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Study of Haematological Profile in HIV Infected Patients

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Abstract
Background: HIV is multisystem disease; haematologic abnormalities are among the most common clinicopathological manifestations of HIV infection. Haematological abnormalities may occur as a result of HIV infection itself, as sequel of HIV related opportunistic infections or malignancies or as a consequence of therapies used for HIV infection and associated conditions, being responsible for significant mortality and morbidity of patients.
Objectives: To study the hematologic profile of human immunodeficiency virus (HIV)-positive patients and its association with the clinicoimmunologic stage of the disease
Methods: 100 cases of HIV positive patients were studied over a period of 2 years. Anemia was defined as Hb < 13g/dl in males and <12g/dl in females (WHO); Leukopenia <4000/µl; neutropenia (absolute lymphocyte count taken as percentage of total leukocyte count) <1500/µl; lymphopenia (absolute lymphocyte count) <800/µl and thrombocytopenia as <1.5 lakh/µl. Bone marrow study was done in 10 patients,of which 7 patients had pancytopenia.one patient was diagnosed with ALL-L3.CD4 count was measured using flow cytometry
Results: there was statistically significant prevalence of HIV infection in age group between 21-50 yrs.Prevalence of anemia was 87%, leucopenia 32%, lymphopenia 20%, neutropenia 12% and thrombocytopenia 26%. There was statistically significant association of anemia & leucopenia with decline in CD4 count and presence of AIDS. Neutropenia,lymphopenia,Thrombocytopenia occurred independently of CD4 count or presence of AIDS. Bone marrow revealed 3 cases with hypercellular marrow, 5 hypocelluar marrow and 2 normocellular marrow
Conclusion: The frequency and severity of anemia & leukopenia, increases with decline in CD4 count and presence of AIDS. Neutropenia,lymphopenia &Thrombocytopenia occur independent of decline in CD4 count or presence of AIDS

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I. Introduction

HIV is global pandemic with cases reported from virtually every country. As per the recently released, India HIV Estimation 2017 report, National adult (15–49 years) HIV prevalence in India is estimated at 0.22% (0.16% – 0.30%) in 2017. In 2017, adult HIV prevalence is estimated at 0.25%(0.18-0.34) among males and at 0.19% (0.14-0.25) among Females.

The adult HIV prevalence at national level has continued its steady decline from an estimated peak of 0.38% in 2001-03 through 0.34% in 2007, 0.28% in 2012 and 0.26% in 2015 to 0.22% in 20171 .India is estimated to have around 87.58 (36.45 – 172.90) thousand new HIV infections in 2017, showing new HIV infection decline by 85% since the peak of 1995 and by 27% between 2010-2017. Women are accounted for 40% of annual new HIV infection in 2017 [1].

HIV is multisystem disease; haematologic abnormalities are among the most common clinicopathological manifestations of HIV infection.The hematological system is primarily involved in almost all patients and is responsible for manifestation of the infection in various forms depending upon the dominant involvement of the bone marrow or peripheral blood.

Disorders of haematological system including lymphaedenopathy, anaemia, leucopenia and/or thrombocytopenia are common throughout the course of HIV infection and may be direct result of HIV, manifestations of secondary infections or neoplasms or side effect of anti retroviral therapy.[2] HIV is a likely mediator of defective hematopoiesis through mechanisms like direct infection of early hemopoetic precursors, aberrations of local cytokine and growth factor signaling and changes in the bone marrow stroma.[4] Over time, hematological abnormalities have been documented as independent predictors of morbidity and mortality among HIV-infected individuals.[3,4]

The hallmark of HIV disease is a profound immunodeficiency resulting primarily from a progressive quantitative and qualitative deficiency of the subset of T lymphocytes referred to as helper T cells. This subset

of T cells is defined phenotypically by the presence on its surface of the CD4 molecule, which serves as the primary cellular receptor for HIV.[5]

India's ART programme is the second largest globally and has been acclaimed as one of the best public health programmes providing HIV care services. PLHIV have direct access to free diagnostic facilities, free first-line therapy, second and third-line ART, prevention of parent to child transmission of HIV (PPTCT) services, prevention, diagnosis and management of opportunistic infections including management of TB with daily anti-TB treatment through a single window approach

The impact of the programme is evident. India's gains are one of the major contributors to the global success

The lifesaving ART has improved millions of lives. AIDS related deaths have gone down by almost 71% since its peak in 2005, against a global average of 48%. The success is encouraging, and gains are to be consolidated.

The principle of "hit hard hit early" is becoming more and more pertinent as the programme is maturing.

The country is committed to achieving the SDG of ending AIDS as a public health threat by 2030 and is signatory to the UN strategy of 90-90-90 by 2020 which aims at ending AIDS epidemic by achieving that

• 90% of the estimated PLHIV know their status, of which

• 90% PLHIV are on ART, of which

• 90% PLHIV have viral suppression

To achieve this aim, standardized and uniform national ART technical guidelines remain the mainstay to standardize treatment practices and thereby improve the quality of HIV care across all sectors of health care in our country context, especially when many other guidelines with a wide spectrum of recommendations already exist.

