threatening	<6.5g/dl

STUDY PLACE AND STUDY POPULATION

Anemia patients with histopathological or radiologically confirmed solid malignancies who visited the Department of General Medicine, Jaipur National University Institute for Medical Sciences and Research Centre, Jaipur, Rajasthan were recruited for the study purpose. In addition, prior to inclusion in the study, all subjects supplied written informed consent. The following were the inclusion criteria: (1) Anemia patients with histopathological or radiologically confirmed solid malignancies and age ≥ 18 years; (2) Both gender; (3) Patients wanting to engage in the study and providing written consent. Patients less than 18 years with primary hematological malignancies, patients on chemotherapy or those who underwent surgery for malignancy, patients with previous history of anemia, or repeated blood transfusions and patients with learning disabilities were excluded from the study.

SAMPLE SIZE:

The formula used for calculation of sample size is:

$N = (Z\alpha/2)2\times P\times(100-P)/E^2$ Where Prevalence, **P**=37%·

(Which is the mean prevalence of anemia in cases of solid malignancies according to the study conducted by Jounblat Y, et al.)[2]

Zα be the level of confidence at 90% =1.96 and

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allowable error (**E**) of 10%.
Thus, the minimum sample size (n) required is 50.

STUDY TOOLS

For the better comprehension of the anemia patients in the area all the study tools including theconsent form, demographic form, and SF-36 questionnaire were prepared in both Hindi and English language (wherever needed).

SHORT FORM HEALTH SURVEY 36 (SF-36) QUESTIONNAIRE

The SF-36 is one of the most common instruments used in health research which helps to detectmedically and socially relevant differences in health status over time using a small number of statistically-efficient dimensions. It consists of 36 questions: one of them measures health transitions over a one-year period and is not used in scale calculation, and the remaining questions are grouped into eight scales or domains. The eight scales can be aggregated into two independent summary measures: physical component summary (PCS) and mental component summary (MCS). Higher scores indicate better health.[172, 173, 174, 175]

Quality of Life was assessed by the Short Form-36 (SF-36). Scoring the 36-ItemHealth Survey is a two-step process. First, precoded numeric values are recorded as per the scoring key givenin Table 2. All items are scored so that a high score defines a more favorable health state. In addition, each item is scored on a 0 to 100 range so that the lowest and highest possible scoresare 0 and 100, respectively. Scores represent the percentage of the total possible score achieved.[179]

Table 2: Scoring key[179]

ITEM NUMBERS	CHANGE ORIGINAL RESPONSE CATEGORY*	TO RECORDED VALUEOF:
1,2,20,22,34,36	1	100
	2	75
	3	50
	4	25
	5	0
3,4,5,6,7,8,9,10,11,12	1	0
	2	50
	3	100
13,14,15,16,17, 18,19	1	0
	2	100
21,23,26, 27,30	1	100
	2	80
	3	60
	4	40
	5	20
	6	0
24,25,28, 29,31	1	0
	2	20
	3	40
	4	60
	5	80
	6	100
32,33, 35	1	0
	2	25
	3	50
	4	75
	5	100

(*Precoded response choices as printed in the questionnaire)

In step 2, items in the same scale are averaged together to create the 8 scale scores. Table 3 lists the item saveraged together to create each scale. Items that are left blank (missing data) are not taken into account when calculating the scale scores. Hence, scale scores represent the

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average for all items in the scale that the respondent answered.[179]

SCALE	NUMBER OF ITEMS	AFTER RECODING PER TABLE 2, AVERAGE THE FOLLOWING ITEMS
Physical functioning	10	3,4,5,6,7,8,9,10,11,12
Physical role limitation	4	13,14, 15, 16
Emotional role limitation	3	17,18, 19
Energy/fatigue	4	23,27, 29, 31
Emotional well-being	5	24,25, 26, 28, 30
Social functioning	2	20,32
Pain	2	21,22
General health	5	1,33, 34, 35, 36

Table 3: Items averaged together to create each scale[179]

The eight scales can be aggregated into two independent summary measures: physical component summary (PCS) and mental component summary (MCS). Higher scores indicate better health.

Statistical analysis

The Rao soft sample size calculator was used to compute the sample size at 95% confidence interval (CI), 5% margin of error, and 50% response distribution. The overall sample size was determined to be 50 patients. MS-EXCEL software version 17 and Statistical Package for Social Sciences (SPSS 29.0, Chicago, USA) were used to conduct the statistical analysis []. The Shapiro-Wilk test was used to identify the pattern of data distribution, and it revealed that the data was not normally distributed. The association between categorical variables and normally distributed numerical outcome variables were assessed by comparing the mean valuesusing unpaired t-test and Mc-Nemar's test. Association between two categorical variables was assessed by Chi-square test/fisher's exact test. All the analysis was done at a significance level$p < 0.05$.

