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Study of bone marrow abnormalities in patients with HIV infection-a prospective study in tertiary care center of Nalgonda district

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Abstract
Context: Bone marrow abnormalities reported in various stages of HIV infection have not attracted much attention; this is partly because the clinical picture of HIV infection is still dominated by opportunistic infections and malignancies.
Aims: 1. To study the bone marrow abnormalities in patients with HIV / AIDS and to find their association with peripheral hematological abnormalities. 2. To draw conclusions and compare with previous studies.
Settings and Design: The present Prospective study was conducted at the Department of pathology, Kamineni Institute of Medical Sciences, Narketpalli over a period of 2 years starting from January 2017 to Dec 2018.
Methods and Material: The study population included 54 newly detected HIV positive symptomatic or asymptomatic patients. Patients were classified into two clinical groups according to NACO criteria 1) AIDS and 2) Non-AIDS. Bone marrow analysis was done for HIV patients who presented with anemia, leucopenia, Thrombocytopenia and Bi-cytopenia.
Results: Patients were classified into two clinical groups: AIDS (55.5%) and NON-AIDS (44.5%). Most common age group involved was 21-40 years and Male to Female ratio is 4:1 in AIDS Group and 1.6:1 in Non-AIDS group. Most common haematological abnormality was Anaemia present in 73.3% of AIDS group and 79.1% of Non-AIDS group. Bone marrow was predominantly normocellular (AIDS: 50%, Non-AIDS: 62.5%) with normoblastic maturation. Myelodysplasia was predominantly seen in Granulocytic series (AIDS: 26.6%, Non-AIDS: 12.5%). Erythroid dysplasia was reported in 23.3% of cases of AIDS group and 8.3% in Non-AIDS group. Megakaryocytic dysplasia was seen in 2 cases of AIDS group. Myelodysplasia was common in patients with CD4 counts < 200/µL. Patients with myelodysplasia presented with anaemia (52.9%), Leukopenia (41.1%) and Thrombocytopenia (11.7%).
Conclusions: Bone marrow examination is usually performed in HIV patients to evaluate peripheral cytopenia. Myelodysplasia commonly observed in HIV patients predominantly involves Granulocytic series. Erythroid dysplasia is prominent in AIDS Patients. Myelodysplasia associated with anemia carries poor prognosis and marks progression to advanced disease. Bone marrow abnormalities evolve and increase in frequency during progression of HIV disease and thorough schematic evaluation carries prognostic significance.

Keywords: Bone marrow, myelodysplasia, Bi-cytopenia, AIDS, NACO

1. Introduction
As the Human Immunodeficiency Virus (HIV) pandemic enters its Fifth decade, the resultant Acquired Immuno-Deficiency Syndrome (AIDS) is a global health crisis with approximately 36.9 (31.1-43.9) million people affected worldwide. Estimated 940 000 [670 000−1 300 000] people dying from HIV globally in 2017 were 52% fewer than in 2004 (the peak) and 34% fewer than in 2010 in spite of a period of substantial population growth in many high burden countries [1].
In absolute numbers, India continues to stand second next to South Africa having 2.1 million with HIV infections. The estimated number of HIV infections till the year 2017 in the Telugu speaking states of Telangana and Andhra pradesh is 2.04 and 2.70 lakhs respectively and is rapidly increasing. An estimated 87.58 thousand new HIV infections occurred in 2017 out of which Telangana turned out to have the highest estimated 9,324 new cases contributing to 11 per cent of total in the country [2].

Bone marrow abnormalities are found at all stages of HIV disease, increasing in frequency as the disease progresses. Infection of marrow mesenchymal stem cells with HIV bas been incriminated as an important factor causing bone marrow defects [3]. As a result of HIV infection the marrow produces a histiocytic reaction which varies from increased number of histiocytes to a full blown hemophagocytic syndrome with severe pancytopenia [4]. Several defects in bone marrow progenitor cells have also been described. Reduced colony growth factor has been demonstrated for granulocyte macrophage progenitor cells, multipotential hematopoietic progenitor cells, and megakaryocytic progenitor cells as well as early erythroid progenitor cells in most patients with AIDS [4].

Although, erythroid dysplasia has been reported to be the most common, abnormal granulocytic and megakaryocytic developments are encountered in approximately one-third patients [5]. Few studies have shown dysgranulopoiesis to be more frequent and more accentuated than other kinds of dyshematopoiesis [6]. Intense vacuolization, especially in the granulocytic series is frequent. Dys-erythropoiesis may manifest as florid megaloblastic change. This was found unrelated to serum cobalamin and folate levels or to drug therapy with zidovudine or folate antagonists, although these drugs may accentuate it. Granulocytic dysplasia may be apparent at all stages of maturation, with megaloblastic change, nuclear abnormalities and pelger cells reflecting dysfunctional nuclear maturation [7]. Erythroblasts are often bi or multinucleated with an irregular nuclear outline and basophilic stippling. Abnormal sideroblasts including ring forms may be present. Dysplastic features in megakaryocytes are common, occurring in one third of marrows and include nuclear hypo-lobulation and micro-megakaryocytes and intense vacuolization [7].

Plasmacytosis has also been reported to occur in HIV infection [8]. Granulomas are infrequent findings in the bone marrow biopsies and may be associated with a broad spectrum of infectious and non-infectious disorders.

The ever-increasing prevalence of HIV infection world-wide coupled with improved management of opportunistic infections means that patients will live long enough to present with end organ manifestations of the HIV. We are beginning to learn various clinical manifestations and abnormalities in patients with HIV infection in India. There is a possibility that the manifestations in the Indian patients may not be the same as reported from other countries.

Bone marrow abnormalities of HIV infection have not attracted much attention; this is partly because the clinical picture of HIV infection is still dominated by opportunistic infections and malignancies. Hence, it is imperative to methodically observe and follow clinical and laboratory aberrations in such patients in order to improve our diagnostic and therapeutic skills pertinent to HIV/AIDS. Here we aimed at studying the bone marrow abnormalities in patients with HIV infection and to investigate their association with peripheral blood abnormalities. The findings of this study are all too relevant today with the increasing prevalence of HIV and the hope of greater access to antiretroviral medications.