II. Materials And Methods

Source of data

All subjects aged >18 years of either sex who were proved to be positive for HIV attending opd and getting admitted in B.T.G.H, Gulbarga attached to M.R.M.C

Methods of collection of data (including sampling procedure, if any)

- Study design: prospective and observational study
- Study period : between November-2016 to May-2018
- Sample size- Minimum of 100 cases of HIV positive patients attending Medicine OPD and admitted to B.T.G.H, Gulbarga; attached to M.R.M.C will be studied
- Sampling method: simple random sampling
- Data analysis:statistical was analysed by SPSS 16.0 version package. Chi-square,ANOVA,t-test,correlation tests were applied for significance. p-value <0.05 was considered as significant.

INCLUSION CRITERIA

All patients of >18 years of age and either sex proved to be HIV positive as per WHO criteria attending Medicine OPD and getting admitted in B.T.G.H attached to M.R.M.C, Gulbarga will be taken for study.

EXCLUSION CRITERIA

1. Age < 18 years.
2. Pregnant females.
3. Patient with previously known haematological disorder.
4. Intercurrent infection unrelated to HIV with significant effect on haematological profile.
5. CKD in HIV
6. Malignancy in HIV patients
7. Patients on cytotoxic therapy for malignancy

Data was collected by using pre-tested proforma meeting the objectives of the study. Purpose of the study was carefully explained to the patients and consent was taken. All patients were interviewed, detailed history was taken with respect to risk factors and detailed physical examination was carried out. Appropriate investigations were carried out.

Laboratory investigations like

Complete hemogram

Peripheral smear for cell morphology

LFT

RFT

LDH

CD4 count

Vitamin B12,Folic acid levels
Iron profile studies
Chest-x ray[if required]
CSF analysis[if required]
Bone Marrow Aspiration[if required]
Bone Marrow Biopsy[if required]
The results were analysed by calculating percentages, the mean values, standard deviation, standard error, unpaired 't' test, Chi-square 't' test, ANOVA and proportion test.
Proportions were compared using Chi-square test of significance. A 'p' value of less than 0.05 was considered statistically significant

III. Results

Table-1: Age and Sex Distribution of Study Population

Age (in years)	Males (n=74)		Females (n=26)		Total (n=100)	
	Number	%	Number	%	Number	%
≤20	0	0	03	11.5	03	03%
21-30	08	10.8	03	11.5	11	11%
31-40	30	40.5	14	53.8	44	44%
41-50	17	23.0	05	19.2	22	22%
51-60	15	20.3	01	03.8	16	16%
≥ 61	4	05.4	00	00	4	4%

In the present study 74% of patients were males and 26% were females. The patient's age in the study ranges from 18 years to 70 years with a mean age of 40.94±10.91 years. 77% of the patients fell in the age group between 21 to 50 years with 44% between 31 to 40 years. There was statistically significant association between particular age(21-50) group and sex (p=0.023).Hence explains the high prevalence of hiv in reproductive age group

Table-2: Sex Distribution of Anaemia

Hb (in grams/dl)	Males (n=74)		Females (n=26)		Total (n=100)	
	Number	%	Number	%	Number	%
<7	12	16.2	07	26.9	19	19%
≥7<10	30	40.5	09	34.6	39	39%
≥10<13 (M) **≥10<12 (F)**	24	33.7	04	15.3	28	28%
≥13(M) **≥12(F)**	08	09.4	06	23	14	14%

Anemia was considered in three categories with haemoglobin (in grams/dl) <7, 7-10 and 10-12(females), 10-13(males) as severe, moderate and mild anemia respectively. Anemia was seen in 86% of patients in the present study. The mean haemoglobin was 9.44±2.85g/dl, with range from 2.2 g/dl to 15.5 g/dl. The mean haemoglobin in males was 9.43 g/dl and in females was 9.37g/dl. There was no satistically significant association of anemia with particular sex(p value=0.139)

