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ORIGINAL ARTICLE

BASELINE HAEMATOLOGICAL EVALUATION IN INDIVIDUALS PRIOR TO INITIATING ANTIRETROVIRAL THERAPY FOR HIV

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Abstract:

Background: *Human immunodeficiency virus (HIV) was discovered in 1983, while acquired immunodeficiency syndrome (AIDS) was first detected in 1981. Since then, it continues to be a public health problem. The phenomenon of HIV/AIDS is best viewed as a pandemic affecting almost all countries of the world. The first case of HIV/AIDS in Bangladesh was documented in 1989.This study was conducted to evaluate the baseline haematological characteristics in individuals prior to initiating antiretroviral therapy for HIV.* ***Methods:*** *This study was a cross sectional analytical study conducted among one hundred and fifty-four HIV positive patients attending at ART center, Bangabandhu Sheikh Mujib Medical University. Patients were included as per inclusion and exclusion criteria from April 2019 to October 2022. Co-morbid conditions were excluded mostly by self-reporting and clinically relevant investigations.* ***Results:*** *The study revealed that HIV infected patients were predominantly middle-aged and young comprising > 70% of the patients with the mean age of the patients being 35.5 ± 9.5 years (range: 20-60 years). A male preponderance was observed in the study with a male-to-female ratio being 3:1. The majority (92.2%) of patients received first-line ART. The red cell indices like Hct, MCV, MCH, and MCHC were also low at the initiation of therapy but changed to normality after treatment.* ***Conclusion:*** *From the findings of the study, it can be concluded that HIV infected individuals are predominantly male, middle-aged, and young. The most common haematological abnormality is anaemia which is significantly reduced in percentage after a mean treatment period of nine and a half months with ART.*

Key words: *Haematological changes, Antiretroviral therapy, ART regimens, HIV, Immune system response.*

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Introduction:

Human immunodeficiency virus (HIV) was discovered in 1983, while acquired immunodeficiency syndrome (AIDS) was first detected in 1981. Since then, it continues to be a public health problem [1,2]. The phenomenon of HIV/AIDS is best viewed as a pandemic affecting almost all countries of the world [3]. The first case of HIV/AIDS in Bangladesh was documented in 1989 [4,5].The total population of individuals living with HIV (PLHIV) in Bangladesh is 14,000 across all age groups. Among them, fewer than 500 are in the 0-14 age range, while 4,800 are women aged 15 and above and 8,700 are men aged 15 and above. HIV incidence per 1000 population is 0.01 and HIV prevalence (15-49 years) is <0.1[6].There were total 580 (all ages) AIDS related death in 2018[6].HIV can spread through the exchange of a range of body fluids, including blood, breast milk, sperm, and vaginal secretions, from infected people. During pregnancy and delivery, HIV can be passed from a mother to her child [7]. HIV is an enveloped virus that predominantly affects the immune system by targeting T-lymphocytes. It replicates by exploiting the deoxyribonucleic acid of CD4+ T cells, decreasing their numbers and putting the patient at risk of opportunistic infections over months to years, finally leading to death [8,9]. HIV is classified into HIV-1 and HIV-2 with HIV-1 being the predominant cause of AIDS worldwide [10,11,12,13]. When HIV enters the body, it spreads quickly to cells and tissues, insidiously destroying the lymph node's architecture and prompting the immune system to soar a defense against it via CD4+ and CD8+ T cells, which are then killed by the virus, allowing free HIV replication and eventually full-blown AIDS. The World Health Organization (WHO) has classified AIDS into four stages based on symptoms, clinical signs, and opportunistic infections, starting with Stage I, which is asymptomatic, then Stage II, which is mildly symptomatic, Stage III, which is moderately symptomatic, and Stage IV, which is HIV wasting syndrome [14].Based on the stage of infection, HIV may have different symptoms. Although persons living with HIV are most infectious in the first few months following infection, many do not feel they are infected until later [15]. Peoplemay have no symptoms or an influenza-like sickness, such as fever, headache, rash, or sore throat, in the first few weeks following infection. They may develop other signs and symptoms when the virus impairs their immune system, including swollen lymph nodes, weight loss, fever, diarrhea, and cough [16,17]. They could acquire serious illnesses like tuberculosis (TB), cryptococcal meningitis, severe bacterial infections, and malignancies like lymphomas and Kaposi's sarcoma if they don't get treatment [7]. Haematological abnormalities commonly found in HIV-infected individuals are anaemia, granulocyte disorders, thrombocytopenia, lymphomas, coagulopathies, and vascular malignancies. Although these abnormalities are detected in the majority of cases in the middle or advanced stages of HIV infection, anaemia and thrombocytopenia may occur in the early stages of HIV infection [18,19,20]. The origin of haematological disorders in HIV infection remains incompletely understood but has been attributed to several factors causing dysfunctional haematopoiesis in the bonemarrow[21].