2. Aim of the study

1. To study the bone marrow abnormalities in patients with HIV / AIDS and to find their association with peripheral hematological abnormalities.
2. To draw conclusions and compare with previous studies.

3. Materials and methods

This was a Prospective study done at the Department of Pathology, Kamineni institute of medical sciences, Narketpalli over a period of 2 years starting from January 2017 to Dec 2018. Prior informed consent was taken from all the patients and the study was approved by Institutional review board of kamineni Institute of medical sciences, Narketpalli. The study population included 54 newly detected HIV +ve symptomatic or asymptomatic patients. HIV was diagnosed by ELISA method as per NACO guidelines.

3.1 Inclusion criteria: HIV positive patients who had

- Anemia
- Leucopenia
- Thrombocytopenia
- Bi-cytopenia

3.2 Exclusion criteria: Patients who had

- Chronic liver disease
- Renal disease other than explained HIV
- Primary hematological abnormalities

Detailed history was taken which mainly included age, sex, place of residence, occupation, history of blood or blood product transfusions, high risk behavior, fever, weight loss, diarrhea, oral or genital ulcerations, bleeding diathesis or history suggestive of systemic involvement. All patients were subjected to thorough physical examination both systemic and general. Patients were classified into two clinical groups according to NACO criteria 1) AIDS and 2) Non-AIDS.

3.3 Investigations: Bone marrow examinations was performed for the above-mentioned indications. Posterior superior iliac spine was chosen as the site for bone marrow aspiration and biopsy because of large marrow space and as it is the least painful site. In obese and old patients' sternum was used for bone marrow aspiration. Smears were prepared, air dried and were stained with Leishman's stain. Bone marrow sample was examined for cellularity, morphology including dysplastic changes, fibrosis, granuloma formations.

Other investigations done were: Hemoglobin, Total leucocyte count, Differential leucocyte count, Platelet count, reticulocyte count, total RBC count, Serum Iron, Serum Ferritin, Serum Vitamin B 12 and folate.

CD4 and CD8 lymphocyte counts were measured using Flow cytometry. Other relevant investigations where necessary were done in individual patient.

4. Observations/results

4.1 microscopy

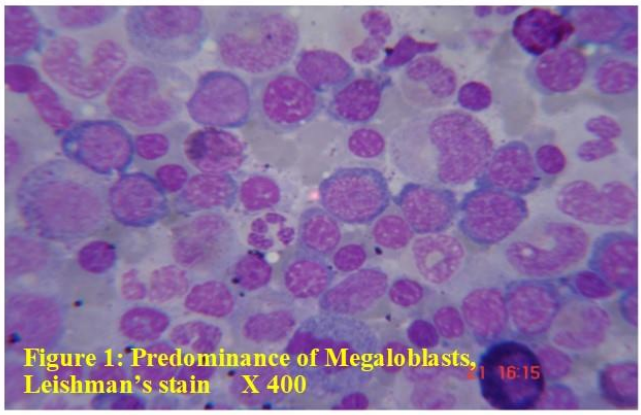


Figure 1: Predominance of Megaloblasts, Leishman's stain X 400

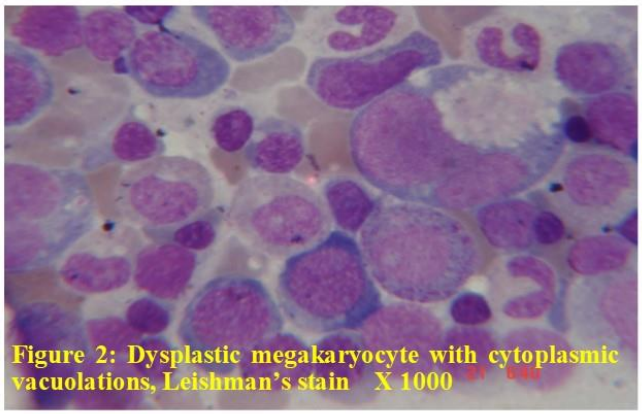


Figure 2: Dysplastic megakaryocyte with cytoplasmic vacuolations, Leishman's stain X 1000