Figure-7

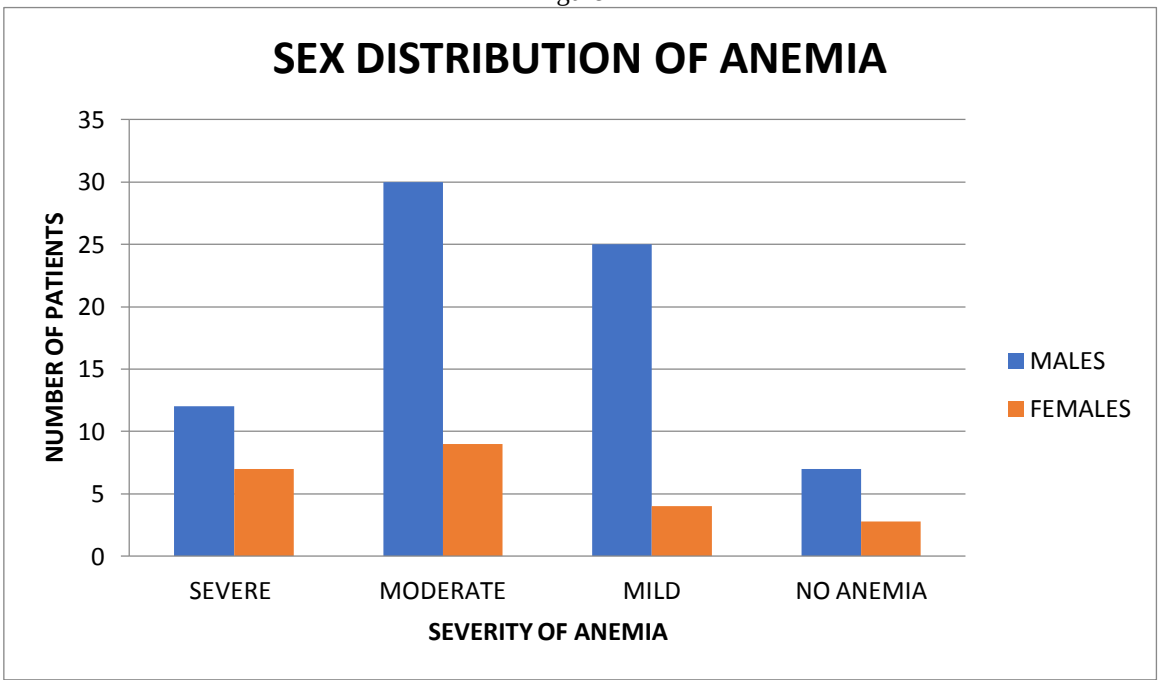

Table-5: Sex distribution of total leukocyte count

TLC in cells/µl.	Males (n=74)		Females (n=26)		Total (n=100)	
	Number	%	Number	%	Number	%
≤4000	26	35.1	06	23.1	32	32
>4000-≤11000	42	56.75	15	57.6	57	57
>11000	06	08.1	05	19.2	11	11

In the present study the mean leukocyte count was 6500±4058.83 cells/µl. Leukopenia (TLC≤ 4000cells/ µl) was seen in 32% of patients and leucocytosis (TLC>11000cells/ µl) in 11%. The mean total leukocyte count in males is 6500 cells/µl and in females was 6345 cells/µl. There was no statistically significant association between leukopenia and particular sex (p=0.253).

Table-: Sex distribution of neutropenia

Absolute neutrophil count (in cells/µl)	Males (n= 74)		Females (n=26)		Total (n=100)	
	Number	%	Number	%	Number	%
<1500	8	10.82	4	15.38	12	12
>1500	66	89.18	22	84.62	88	88

Patients with absolute neutrophil count (taken as percentage of total leukocyte count) less than 1500 were considered to have neutropenia. The absolute neutrophil count ranges from 380cells/µl to 17100cells/µl with a mean of 4631.73±3360.78 cells/µl. The mean absolute neutrophil count in males was 4631.73 cells/µl and in females was 4510.07 cells/µl. Neutropenia was seen in 12 patients with no statistically significant association to particular sex (p=0.537). Similarly there was no statistically significant association between particular age group and neutropenia (p=0.537).

Table-8: Sex distribution of Lymphopenia

Absolute lymphocyte count (in cells/µl)	Males (n=74)		Females (n=26)		Total (n=100)	
	Number	%	Number	%	Number	%
<800	16	21.62	4	15.38	20	20
>800	58	78.38	22	84.62	80	80

Absolute lymphocyte count (taken as percentage of total leukocyte count) less than 800 cells/µl was considered to have lymphopenia. The mean absolute lymphocyte count was **1616.66±1046.63** cells/µl ranging from **128-5661**cells/µl. The mean lymphocyte count in males was 1616.66 cells/µl and in females was 1586.39 cells/µl. Lymphopenia was present in 20% of cases with no statistically significant association to particular sex (p=0.48). Similarly there was no statistically significant association between particular age group and lymphopenia (p=0.494).

Table-9: Sex distribution of platelet count

Platelet count in lakh/µl	Males (n=74)		Females (n=26)		Total (n=100)	
	Number	%	Number	%	Number	%
<1.5	20	27.1	06	23.1	26	26%
1.5-4	52	70.3	20	76.9	72	72%
>4	02	02.6	0	0	02	02%

Thrombocytopenia (platelet count less than 1.5 lakh/µl) was seen in 26 patients. The mean platelet count was **:** 2.07± 0.98 lakhs/µl. The mean platelet count in males was 2.07 lakh/µl and in females was 2.03 lakh/µl. There was no statistically significant association of thrombocytopenia with particular sex (p=0. 626).