Methods:

This study was a cross sectional analytical study conducted among one hundred and fifty-four (154) HIV positive patients attending at antiretroviral-therapy centre, Bangabandhu Sheikh Mujib Medical University from April 2019 to October 2022. Patients were included by Laboratory confirmation of HIV infection through serological testing and Inability to provide informed consent for treatment excluded. Co-morbid conditions were excluded mostly by self-reporting and clinically relevant investigations. Study purpose was explained to the study subjects and informed written consent was taken. All demographic characters like age, sex, address, and education level, and occupation, marital and socio-economic status were documented in a structured form after the patient's registration. History related to risk factors and sexual patterns was asked face-to-face to the patients and documented in the datasheet. Reports were collected on a day-to-day basis and entered into Microsoft Office 2010 Excel worksheet.

Data collection

All participants signed informed written consent before entering the study. Before study enrolment, all individuals were informed of the voluntary nature of participation and confidentiality as well as the use of their data for research purposes only.

Sampling method

Purposive sampling as per inclusion and exclusion criteria was applied to collect sample.

Ethical consideration

Prior to the commencement of this study, the research protocol was approved by the Institutional Review

Board (IRB) of BSMMU, Dhaka. The purpose of the study along with its procedure, methods, risks, and benefits were explained to the patients in an easily understandable local language and then informed consent was taken from those who voluntarily agreed to participate in the study. Informed consent was obtained.

Statistical analysis

Data were processed and analyzed using the statistical software SPSS (Statistical Package for Social Sciences), version 24.0. The level of significance was set at 5% and p-value < 0.05 was considered statistically significant.

Result

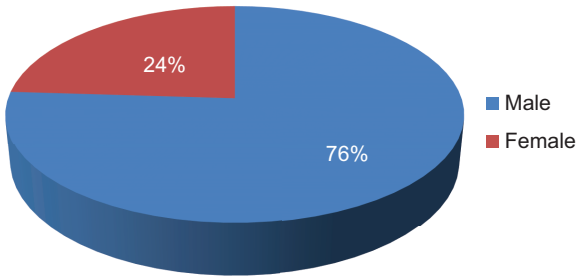

Fig.-1: *Gender distribution of our study patients (n = 154)*

Figure 1 show in terms of gender distribution, more than three-quarters 117 (76.0%) were male and 37 (24.0%) were female with male-to-female ratio being roughly 3:1.

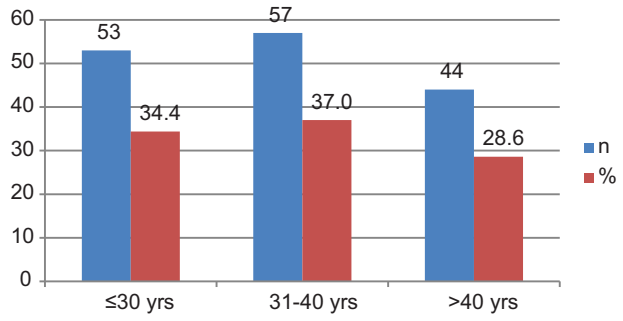

Fig.-2: *Age distribution of our study patients (n =154)*

In Figure 2 age distribution shows that more than one-third 57 (37.0%) of the HIV positive patients were 31-40 years old, 53 (34.4%) were d" 30 years old and 44 (28.6%) were > 40 years old with mean age of the patients being 35.5 ± 9.5 years (range: 20-60 years).

Table-I

Distribution of our study patients by Education (n = 154)

Education	n	%
Illiterate	04	2.6
Primary	49	31.9
Secondary	61	39.6
Higher Secondary	19	12.3
Graduate	21	13.6
Total	154	100

In Table 1 we found more than one-third 61 (39.6%) of the patients were secondary level educated, 49 (31.9%) were primary level, 19 (12.3%) higher secondary, 21 (13.6%) graduate-level educated and 4 (2.6%) patients were illiterate respectively.