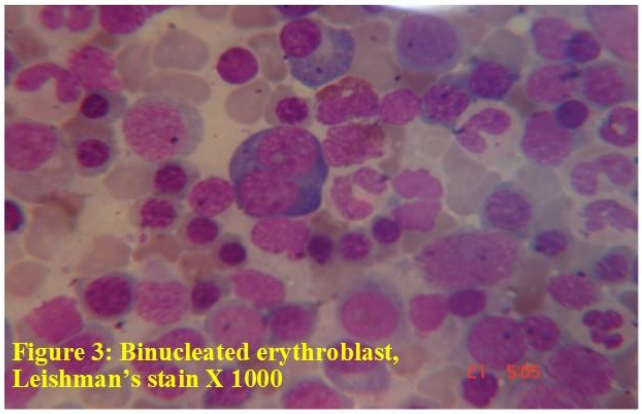


Figure 3: Binucleated erythroblast, Leishman's stain X 1000

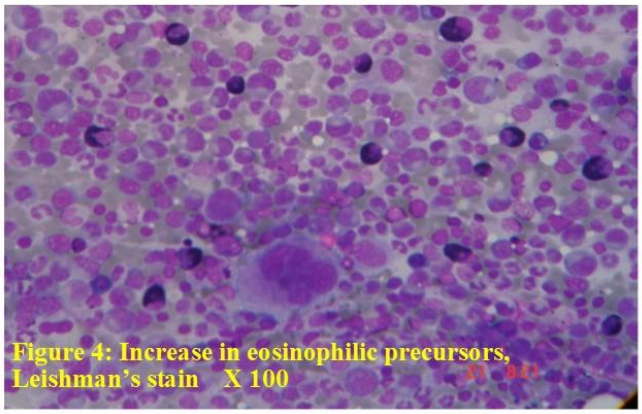


Figure 4: Increase in eosinophilic precursors, Leishman's stain X 100

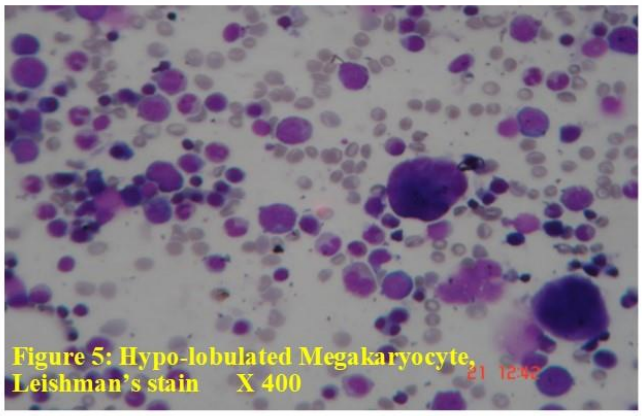


Figure 5: Hypo-lobulated Megakaryocyte, Leishman's stain X 400

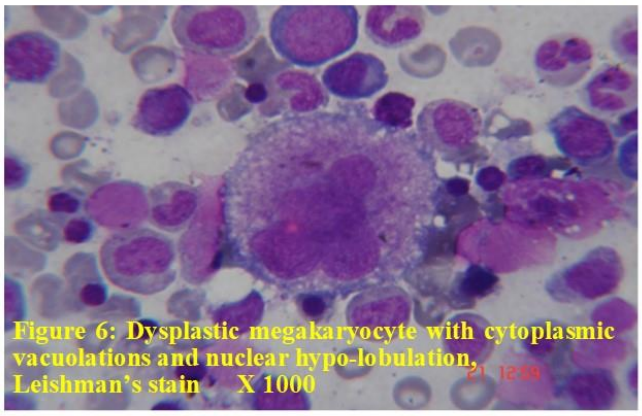


Figure 6: Dysplastic megakaryocyte with cytoplasmic vacuolations and nuclear hypo-lobulation, Leishman's stain X 1000

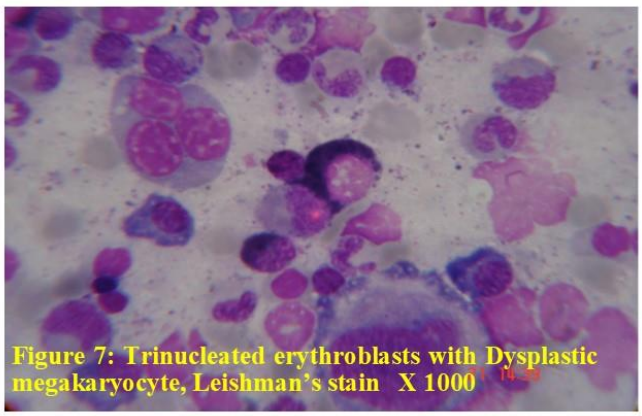


Figure 7: Trinucleated erythroblasts with Dysplastic megakaryocyte, Leishman's stain X 1000

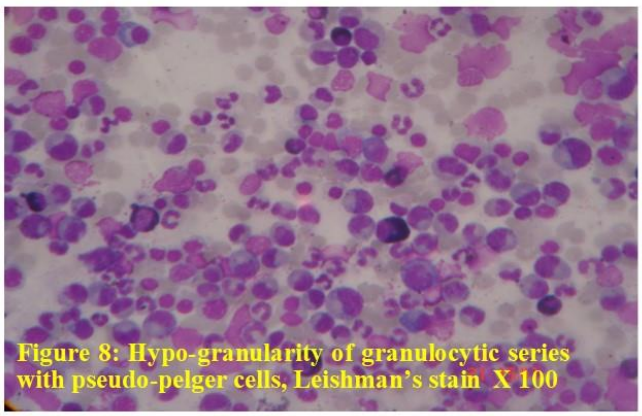
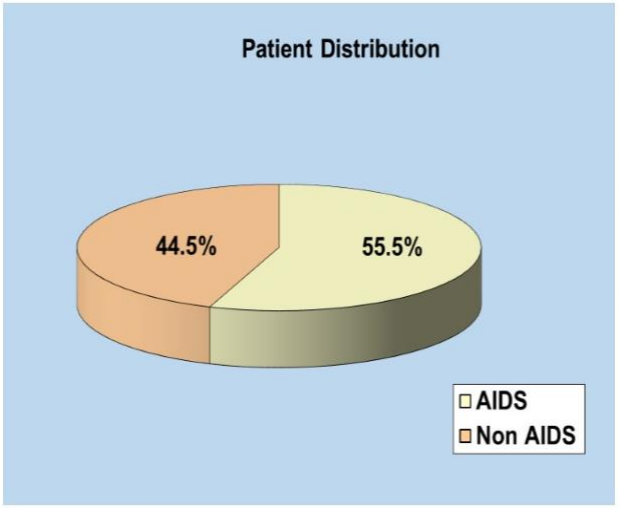
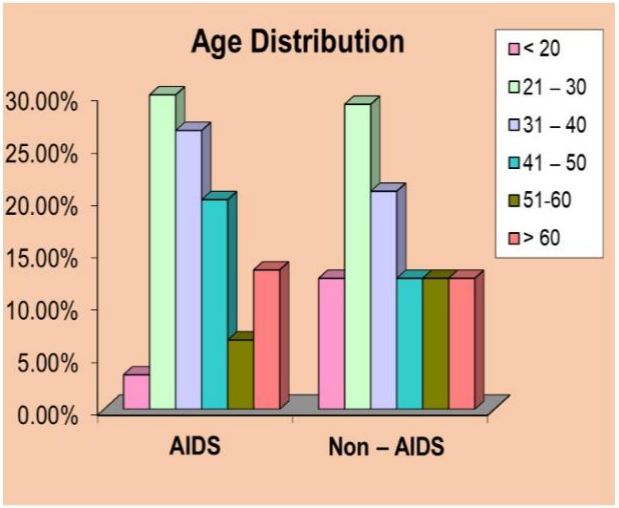
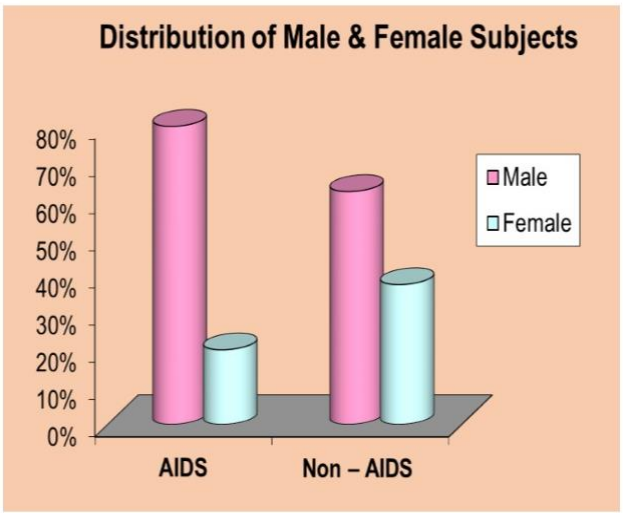