Table-11: Sex distribution of type of anemia

Type of anaemia	Males (n=74)		Females (n=26)		Total (n=100)	
	Number	%	Number	%	Number	%
NHA	13	17.56	8	30.76	21	21
NNA	16	21.62	2	7.69	18	18
MHA	27	36.48	8	30.76	35	35
MaHA	3	4.05	1	3.84	4	4
DA	2	2.70	2	7.69	4	4
NNP	13	17.56	5	19.23	18	18

The commonest type of anemia in present study was microcytic hypochromic anemia (35%). The commonest type of anemia was microcytic hypochromic anemia in males (36.48%) and in females (30.76%). There was no statistically significant association between type of anemia and particular sex .

Table-13: Sex Distribution of CD4 count

CD4 count (in cells/µl)	Males (n=74)		Females (n=26)		Total (n=100)	
	Number	%	Number	%	Number	%
≥200	30	40.5	9	34.6	39	39
<200	44	59.5	17	65.4	61	61

Patients were considered in two groups with CD4 count less than 200 cells/µl and more than 200 cells/µl. 39 and 61 patients had CD4 count less than and more than 200 cells/µl respectively. Mean CD4 count in males is 210.38 cells/µl and in females is 211.46 cells/µl. There was no significant association of CD4 count to particular sex (p=0.594).

Table-15: Haematological Manifestations In Relation To Clinical Status*

Parameter	Non AIDS (n=13) Mean±SD	CDC Defined AIDS (n=87) Mean±SD	P value*
Age (in years)	41.31±5.55	40.88±11.52	0.58
Hb (gm/dl)	11.16±3.14	09.18±2.7	**0.009***
Total count	7084.61±3141.61	6412.64±4186.62	0.266
Platelet count	2.41±0.80	2.01±1.01	0.184
Absolute neutrophil count(ANC)	4950.00±2528.20	4584.17±3477.47	0.282
Absolute lymphocyte count(ALC)	1848.62±940.97	1582.00±1062.13	0.247
CD4 count	331.38±299.99	187.93±146.539	0.059

***Mann-Whitney U test**

Haematological manifestations were compared in patients without AIDS and in patients with CDC defined AIDS. There was statistically significant reduction in haemoglobin levels (p<0.009), with the presence of AIDS. There was no statistically significant difference with respect to age, platelet count , total leukocyte count, absolute lymphocyte count, absolute neutrophil count and CD4 count

Haematological Manifestations In Relation To Immune Status

Table-16: Anaemia in relation to CD4 count

Hb (in gms/dl)	CD4 >200 (n=39)		CD4 <200 (n=61)		Total (n=100)	
	Number	%	Number	%	Number	%
<7	01	02.6	18	29.5	19	19%
≥7<10	14	35.9	25	41.0	39	39%
≥10<13 (M) ≥10<12 (F)	17	43.6	12	18.0	29	29%
≥13(M) ≥12(F)	07	17.9	06	11.5	13	13%

When haemoglobin was analysed in relation to CD4 count, only 1 patients (2.6%) with CD4 count >200 had severe anemia compared to 18 patients (29.1%) with CD4<200. The mean haemoglobin in patients with CD4 count more than 200 was 9.40±2.84 g/dl and in those with CD4 count less than 200 was 9.41±2.85 g/dl. There was statistically significant association of anemia (p=0.001) and haemoglobin concentration (p=0.0005) with decline in CD4 count.

TLC Cells/µl	CD4 >200 (n= 39)		CD4 <200 (n=61)		Total (n=100)	
	Number	%	Number	%	Number	%
≤4000	03	7.7	29	47.5	32	32%
>4000-≤11000	30	76.9	27	44.3	57	57%
>11000	06	15.4	05	8.2	11	11%

In the present study 29 patients with CD4 count less than 200 had leukopenia whereas only 3 patients with CD4 count more than 200 had leukopenia. The mean total leukocyte count in patients with CD4 count more than and less than 200 was 6550± 4108.5 cells/µl and 6519.2 ±4074.93 cells/µl respectively. There was statistically significant association of decrease in total leukocyte count ($p<0.001$) with decline in CD4 count.

Table-19: Lymphopenia In Relation To CD4 Count

Absolute lymphocyte count (in cells/µl)	CD4 >200 (n= 39)		CD4 <200 (n= 61)		Total (n=100)	
	Number	%	Number	%	Number	%
<800	5	12.82	15	24.59	20	20
>800	34	89.47	46	74.19	80	80

In this study, 15 of 20 patients with lymphopenia had CD4 count less than 200. The mean absolute lymphocyte count in patients with CD4 count more than 200 was 1621 ± 1064.9 cells/µl and less than 200 was 1618 ± 1051.9 cells/µl. There was no statistically significant association of CD4 count with lymphopenia .($p>0.05$)

Table-21: Type of Anemia In Relation To CD4 Count

Type of anemia	CD4 >200 (n=39)		CD4 <200 (n=61)		Total (n= 100)	
	Number	%	Number	%	Number	%
NHA	7	17.9	14	22.9	21	21
NNA	11	28.94	7	11.29	18	18
MHA	10	26.31	25	40.32	35	35
MaHA	-	-	4	6.45	4	4
DA	-	-	4	6.45	4	4
NNP	11	28.94	7	11.29	18	18

P=

The commonest type of anemia in patients with CD4 count more than 200 was normocytic normochromic anemia/picture (28.94%) and in patients less with CD4 count less than 200 was microcytic hypochromic anemia (40.32%). There was increased possibility of microcytic hypochromic anemia with decrease in CD4 count ($p=0.029$), which was statistically significant.