II. RESULTS

Demographic characteristics of the patients (N=50)

A total of 50 patients were recruited in the study with a mean age ± S.D (in years) 55.74 ±
12.82 years of which the majority of the population were male (n=26, 52%) and the remaining were female (n=24, 48%). Majority of the participants were married (84%). In terms of residence, 78% of the participants belonged to rural area while the rest 22% were urban. In terms of lifestyle factors, 64% of the participants were smokers and 58% were alcoholics and almost 72% of the participants had primary education. More details regarding the demographicvariables are given in Table 1.

Table 1: Demographic characteristics of the patients (N=50)

DEMOGRAPHIC VARIABLES		**FREQUENCY N (%)**
Age (years)	< 50	15 (30)
	50 - 70	28 (56)
	> 70	7 (14)
Gender	Male	26 (52)
	Female	24 (48)
Residence	Rural	39 (78)
	Urban	11 (22)
Marital status	Married	42 (84)
	Unmarried	8 (16)
Smoking	Smoker	32 (64)
	Non-Smoker	18 (36)
Alcohol	Alcoholic	29 (58)
	Non-Alcoholic	21 (42)
	Primary	36 (72)

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Education	Secondary	5 (10)
	Tertiary	9 (18)

Prevalence of solid malignancies and Carcinomas among the anemic patients (N=50)

The most commonly noted solid malignancies were CA Lung (20%) followed by CA breast (16%) and colon (12.2%) malignancies. While, CA Ovary comprised (6%) followed by CA Gall Bladder, Buccal Mucosa, Cervix, Stomach, Tongue and HCC consisting 2 cases of each (4%). Rest of other malignancies, there was only one case each (2%).

Table 2: Distribution of Type of Carcinoma (N=50)

Type of Carcinoma	FrequencyN (%)
CA Gall Bladder	2 (4)
CA Anaplastic Thyroid	1 (2)
CA Breast	8 (16)
CA Buccal Mucosa	2 (4)
CA Cervix	2 (4)
CA GEJ	1 (2)
CA Head of Pancreas	1 (2)
CA Lung	10 (20)
CA Esophagus	1 (2)
CA Ovary	3 (6)
CA Prostrate	1 (2)
CA Pyriform Fossa	1 (2)
CA Stomach	2 (4)
CA Tongue	2 (4)
Colorectal CA	1 (2)
Germ Cell Tumor of Ovary	1 (2)
HCC	2 (4)
Liposarcoma Stage 4	1 (2)
Metastatic CA Omentum	1 (2)
Metastatic Leiomyosarcoma	1 (2)
Metastatic SCC	1 (2)
Mixed Giant Cell Tumor	1 (2)
Oropharyngeal CA	1 (2)
Pleomorphic Liposarcoma	1 (2)
Primary Gastric Lymphoma	1 (2)
Rectosigmoid CA	1 (2)
Total	**50 (100)**

Categorization of Anemia based on severity among the patients (N=50)

Table 3 represents data on the distribution of individuals across two categories of anemia severity. The mean Hb concentration was found to be 8.08 ± 0.804 g/dl, (range between 5.8 to 9.7 g/dl). There was not a single case that has Hb level more than 10 g/dl, so we did not find any case which falls under mild or normal anemia category. There were 30 (60%) cases with moderate anemia, followed by 20 (40%) cases with severe anemia.

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Table 3: Categorization of Anemia based on severity among the patients (N=50)

Severity of Anemia	Frequency n (%)
Moderate Anemia (8 – 9.9 g/dl)	30 (60)
Severe Anemia (< 8 g/dl)	20 (40)
Total	50 (100)

Distribution of Sex among Anemia Category (N=50)

This table provides a cross-tabulation of anemia category and sex within study sample. Our study finds out that, there were 13 female cases (43.3) and 17 male cases (56.7%) among moderate anemia category. While, 11(55.0%) females and 9 (45.0%) male cases among severe anemia category. We did not find any significant association between sex and anemia category in our study by applying chi square test ($X^2 = 0.654$, p value = 0.419)

Table 4: Distribution of Sex among Anemia Category (N=50)

Anemia Category		Sex		Total
		F	M	
Moderate Anemia	Count	13	17	30
	% within Anemia Category	43.3%	56.7%	100%
Severe Anemia	Count	11	9	20
	% within Anemia Category	55%	45%	100%
Total	Count	24	26	50
	% within Anemia Category	48%	52%	100%

Causes of Anemia (N=50)

The most common cause, affecting 66.0% (33 cases) was iron deficiency, followed by serum vitamin B12 deficiency 16.0% (8 cases), chronic disease 10.0% (5 cases) and other causes accounts for 8.0% (4 cases). Iron deficiency is the leading cause, followed by vitamin B12 deficiency, chronic disease, and other unspecified causes.