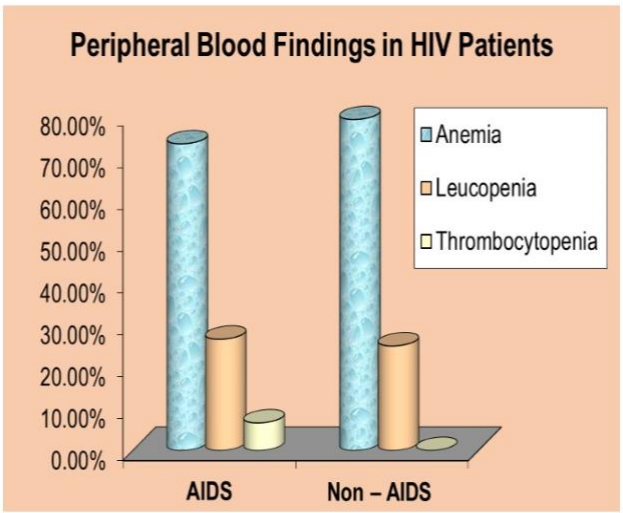
Figure 8: Hypo-granularity of granulocytic series with pseudo-pelger cells, Leishman's stain X 100

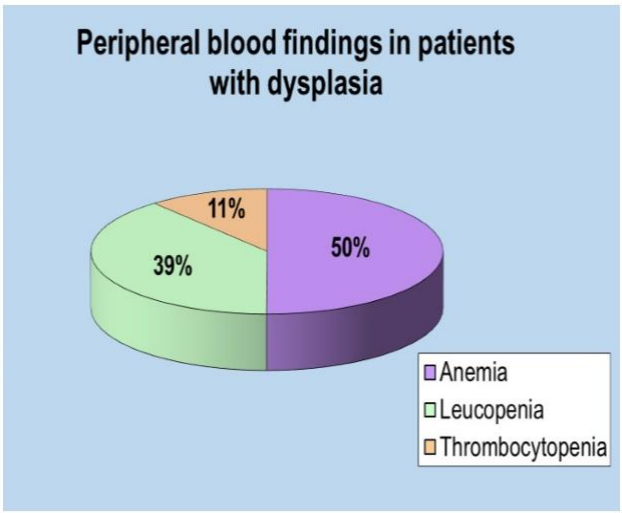
4.2 Graphical representation of statistics