Figure 24

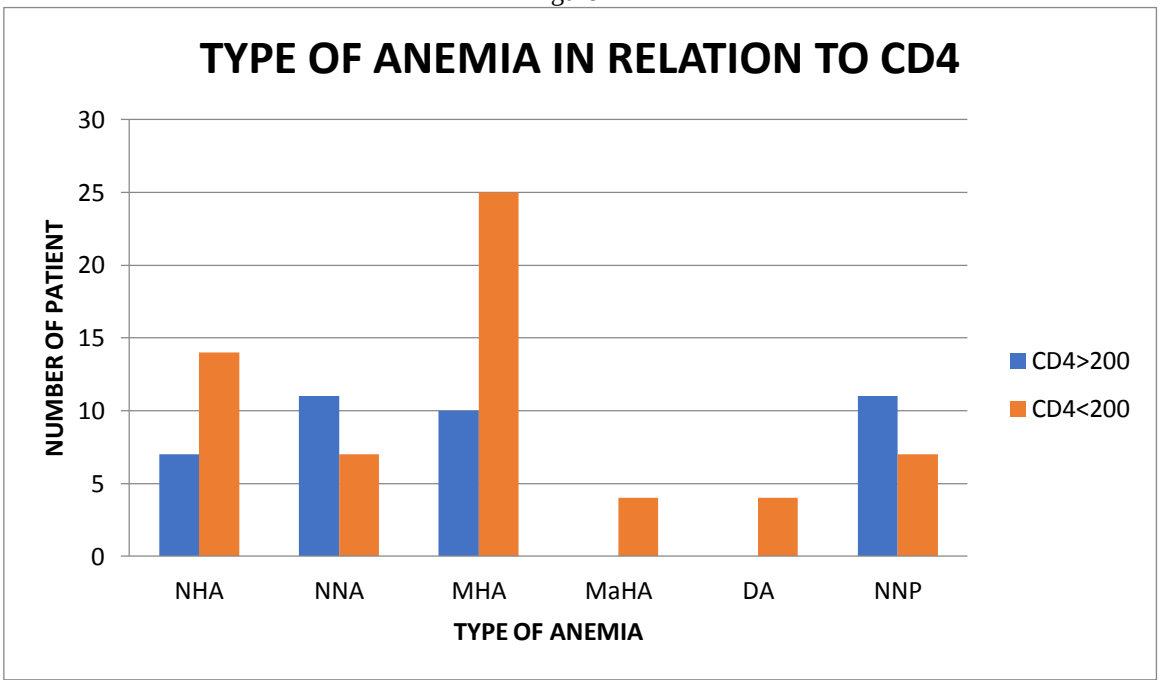

Table-22: Age and Sex Distribution of Bone marrow examination

Age group in yrs	Hypercellular(3)		Hypocellular(5)		Normocellular (2)		Total (10)
	Males	Females	Males	Females	Males	Females	
≤20	-	1	-	-	-	-	1
21-30	-	-	1	-	-	-	1
31-40	-	1	-	-	1	1	3
41-50	1	-	1	-	-	-	2
51-60	-	-	3	-	-	-	3
≥61	-	-	-	-	-	-	-

Bone marrow examination was done in 10 patients. Of which Pancytopenia was present in 9 patients in the present study. Patients with underwent bone marrow examination using trephine biopsy needle. 3 patients had hypercellular marrow, 5 had hypocellular marrow and 2 had normocellular marrow. One patient had ALL-L3 and one patient with non-hodgkins disease had tumour cell infiltrates. All patients with pancytopenia had CD4 count less than 200.

Haematological Manifestations In Relation To CD4 Count

In brief haemoglobin, total leukocyte count, and type of anemia has statistically significant association with reduction in CD4 count ($p<0.05$); whereas there was no statistically significant association for age, sex, neutrophil count, lymphocyte count and platelet count with reduction in CD4 count ($p>0.05$).