Table II

Distribution of our study patients by occupation (n = 154)

Occupation	n	%
Service	42	27.3
Unemployed	37	24.0
Housewife	34	22.1
Business	22	14.3
Others	19	12.3
Total	154	100

In Table II over one-quarter 42 (27.3%) patients were service-holder, 37 (24.0%)1 unemployed, 34 (22.1%) housewife, 22 (14.3%) were businessman and 19 (12.3%) patients were connected with others occupation.

Table III

Distribution of the study patients by types of ART received during study period (n = 154)

ART	n	%
First-line	142	92.2
Second-line	12	7.8
Total	154	100

In Table III out of 154 study patients, 142 (92.2%) received first-line ART. On the other hand, second-line ART was received by 12 (7.8%) patients respectively.

Table IV

Changes in selected haematological parameters before and after ART for 7-8 months (n = 50)

Haematological parameters	Before ART	After ART	p-value
Haemoglobin (gm/dl)	12.3 ± 2.1	13.2 ± 1.5	0.0154
ESR (mm in 1sthr)	33.5 ± 17.7	14.3 ± 6.5	<0.0001
TC of WBC (/cmm)	6934 ± 2125	7530 ± 2225	0.1739
N (%)	58.5 ± 12.4	55.5 ± 12.6	0.2330
L (%)	31.2 ± 11.5	34.5 ± 10.6	0.1389
Platelet count (10^9 /L)	265 ± 83	287 ± 67	0.1479
Hct (%)	37.3 ± 6.3	41.3 ± 4.6	0.0005
MCV (fl)	84.3 ± 8.1	93.5 ± 10.0	<0.0001
MCH (pg)	27.7 ± 2.7	29.8 ± 3.7	0.0016
MCHC (gm/L)	31.8 ± 1.3	32.9 ± 1.4	0.0001

Table IV shows the changes in haematological parameters before and after 7-8 months of ART. The level of haemoglobin improved significantly from 12.3 gm/dl to 13.2 gm/dl (p = 0.0154), while ESR decreased abruptly from 33.5 ± 17.7 mm in 1st hr to 14.3 ± 9.1 mm in 1st hr at the end-point of study (p = <0.0001). Neutrophil decreased and lymphocyte increased to some extent, although the difference was statistically not significant (p = 0.2330 and p = 0.1389 respectively). The haematocrit (Hct), MCV, MCH, and MCHC changed significantly from their before ART figures to the end-point of the study (p = 0.0005, p = < 0.0001, p = 0.0016 and p = 0.0001 respectively).

Table V shows the changes in haematological parameters before and after 9-10 months of ART. The level of haemoglobin responded well (p = 0.0491) and ESR decreased appreciably from 40.0 ± 13.9 mm in 1st hr to 19.6 ± 17.2 mm in 1st hr at the end-point of the study (p < 0.0001). The total count of WBC did not show a significant response. However, neutrophil decreased insignificantly at the end-point of the study (p = 0.0279). All the red-cell indices like Hct, MCV, MCH, and MCHC improved significantly from their before ART figures to the end-point of the study (p = 0.0017, p = < 0.0001, p = < 0.0001 and p = 0.0001 respectively).

Table V

Changes in selected haematological parameters before and after ART for 9-10 months (n = 50)

Haematological parameters	Before ART	After ART	p-value
Haemoglobin (gm/dl)	12.7 ± 1.9	13.4 ± 1.7	0.0491
ESR (mm in 1sthr)	40.0 ± 13.9	19.6 ± 17.2	<0.0001
TC of WBC (/cmm)	6540 ± 2158	7190 ± 1606	0.0907
N (%)	60.6 ± 11.6	55.4 ± 11.7	0.0279
L (%)	30.6. ± 10.2	34.7 ± 10.5	0.0505
Platelet count (10^9 /L)	262 ± 69	278 ± 81	0.2903
Hct (%)	38.3 ± 5.4	41.6 ± 4.8	0.0017
MCV (fl)	84.9 ± 8.3	96.5 ± 9.3	<0.0001
MCH (pg)	28.0 ± 3.2	30.9 ± 3.5	<0.0001
MCHC (gm/L)	31.9 ± 1.6	33.1 ± 1.3	0.0001