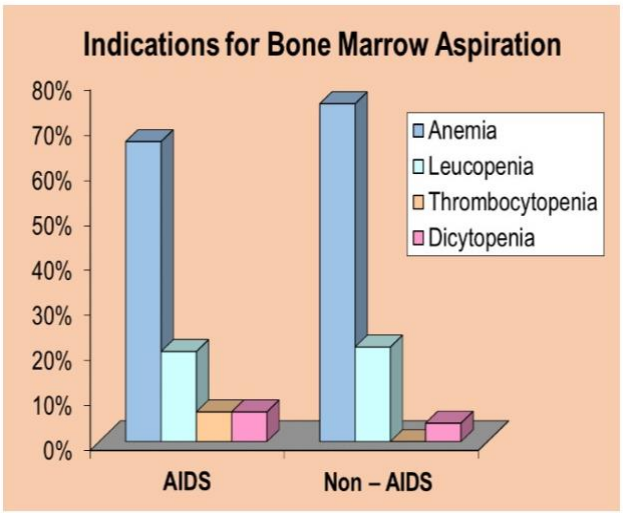


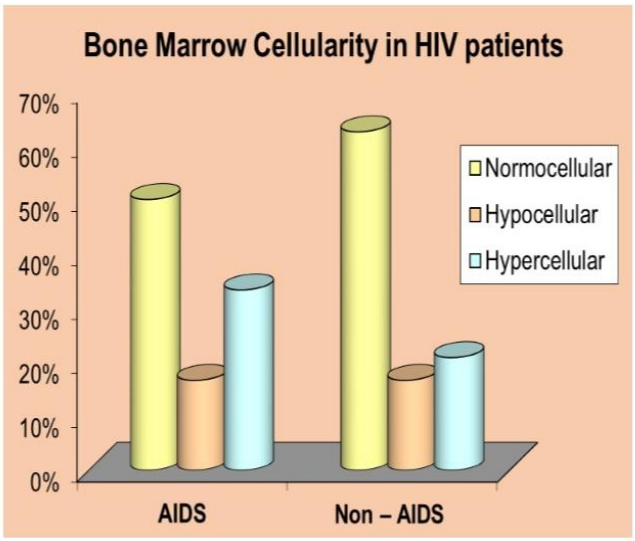


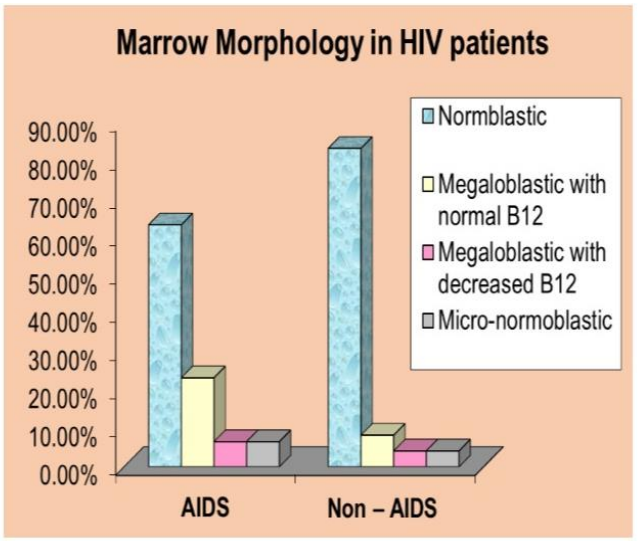


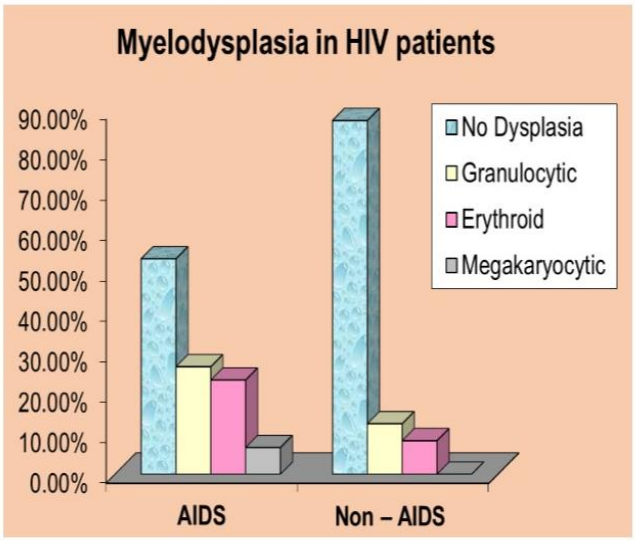


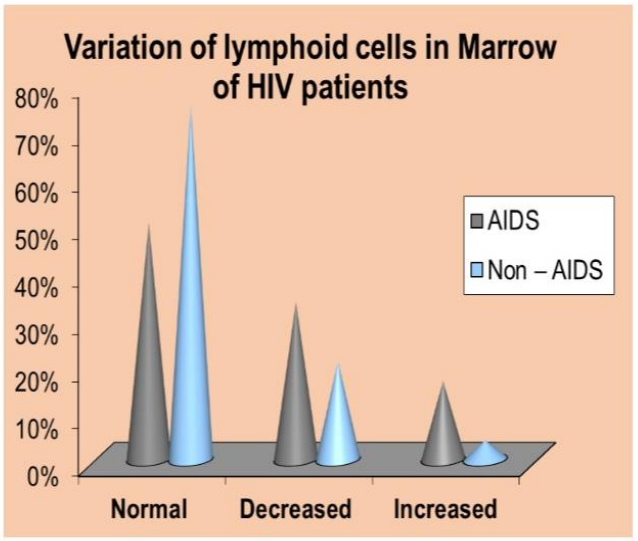


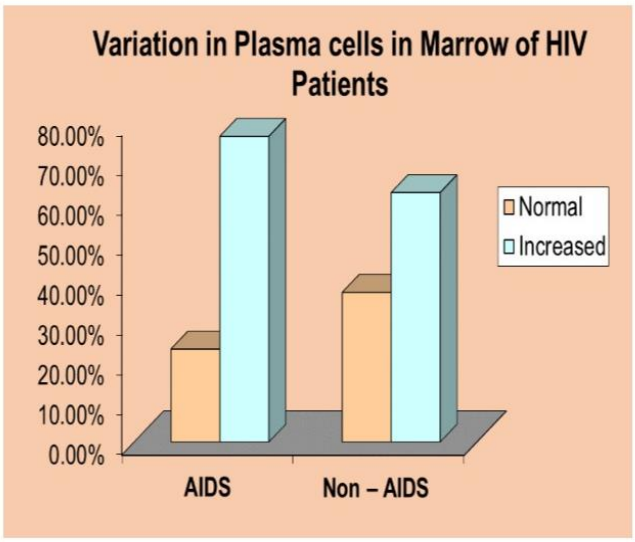


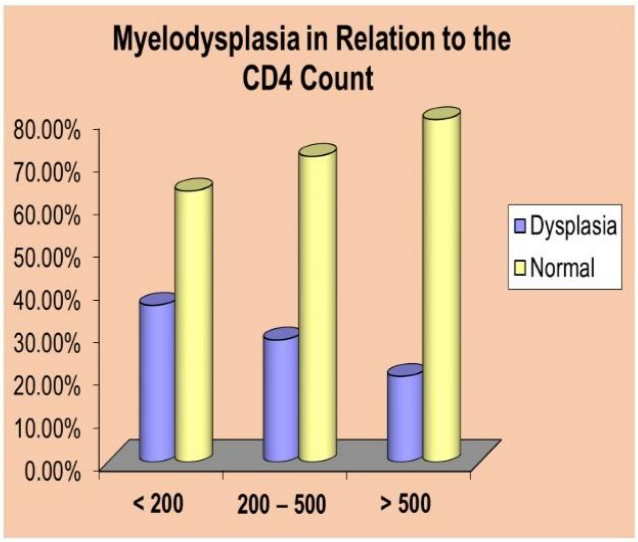












4.3 Observations: statistics

Table 1: Patient Distribution

Classified as	No. of Patients	Percentage (%)
AIDS	30	55.5
Non-AIDS	24	44.4

Table 2: Age wise Distribution

Years	AIDS	Non – AIDS
< 20	1 (3.3%)	3 (12.5%)
21 – 30	9 (30%)	7 (29.1%)
31 – 40	8 (26.6%)	5 (20.8%)
41 – 50	6 (20%)	3 (12.5%)
51-60	2 (6.61%)	3 (12.5%)
> 60	4 (13.3%)	3 (12.5%)