Table-23: **Haematological Manifestations In Relation To CD4 Count**

Parameter	CD4>200 (n=39)	CD4<200 (n= 61)	Total (n=100)
Anemia	32	55	87
Leukopenia	03	29	32
Thrombocytopenia	11	15	26

Neutropenia	0	12	12
Lymphopenia	5	15	20
Type of anemia	NNA NNBP(29%)	MHA(40.3%)	MHA(35%)

gure 25

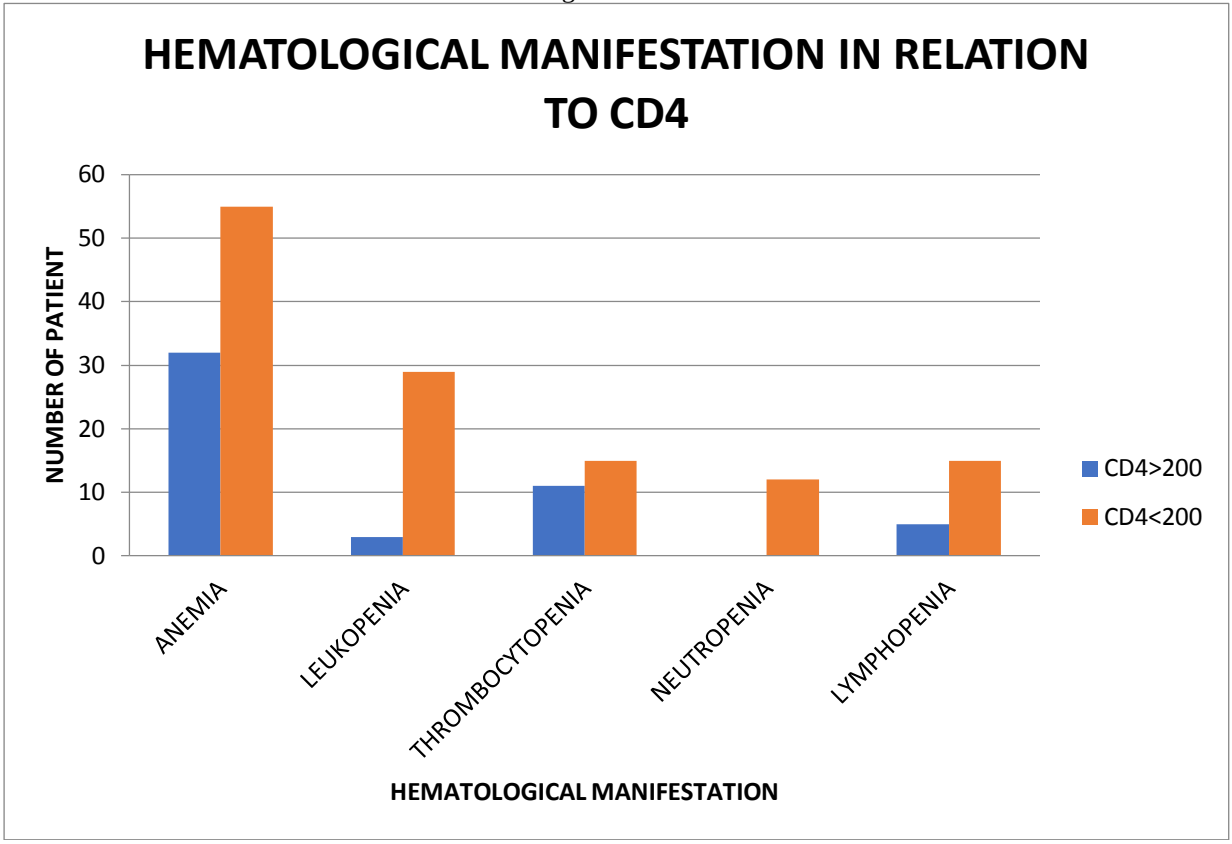

TABLE-24 SEVERITY OF ANEMIA IN RELATION TO CLINICAL STATUS

Anaemia	AIDS(87)	Non-AIDS(13)
Mild	**23**	**6**
Moderate	**38**	**1**
Severe	**17**	**2**
No Anaemia	**9**	**4**

In the present study 87 patients were classified as having AIDS,where as 13 patients as Non-AIDS(according to WHO clinical staging).78 patients with AIDS had anemia,of which 17 patients had severe anemia & 38 patients had moderate anemia.There is statistically significant relation between anemia and stage of HIV disease.(p=0.018)