Table VI

Changes in selected haematological parameters before and after ART for 11-12 months (n = 54)

Haematological parameters	Before ART	After ART	p-value
Haemoglobin (gm/dl)	12.8 ± 1.7	13.5 ± 1.6	0.0297
ESR (mm in 1sthr)	40.0 ± 17.1	18.0 ± 4.7	<0.0001
TC of WBC (/cmm)	6798 ± 1699	6462 ± 1040	0.2179
N (%)	58.4 ± 11.0	54.7 ± 11.5	0.0905
L (%)	32.6 ± 9.6	36.5 ± 10.2	0.0432
Platelet count (10^9 /L)	247 ± 68	302 ± 81	0.0002
Hct (%)	39.3 ± 5.0	42.3 ± 5.2	0.0028
MCV (fl)	84.6 ± 5.6	95.0 ± 12.7	<0.0001
MCH (pg)	27.8 ± 2.2	30.2 ± 4.4	0.0005
MCHC (gm/L)	31.8 ± 1.6	32.6 ± 1.5	0.0085

Table VI depicts the changes in haematological parameters before and after 11-12 months of treatment with ART. The level of haemoglobin increased significantly from 12.8 gm/dl to 13.5 gm/dl (p = 0.0297). The ESR decreased well from 40.0 ± 17.1 mm in 1st hr to 18.0 ± 4.7 mm in 1st hr at the end-point of the study (p = < 0.0001). Lymphocyte increased significantly during the same period of time (p = 0.0432). Platelet count also increased significantly (p = 0.0002). All the red-cell indices like Hct, MCV, MCH, and MCHC improved significantly from their before ART figures to the end-point of the study (p = 0.0028, p = < 0.0001, p = 0.0005 and p = 0.0085 respectively).

Discussion:

The study revealed that HIV infected patients were predominantly middle-aged (31-40 years) and young (d" 30 years old) comprising > 70% of the patients with the mean age of the patients being 35.5 ± 9.5 years (range: 20-60 years). The mean age was 34.5 ± 9.6 years among 250 HIV positive patients in a study by Parinitha and Kulkarni in India [3]. The mean age was 35.3 ± 9.5 years in another study in Bangladesh by Rahman et al. [22]. A male preponderance was evidenced in the study with the male-to-female ratio being roughly 3:1. In India, a study by Kathuria et al. [23] reported a male-to-female ratio of 1.5:1. Similar study in Bangladesh by Rahman et al. [22] reported male-to-female ratio roughly 2:1.

Majority (92.2%) of patients received first-line ART. However, 12 patients were switched to second-line ART due to virological, immunological or clinical failure. In the present study, there was significant improvement in haematological parameters (like haemglobin, ESR, neutrophil, platelet count and red cell indices) is noted after 7- 12 months of treatment with ART. There was significant change in haemoglobin level in all patients who received ART for 7-8 months, 9-10 months and 11-12 months. Although the significant level of neutrophil, lymphocyte and platelet count varies in different groups and this might be due to the different factors such as the difference in the study population, sample size, study design and anti-retroviral drug formulations. While many medications used to treat HIV-related disorders are myelosuppressive, the use of zidovudine is the most common cause of severe cytopenia[24, 25]. After initiation of ART the mean value of red cell indices (Hct, MCV, MCH and MCHC) increased significantly in overall and as well as in 7-8 months, 9-10 months and 11-12 months group, which act as evidences of step up of haemoglobin level following ART. These findings are consistent with other studies [15, 26, 27].

Although significant changes in haematological parameters are noted after 7-12 months of treatment with ART, no significant differences in changes were observed among the three different durations (7-8 months, 9-10 months, and 11-12 months) of treatment concerning these variables, indicating that duration of treatment does not have an impact on these haematological parameters. There is an impact of treatment, but not in the duration of treatment. Besides this, different ART does not have significant differences in changes in haematological parameters.

Limitations of the study:

Present study is not without limitation. The sampling method was purposive that might have led to bias.

Conclusion:

From the findings of the study, it can be concluded that HIV infected individuals are predominantly male,

middle-aged, and young. The most common haematological abnormality is anaemia which significantly reduced in percentage after a mean treatment period of nine and a half month with ART. The red cell indices like Hct, MCV, MCH, and MCHC are found low at the initiation of therapy but changed to normality with ART. The duration and types of ART do not have a significant impact on differences in changes in haematological parameters.

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