Table 3: Distribution of Male & Female Subjects

Sex Distribution	AIDS	Non – AIDS
Male	24 (80%)	15 (62.5%)
Female	6 (20%)	9 (37.5%)

Table 4: Indications for Bone Marrow Aspiration

Parameter	AIDS	Non – AIDS
Anaemia	20 (66.6%)	18 (75%)
Leukopenia	6 (20%)	5 (20.8%)
Thrombocytopenia	2 (6.6%)	0
Bi-cytopenia	2 (6.6%)	1 (4.1%)

Table 5: Peripheral Blood Findings in Patients of AIDS and Non-AIDS

Parameter	AIDS	Non – AIDS
Anaemia	22 (73.3%)	19 (79.1%)
Leukopenia	8 (26.6%)	6 (25%)
Thrombocytopenia	02 (6.6%)	0

Table 6: Bone Marrow Cellularity in HIV patients

Bone marrow Cellularity	AIDS	Non – AIDS
Normocellular	15 (50%)	15 (62.5%)
Hypocellular	5 (16.6%)	4 (16.6%)
Hypercellular	10 (33.3%)	5 (20.8%)

Table 7: Marrow morphology in HIV Patients

Parameter	AIDS	Non – AIDS
Normoblastic	19(63.3%)	20(83.3%)
Megaloblastic-Normal	7(23.3%)	2(8.3%)
Vitamin B12 /Folate		
Megaloblastic-Decreased	2(6.6%)	1(4.17%)
Vitamin B12 /Folate		
Micro-normoblastic	2(6.6%)	1(4.17%)

Table 8: Myelodysplasia in bone marrow of HIV patients

Dysplasia	AIDS	Non – AIDS
No Dysplasia	16 (53.3%)	21 (87.5%)
Granulocytic	8 (26.6%)	3 (12.5%)
Erythroid	7 (23.3%)	2 (8.3%)
Megakaryocytic	2 (6.6%)	0 (0%)

Table 9: Variation of lymphoid cells in bone marrow of HIV patients

Lymphoid cells	AIDS	Non – AIDS
Normal	15 (50%)	18 (75%)
Decreased	10 (33.3%)	5 (20.8%)
Increased	5 (16.6%)	1 (4.1%)

Table 10: Variation in Plasma cells in Bone Marrow of HIV Patients

Plasma Cells	AIDS	Non – AIDS
Normal	7 (23.3%)	9 (37.5%)
Increased	23 (76.6%)	15 (62.5%)

Table 11: Myelodysplasia in Relation to the CD4 Count

CD4 Count	Dysplasia	Normal
< 200	11 (36.6%)	19 (63.3%)
200 – 500	4 (28.5%)	10 (71.4%)
> 500	2 (20%)	8 (80%)

Table 12: Peripheral blood findings in patients with dysplasia

CD4 Count	Number	Percentage (%)
Anaemia	9	52.9
Leukopenia	7	41.1
Thrombocytopenia	2	11.7

4.4 Interpretation of the results

Table 1: A total of 54 subjects are taken into the study. Among them 30 subjects had AIDS and 24 did not satisfy the criteria for AIDS.

Table 2: The commonest age group of the patients was 20 – 40 years with a range of 18-72 years.

Table 3: Of the AIDS group 24 patients (80 %) are males and 6 patients (20%) are females. In the Non-AIDS group 15 patients (62.5%) are males and 9 patients (37.5%) are females. Male to female ratio was 4:1 in AIDS group and 1.6:1 in Non-AIDS group.

Table 4: In the AIDS group, of the 30 subjects, 20 (66.6%) had anemia, 6(20%) had leucopenia, 2 (6.6%) had thrombocytopenia and 2 (6.6%) had Bi-cytopenia (anemia and thrombocytopenia) as an indication for the bone marrow aspiration. In the Non-AIDS group, of the 24 subjects, 18 (75%) had anemia, 5 (20,8%) had leucopenia and 1 (4.1%) had Bi-cytopenia (anemia and thrombocytopenia) as an indication for bone marrow aspiration.

Table 5: In the AIDS group of the 30 subjects, 22 (73.3%) had anemia, 8 (26.6%) had leucopenia and 2 (6.6%) had thrombocytopenia in the peripheral blood examination. In the Non-AIDS group of the 24 subjects, 19 (79.1%) had anemia, 6 (25%) had leucopenia.

Table 6: As many as 15 (50%) of AIDS and 15 (62.5%) of Non-AIDS subjects had normocellular bone marrow. Bone marrow was hypocellular in 5 (16.6%) of AIDS and 4 (16.6%) of Non-AIDS subjects. Bone marrow was hypercellular in 10 (33.3%) of AIDS and 5 (20.8%) of Non-AIDS subjects.

Table 7: Marrow showed predominantly Normoblastic erythropoiesis in majority of Cases of AIDS and Non-AIDS. Megaloblastic change with normal vitamin B12 / folate levels represents erythroid dysplasia and is reported in 2 cases of AIDS and 1 case of Non-AIDS. Other cases with Megaloblastic erythropoiesis had decreased levels of Vitamin B12 /folate. Two Cases of AIDS and one case of Non-AIDS with Micro-normoblastic picture had decreased levels of Serum Iron and Ferritin.