SEVERITY OF ANEMIA IN RELATION TO CLINICAL STATUS

Figure 26

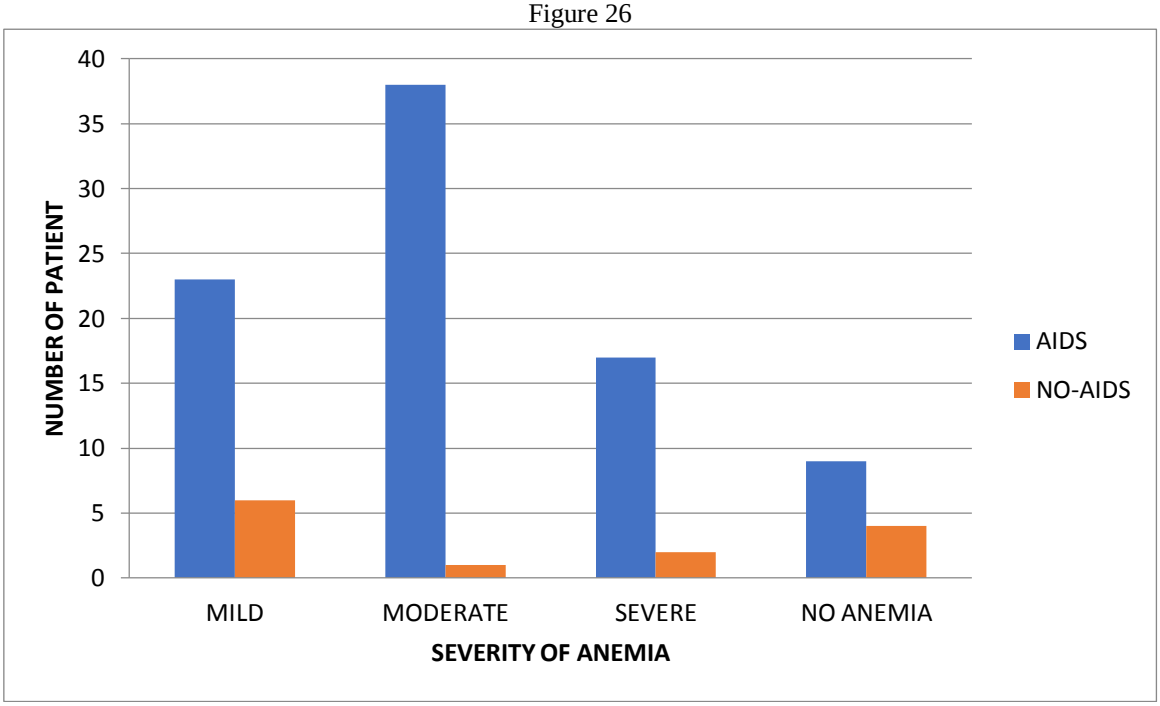

TABLE-25 SEVERITY OF ANEMIA IN RELATION TREATMENT AND IMUNNE STATUS

In the present study 87 patients were on ART,and 13 patients were ART NAIVE.55/87 patients on ART had CD4<200 ,of which 17 patients had severe anemia and 24 patients had moderate anemia.To know the relation of anemia with ART patients with pretreatment Hb should be compared with Hb after initiation of ART,which is a limitation of this study.

Anaemia	ART(87)		ART NAIVE (13)	
	CD4>200	CD4<200	CD4>200	CD4<200
<7	1	17	0	1
≥7-10	12	24	2	1
≥10-13(M) ≥10-12(F)	14	8	3	3
≥13(M) ≥12(F)	5	6	2	1

DISCUSSION

Age and Sex Distribution

Table-26

Sex distribution of patients in various studies

Sex	S k agarwal et al N=80	Byomakesh et al n=200	Thripati et al n=54	Manisha et al n=416	Adediran et al n=49	Present study n=100
Males	87.5%	67.5%	79.72%	83.2%	65%	74%
Females	14.2%	32.5%	21.28%	16.8%	35%	26%

The results from data analysis shows predominance of males constituting 74% of the study population (n=764of 100). Report from Adediran et al[129] showed a similar sex distribution.

The patients age in the present study ranges from 18 to 70 years. . 93% of the patients fell in the age group between 21 to 60 years with 44% between 31 to 40 years.Age distribution shows those with sexually active part of life as well as highly productive age group were more affected. Though compared to female age distribution (mean=41.09 years), males were younger (mean=40.9 years); There was statistically significance association of particular age(21-50) group and sex distribution (p=0.023).

Signs and symptoms

Among the signs, pallor was the most common sign present in 67% of the patients followed by emaciation present in 58% & oral thrush present in 29%. The increased prevalence of these signs in the present study could possibly be due to severity of the illness as majority of them belonged to CDC defined AIDS category (n=87).

HAEMATOLOGICAL MANIFESTATIONS

Anemia was the most common haematological manifestation seen in the present study which is in accordance with other previous studies. The multifactorial origin of anemia in HIV disease complicates its differential diagnosis and treatment.

Anemia

Table-27

Percentage of anemia in various studies

Study	Debarshi Saha et al		Omoregie et al		Erhabor et al		Manisha et al		Byomakesh et al		Present study	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
% anemia	150	66.7	217	60.6	100	80	416	90.8	200	65.5	100	86%

The WHO definition was considered for anemia, with male patients of haemoglobin less than 13gm% and female patients less than 12% were taken to have anemia. The prevalence of anemia in the present study was 86%, with 19% of patients having severe anemia (Hb<7gm %). This is in accordance with some previous studies like Erhabor et al.[130]

This study showed reduction of haemoglobin with reduction in CD4 count (p=0.001) and presence of CDC defined AIDS (p=0.018); which was statistically significant. This is in accordance with previous studies like Attili SVS et al.[12] Amongst them 17 patients with severe anemia belonged to CDC defined AIDS category.