Table 5: Intensity and Causes of Anemia (N=50)

Diagnosis	Frequency N (%)
Iron Deficiency	33 (66)
Serum Vitamin B12	8 (16)
Chronic Disease	5 (10)
Other Causes	4 (8)

Cross tabulation between Category of Anemia and Various scores including Physical Functioning Score, Physical Role Limitation Score, Emotional Role Limitation Score, Fatigue Score, Emotional Well Being Score, Pain Score and General Health (N=50)

This table presents a cross-tabulation of anemia category and physical functioning score within our sample. We find out in study that, 6 cases (20%) fall in ≤ 50 and 24 (80%) falls in > 50 physical functioning score in moderate anemia group. Respectively, 5 cases (25%) in ≤ 50 and 15 cases (75%) in > 50 physical functioning score in severe anemia group. This table presents the distribution of cases across anemia category and physical role limitations. In moderate anemia group, equal distribution within physical role limitations categories, 15 cases (50%) within ≤ 50 and 15 cases (50%) with > 50 physical limitation score group while, in severe anemia category higher percentage within the > 50 like 14 cases (70%) compared to 6 cases (30%) within ≤ 50 physical role limitation group. This table displays the distribution of cases between Anemia Category and Emotional Role Limitation. In moderate anemia group, 36.7% of cases were in ≤ 50 emotional role limitations group, while 63.3% falls in > 50 emotional role limitations group; while in

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severe anemia 45% of cases were in ≤ 50, while 55% have > 50 emotional role limitation group. This table shows the relationship between Anemia Category and Fatigue. Within the moderate anemia category, 46.7% of individuals report fatigue levels ≤ 50, while 53.3% report fatigue levels > 50. In the severe anemia category, 55% of individuals report fatigue levels ≤ 50, while 45% report fatigue levels > 50. This cross-tabulation table illustrates the relationship between Anemia Category and Emotional Well-Being. In the moderate anemia category, 10% of individuals report emotional well-being levels ≤ 50, while 90% report levels > 50. Within the severe anemia category, similarly, 10% of individuals report emotional well-being levels ≤ 50, while 90% report levels > 50. This table presents the relationship between Anemia Category and Pain Score. Among cases with moderate anemia, 23.3% report pain scores ≤ 50, while 76.7% report scores > 50. For cases with severe anemia, 20% report pain scores ≤ 50, while 80% report scores > 50. This table displays the relationship between Anemia Category and General Health. Within the moderate anemia category, 30% of individuals report general health scores ≤ 50, while 70% report scores > 50. For individuals with severe anemia, 25% report general health scores ≤ 50, while 75% report scores > 50.

Table 6: Cross tabulation between Category of Anemia and Various scores including Physical Functioning Score, Physical Role Limitation Score, Emotional Role Limitation Score, Fatigue Score, Emotional Well Being Score, Pain Score and General Health (N=50)

Anemia Category		Physical Functioning Score		Physical Role Limitation Score		Emotional Limitation Role Score		Fatigue Score		Emotional Well Being Score		Pain Score		General Health Score	
		≤50	>50	≤50	>50	≤50	>50	≤50	>50	≤50	>50	≤50	>50	≤50	>50
Moderate Anemia	Count	6	24	15	15	11	19	14	16	3	27	7	23	9	21
	% within Anemia Category	20%	80%	50%	50 %	36.7 %	63.3 %	46.7 %	53.3%	10 %	90 %	23.3 %	76.7 %	30 %	70%
Severe Anemia	Count	5	15	6	14	9	11	11	9	2	18	4	16	5	15
	% within Anemia Category	25%	75%	30%	70 %	45%	55 %	55%	45%	10 %	90 %	20 %	80%	25 %	75%
Total	Count	11	39	21	29	20	30	25	25	5	45	11	39	14	36
	% within Anemia Category	22%	78%	42%	58 %	40%	60 %	50%	50%	10 %	90 %	22 %	78%	28 %	72%