Table 8: Myelodysplasia was found in 31.4% of subjects. It was more common in AIDS subjects as compared to Non-AIDS subjects. In the AIDS group myelodysplasia was seen in 14 (46.6%) subjects where as in non-AIDS group it was seen in 2 (12.5%) subjects. In AIDS group 8 (26.6%) subjects had dysplasia in granulocytic series, 7 (23.3%) in erythroid series and 2 (6.6%) had dysplasia in megakaryocytic series. In Non-AIDS group 3 (12.5%) subjects had dysplasia in granulocytic series and 2 (8.3%) had dysplasia in erythroid series. Myelodysplasia was commonest in granulocytic series followed by erythroid and megakaryocytic series.

Table 9: There was a decrease in lymphoid cells in bone marrow in 10 (33.3%) subjects of AIDS group and in 5 (20.8%) subjects of Non-AIDS group. Increase in lymphoid cells in bone marrow was seen in 5 (16.6%) of AIDS and in 1 (4.1%) of Non-AIDS subjects. Lymphoid cells in bone

marrow were in normal levels in 15 (50%) of AIDS subjects and 18 (75%) of Non-AIDS subjects.

Table 10: Increased plasma cells in bone marrow was observed in 23 (76.6%) of AIDS subjects and 15 (62.5%) of Non-AIDS subjects. Plasma cells in bone marrow were in normal levels in 7 (23.3%) of AIDS subjects and 9 (37.5%) of Non-AIDS subjects.

Table 11: Myelodysplasia was more common in the patients with CD4 count <200/µl. Dysplasia was noticed in 11 (36.6%) subjects with CD4 count <200/µl, in 4 (28.5%) subjects with CD4 count 200-500 and in 2 (20%) subjects with CD4 count >500/µl.

Table 12: Of the 17 subjects showing myelodysplasia, 9 (52.9%) subjects had anemia, 7 (41.1%) had leucopenia and 2 (11.7%) had thrombocytopenia.

5. Discussion

The study was conducted at the Department of Pathology, Kamineni institute of Medical sciences, Narketpally for a period of 2 years from Jan 2017 to December 2018. This was a prospective study and the study population included newly detected 54 HIV + ve symptomatic or asymptomatic patients. HIV was diagnosed by ELISA method as per NACO guidelines.

A total of 54 subjects are taken into the study. Patients were classified into two groups according to NACO criteria – 1) AIDS and 2) Non-AIDS. Out of the 54 patients, 30 subjects had AIDS and 24 did not satisfy the criteria for AIDS.

The commonest age group of the patients was 20 – 40 years with a range of 18-72 years. Of the 30 patients in the AIDS group 24 patients (80 %) are males and 6 patients (20%) are females. In the Non-AIDS group 15 patients (62.5%) are males and 9 patients (37.5%) are females. Male to female ratio was 4:1 in AIDS group and 1.6:1 in Non-AIDS group. In the study done by A K Tripathi *et al*. 74 patients were analyzed with male to female ratio of 4:1 and the commonest age group was 20-40 years and range of 20-68 years. In another Indian study done by Sharad A. Dhurve commonest age group was 21-40 years with male to female ratio of 7:1(Refer to Table 13).

5.1 Peripheral Blood Findings in Patients of AIDS and Non-AIDS

In the AIDS group of the 30 subjects, 22 (73.3%) had anemia, 8 (26.6%) had leucopenia, 2 (6.6%) had thrombocytopenia and 2 (6.6%) cases had bi-cytopenia (anemia with thrombocytopenia) in the peripheral blood examination.

In the Non-AIDS group of the 24 subjects, 19 (79.1%) had anemia, 6 (25%) had leucopenia and 1 (4.1%) had bi-cytopenia (Anemia with Thrombocytopenia).

The commonest type of anemia was normocytic normochromic type which is seen as a consequence of chronic disease and is in agreement with the reports in the literature. The early diagnosis and effective management of anemia in patients with HIV disease is of tremendous importance as anemia in such patients may be an indicator of poor prognosis and progression to advanced disease. These findings correlated with reference studies [9, 10].

5.2 Bone marrow cellularity in HIV patients

As many as 15 (50%) of AIDS and 15 (62.5%) of Non-AIDS subjects had normocellular bone marrow. Bone marrow was hypocellular in 5 (16.6%) of AIDS and 4 (16.6%) of Non-AIDS subjects. Bone marrow was hypercellular in 10 (33.3%) of AIDS and 5 (20.8%) of Non-AIDS subjects. In the study done by A K Tripathi *et al*. marrow was normocellular in 78.95% of Non-AIDS and 74.50% of AIDS patients, hypocellular in 7% of AIDS and 5% of Non-AIDS patients, hypercellular in 18% of AIDS and 16% of Non-AIDS patients. In the study of Sharad A. Dhurve *et al*. normocellular marrow was reported in 79.43% of AIDS and 79.06% of Non-AIDS patients (Refer Table 13). However, the present study revealed bone marrow to be normocellular in 50% of AIDS and 62.5% of Non-AIDS subjects. The difference is difficult to explain but it is likely to be due to different cohort of patients included in various studies. Majority of patients under study had full blown AIDS where the bone marrow could likely be normocellular or hypocellular rather than hypercellular which is predominant in the early stages of disease.

Marrow revealed Normoblastic maturation in 63.3% of AIDS and 83.3% of Non-AIDS cases in our study. In 5 cases of thrombocytopenia (in isolation and as part of bi-cytopenia) normal to increased megakaryocytes were seen in 3 cases and dysplastic changes in megakaryocytes were reported in other two cases. These findings correlated with reference studies [10].

5.3 Myelodysplasia in Bone marrow of HIV patients

Myelodysplasia was found in 31.4% of subjects. It was more common in AIDS subjects as compared to Non-AIDS subjects. In the AIDS group myelodysplasia was seen in 14 (46.6%) subjects where as in non-AIDS group it was seen in 2 (12.5%) subjects. In AIDS group 8 (26.6%) subjects had dysplasia in granulocytic series, 7 (23.3%) in erythroid series and 2 (6.6%) had dysplasia in megakaryocytic series. In Non-AIDS group 3 (12.5%) subjects had dysplasia in granulocytic series and 2 (8.3%) subjects had dysplasia in erythroid series.