Total Leucocyte Count

Table-28

Percentage of total leucocyte count in various studies

Study	Yinzhong Shen et al		Lauren L et al		Zon LI et al		Erhabor et al		Present study	
	No.	%	No.	%	No.	%	No.	%	No.	%
% leukopenia	1,948	33.2%	516	43.4%	106	65%	100	10%	100	32%

In the present study 32% of patients were having leukopenia which is in par with previous studies like Yinzhong Shen et al [131]. Of the 32 cases, 29 patients had CD4 count less than 200cells/mm^3. There was no statistical significance in leucocyte count with particular age group (p>0.05) and particular sex (p=0.253).

There was decrease in total leukocyte count with worsening immune status (reduction in cd4 count), which is statistically significant (p<0.0001). This is in accordance with other studies like Zon LI et al. Similarly there was reduction in total leukocyte count in patients with CDC defined AIDS compared to patients without AIDS.

Granulocytopenia

Table-29
Percentage of neutropenia in various studies

Study	Debarshi Saha et al		Erhabor O et al		Kaslow RA et al		Lauren L et al		Attili SVS et al		Present study	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
% of neutropenia	150	5.3	100	24	1611	13.4	516	27.5	470	22.7	100	12

Patients with absolute neutrophil count (taken as percentage of total leukocyte count) less than 1500 were considered to have neutropenia. Neutropenia was seen in 12% of cases. This is in accordance with previous studies like Kaslow RA et al. There was no statistical significant association of neutrophil count with particular age group (p=0.537) and particular sex (p=0.537).
All the patients with neutropenia had CD4 count less than 200 cells/mm^3. There was no statistically significant association of reduction in neutrophil count with worsening immune status (reduction in CD4 count) (p>0.05).

Lymphopenia

Table-30
Percentage of lymphopenia in various studies

Study	Debarshi Saha et al		Lauren L et al		Owiredu WK et al		Adediran IA et al		Present study	
	No.	%	No.	%	No.	%	No.	%	No.	%
% of lymphopenia	150	6.6	516	20.7%	442	12.4%	49	64.4%	100	20%

Patients with absolute lymphocyte count (taken as percentage of total leukocyte count) less than 800 were considered to have lymphopenia. Lymphopenia was seen in 20 % of cases. This is in accordance with previous studies like Owiredu WK et al[132] and Lauren L et al. There was no statistical significance in leucocyte count with particular age group (p=0.48) and particular sex (p=0.494).
15 of 20 patients with lymphopenia had CD4 count less than 200. There was no statistically significant association of CD4 count with lymphopenia .(p>0.05)

Platelet Count

Table-31
Percentage of thrombocytopenia in various studies

Study	Yinzhong Shen et al		Murphy MF et al		Galli M et al		Lauren L et al		Present study	
	No.	%	No.	%	No.	%	No.	%	No.	%
% of thrombocytopenia	1948	15.6	105	30	1533	11.2	516	15.5	100	26

In this study thrombocytopenia was seen in 26% of cases. This is in accordance with other studies like Lauren L et al. There was no statistical significance in platelet count with particular age group (p=0.106) and particular sex (p=0.626).
There was no statistically significant difference of prevalence of thrombocytopenia in relation to CD4 count (p=0.782). This is in accordance with previous studies.[12,13] Galli M et al reported thrombocytopenia (which often arises in the early phases of infection) is not related to disease progression.

Type of Anemia

The commonest type of anemia in the present study was microcytic hypochromic anemia (35%). Anemia of chronic disease (including normocytic hypochromic anemia and normocytic normochromic anemia) accounted for 39% followed by microcytic hypochromic anemia accounting for 35%. 4 patients had macrocytic

anemia and 4 patients had dimorphic anemia. Pancytopenia was present in 9 patients; all had CD4 count less than 200.

These results were in accordance with earlier studies by Byomakesh D et al; reported prevalence of anemia of chronic disease, microcytic hypochromic anemia and pancytopenia as 50.8%, 49.2% and 6% respectively.

There was increased possibility of microcytic hypochromic anemia with decrease in CD4 count (p=0.029), which was statistically significant.

Bone marrow cellularity

Bone marrow examination was done in 10 cases (10%) which is in par with studies like Byomakesh D et al (7%). 3 patients had hypercellular marrow, 5 hypocellular marrow and 2 patients normocellular marrow. One patient had ALL-L3 and one patient with non-Hodgkin's lymphoma had bone marrow infiltrates.

IV. Conclusion

In the present study, out of 100 patients, the commonest haematological manifestations found were anemia, leukopenia and thrombocytopenia.

The frequency and severity of anemia & leukopenia increased with decline in CD4 count and has got significant impact on clinical outcomes and quality of life.

Thrombocytopenia,lymphopenia & neutropenia occured independent of decline in CD4 count and clinical status.

Hence all HIV patients should be investigated for haematological abnormalities and treated accordingly to reduce morbidity and mortality.

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