III. DISCUSSION:

The present hospital based observational, cross-sectional study was conducted to assess the prevalence, severity and etiology of anemia in patients with solid malignancies. The study included 50 patients who presented with treatment naïve solid malignancies, and whose previous history and investigations prior to diagnosis did not show anemia. The quality of life was also analyzed in these patients. Complete blood counts, peripheral blood films, serum vitamin B12 assay and serum iron profiles were done to determine the presence of anemia, and its severity and etiology, and quality of life were assessed by the Short Form-36 (SF-36) questionnaire. Anemia in cancer patients is observed as a result of the malignancy itself, blood losses, nutritional deficiencies, hemolysis, endocrine disorders or inflammatory cytokine associated with chronic diseases. The mean age of the cases of solid malignancies in our study was found to be 55.74 ± 12.82 years and out of the 50 cases, 24 were females (48.0%). Similar age of presentation has been observed by other authors. Toledano A et al.[180] in their study observed median age of patients was 64 years (21-90 years). Ludwig H et al.[158] also observed mean age of patients as 65.0 (22.5–96.8), with male preponderance, 59% of their subjects being males. Risk of developing cancer increases with age, more than a third (36%) of all cancers is diagnosed in people aged 75 years or over. Over half (53%) of all cancers occur in people aged 50-74years.[181] The primary possible reason for severe anemia in elder than younger patients is due to the fact that as one gets older, there is a physiological change. As a result of this, there is a decline in hematopoietic stem cell reserves and proliferation capacity, which

leads to suppression of erythropoiesis. A male preponderance was found in our study, females being more anemic than males, because of the fact that majority of the cases noted were from gynecology and 93.3% of these patients had a history of bleeding. This was also observed by other authors such as Gao Fet al.,[157]Hassan FM et al.[156] and Verbeke N et al.[162] in their studies in China, Sudan and Belgium respectively. According to our study, the overall prevalence of anemia across different solid malignancies was 100%, which was much higher than the studies conducted in China (18.98%), [157]Europe (39.3%), [158]Australia (35%), [148]USA (41%), [159]Thailand (54.4%)[161] and Belgium (55.7%).[162] A higher prevalence in our study is because of difference in definition of anemia, study population and survey period. The most commonly noted solid malignancies in our study were lung carcinoma (20.0%) followed by carcinoma breast (16%) and colon and ovary. These findings were similar to the result of the study conducted in Thailand by Mahasittiwat P et al. Where gynecological cancers (30.6%) and breast cancers (26.2%) scored the first two ranks among observed tumor types.[161] A study by Chowdhary G et al. conducted in India revealed that the maximum number of cases were from gynaecology (28.9%) followed by breast carcinoma (22.7%).[182] In our study, the severity of anemia was classified according to the National Cancer Institute Classification and maximum number of patients were found to have grade 2 or moderate anemia (60.0%) followed by grade 3 or severe anemia (40.0%); This was similar to findings in study by Chowdhary G et al. where 27.6% were moderately and 13.4% were severely anemic.[182] Hemoglobin levels were seen to further deteriorate with advancing stages of disease in patients of stage III and stage IV malignancies were observed to have moderate to severe anemia. In the advanced stages of hematological malignancies, bone marrow involvement often leads to progressive anemia. In addition, interaction between tumor cell populations and the immune system can lead to the release of cytokines, especially interferon-γ, interleukin-1 and tumor-necrosis factor-α. This release disrupts endogenous erythropoietin synthesis in the kidney and suppresses differentiation of erythroid precursor cells in the bone marrow. As a result, patients with tumor related anemia can have relatively low levels of erythropoietin for the grade of anemia observed.[183] Ludwig H et al.[158] reported that across most tumor types evaluated, a high prevalence of iron deficiency and moderate to severe anemia was noted in pancreatic (63.2%), colorectal (52.2%) and lung cancer (51.3%) patients. In patients with solid tumors, a significant correlation between tumor stage and anemia was found (P <0.0001andP< 0.0001, respectively). The prevalence of anemia increased from 35.4% in stage I –II to 45.2% in stage III and 53.6%in stage IV patients. The corresponding figures for anemia in our study were 18.4%, 29.8% and 41.2%, respectively. In our study, we evaluated the most common etiology of anemia in cancer patients. Out of the 50 patients with anemia, all cases (100%) had microcytic hypochromic anemia. Out of these 50, 33 patients had low serum iron and serum ferritin levels, and were classified as iron deficiency anemia.8 patients (16.0%) had macrocytic anemia and low levels of serum vitamin B12 and classified as vitamin B 12 deficiency anemia, 5 cases (10.0%) were falls under the category of anemia due to chronic disease of chronic diseases followed by anemia due to other causes responsible for 4 (8.0%). Thus, our study observed iron deficiency and anemia of vitamin B 12 deficiencies to be the most common etiology. Xu H et al. found that approximately 10% of anemic patients were either microcytic or macrocytic; and around 10% of patients were hypochromic. [8]Findings of the present study was supported by KanuriGetal.[184] They reported that the etiology of cancer related anemia in their setting was mostly iron deficiency. Aapro M et al.[150] also found that the major etiology of anemia in cancerpatients was iron deficiency superimposed by anemia of inflammation. Our findings have also been well supported by GoodenoughL Tetal. They reported that the major contributor appears to be iron restricted erythropoiesis resulting from anemia of inflammation, absolute iron deficiency or a combination of the two. [185]Iron deficiency was also seen to be highly prevalentin cancer patients in a study by LudwigHetal.[158] These data indicate that pre-existing micronutrient deficiencies (e.g. iron deficiency) profoundly influence the development of cancer related anemia, In addition to chemotherapy and tumor cell-released cytokines. A comprehensive evaluation of anemia as well as the underlying conditions like the nutritional status and bone marrow function helps to guide anemia management. Ludwig H et al.[158]also observed that across most tumor types evaluated, a high prevalence of Iron deficiency anemia was noted. Iron deficiency was highest in pancreatic (63.2%) and colorectal cancer (52.7%). Marks PW et al.[186]

reported that anemia of cancer may also be evident at initial diagnosis. Activation of the immune system appears to be the driving force for a global diminution of erythropoiesis and analogous to chronic inflammatory conditions observed in anemia of chronic disease. Patients with cancer may develop anemia secondary to poor nutrition in general or due to reduced function in the gastrointestinal (GI) tract to absorb nutrients. Iron deficiency anemia may be due to blood loss or the inability to absorb iron in the GI tract and it often occurs in patients with malignancies of the GI tract, including colorectal cancers. Birgegård G et al. Also reported similar findings. [148]These findings were similar to our study. The mean trigger hemoglobin level in our data was 8.08 ± 0.804 g/dl, which is lower as compared to reports made by Achariyapota V et al. where mean trigger hemoglobin level for initiating transfusion was 9.5 g/dl.[149]Ludwig H et al. in his study initiated transfusion at mean hemoglobin level of 8.6 g/dl.[158] The possible justification for the low mean trigger hemoglobinlevel for initiating transfusion in our study is due to variation among doctors`decision in initiating anemia supportive treatment and also as a result of high frequency of Grade3 anemia when compared to other findings. Regarding the anemia treatment patterns, our data showed that anemia was treated in32% of patients. This result was similar with study of Ludwig H et al.[158] in which 38.9% of patients were treated for their anemia before commencing anti-tumor agents. In Mahasittiwat Petal's study, [161]22.3% of patients with anemia got it corrected prior to commencing anti-cancer treatment, which was lower than our study. The most commonly used supportive treatment for anemia correction in our study was blood transfusion (25.8%), which is in agreement with that of studies of LudwigHetaland Seshadri Tetal. (36%).[158,160] In this study, the quality of life was assessed by the Short Form-36 questionnaire and the results were divided into 8 categories: Physical functioning, physical role limitations, emotional role limitations, fatigue, emotional well-being, social functioning, pain and general health." In this study, we did not find any statistical correlation between the quality of life of the patients and the severity of their anemia. This is in contrast to the studies by KaiserJ et al.[187] and Shasha D et al.[188] where a direct relationship was found between increasing hemoglobin levels and quality of life. This variation in result may be because the patients in both these studies were all undergoing chemotherapy, while in our study patients were treatment naïve.

IV. CONCLUSION

The present study concluded that the major etiology of anemia in Indian cancer patients is iron deficiency. It is a widespread and serious problem especially among lung, gynecological, colorectal, and breast cancer patients. Its early evaluation and management could reduce the incidence of treatment –related anemia in cancer patients. Newer cancer treatment protocols should be designed keeping in mind the high prevalence of anemia in cancer patients. Measuresdirected towards characterization and treatment of anemia should be incorporated as an integral part of cancer management protocols. Patients with anemia should be closely monitored, and a vigilant management strategy should be implemented to reduce the risk of morbidity associatedwith anemia. Quality of life of such patients should also be assessed. Unfortunately, except for pain evaluation, such assessments are infrequent in clinical practice, even at palliative care centers. More than pain, anemia is a factor that can be dealt with to improve the QOL of cancerpatients.