Myelodysplasia was commonest in granulocytic series followed by erythroid and megakaryocytic series.

These findings are in accordance with the study done by AK Tripathi *et al*. where in the myelodysplasia was found in 33% of HIV patients. It was more common in AIDS patients (36%) than in non-AIDS patients (21%). In the study done by AK Tripathi *et al*. myelodysplasia was commonest in granulocyte series (27%) followed by erythroid (4%) and megakaryocytic series (1.5%). In the study done by Sharad A. Dhurve *et al*. also dysplastic changes were predominantly reported in granulocytic series in AIDS patients (14.06%) and erythroid dysplasia was prominent in Non-AIDS group (9.30%).

Higher incidence of dysplasia in advanced disease is probably due to increased viral load, cytokine mediated effect of disease and also effect of infections [13]. Donald S *et al*. and Lionard I. *et al*. reported erythroid dysplasia to be the commonest type of dysplasia whereas others reported it in the granulocyte series [11, 12]. In our study important dysplastic change observed in granulocytic series were cytoplasmic vacuolations, nuclear dysmorphism, hypo-granulations, in erythroid series were irregular nuclear outline, megaloblastic change with normal Vitamin B12 /cobalamin and folate levels, bi/multinucleate erythroblasts and basophilic stippling, in megakaryocytic series were cytoplasmic vacuolations and hypo-lobulations. Most common cause of myelodysplasia could possibly be due to an inherent defect of hematopoietic cells [13].

Majority of the patients (52.9%) with the dysplasia had anemia followed by leucopenia (41.1%) and thrombocytopenia (11.7%) which is in accordance with the previous reports [9, 10]. Reports are lacking on the incidence of HIV disease in patients of myelodysplastic syndrome. Nevertheless, HIV infection should be included in differential diagnosis of patients with secondary myelodysplasia. The myelodysplasia in early stages may not reflect changes in peripheral blood smear and thus may remain undiagnosed. This is evident from our observation that 55% of patients showing erythroid dysplasia did not have anemia.

Other interesting findings noted in our study of bone marrow are increase in eosinophilic precursor cells, presence of pseudo-pelger cells, denuded/naked megakaryocytic nuclei (DN-MK).

5.4 Variation of lymphoid cells in bone marrow of HIV patients

There was a decrease in lymphoid cells in bone marrow in 10 (33.3%) subjects of AIDS group and in 5 (20.8%) subjects of Non-AIDS group. Increase in lymphoid cells in bone marrow was seen in 5 (16.6%) of AIDS and in 1 (4.1%) of Non-AIDS subjects. Lymphoid cells in bone marrow were in normal levels in 15 (50%) of AIDS subjects and 18 (75%) of Non-AIDS subjects.

In the study done by AK Tripathi *et al* the lymphoid cells were found to be decreased in the marrow in 36% of Non-AIDS and 60% of AIDS patients. This decrease in marrow lymphoid cells could possibly explain lymphopenia in HIV patients. It is proposed that decrease in marrow lymphoid pool is consequence of the destruction of lymphoid cells by HIV.

Table 13: Correlation of Bone marrow findings between various Reference studies

Parameter	Tripathi AK		Sharad A Dhurve		OUR STUDY	
Total patients	74		160		54	
M: F Ratio	4:1		7:1		AIDS	4:1
					Non-AIDS	1.6:1
Age group	20-40		21-40		21-40	
(Commonest)						
Marrow cellularity	Normocellular		Normocellular		Normocellular	
(Predominant)	AIDS	78.9 %	AIDS	79.68 %	AIDS	50 %
	Non-AIDS	74.5 %	Non-AIDS	79.06 %	Non-AIDS	62.5 %
Myelodysplastic Changes						
Granulocytic	20 %		AIDS	14.06%	AIDS	26.6%
			Non-AIDS	4.65%	Non-AIDS	12.5%
Erythroid	3 %		AIDS	12.5%	AIDS	23.3%
			Non-AIDS	9.3%	Non-AIDS	8.3%
Megakaryocytic	1 %		AIDS	0	AIDS	6.6%
			Non-AIDS	0	Non-AIDS	0

5.5 Variation of plasma cells in bone marrow of HIV patients

Increased plasma cells in bone marrow was observed in 23 (76.6%) of AIDS subjects and 15 (62.5%) of Non-AIDS subjects. Plasma cells in bone marrow were in normal levels in 7 (23.3%) of AIDS subjects and 9 (37.5%) of Non-AIDS subjects. In the study by *AK Tripathi et al* increased number of plasma cells in the marrow was noticed in 65% of AIDS and in 58% of Non-AIDS subjects. Increased plasma cells could be a polyclonal B cell response to HIV infection and can occur at any stage of HIV disease.

5.6 Myelodysplasia in Relation to the CD4 Count

Myelodysplasia was more common in the patients with CD4 count <200/µl. Dysplasia was noticed in 11 (36.6%) subjects with CD4 count <200/µl, in 4 (28.5%) subjects with CD4 count 200-500/µl and in 2 (20%) subjects with CD4 count >500/µl. This is in accordance with the previous reports [9, 10].

6. Limitations of the study

1. Small sample size.
2. This study is biased towards symptomatic HIV disease as most patient come to hospital when they become symptomatic.

7. Conclusion

- Myelodysplasia is found in 32.43% of cases of HIV / AIDS and is more common in AIDS than in non – AIDS patients.
- Granulocytic series is most commonly associated with evidence of dysplasia followed by erythroid and megakaryocytic series.
- Myelodysplasia is more common in patients with CD4 count < 200/µl and in patients with Anemia.
- 27.07% of patients had decreased lymphoid cells in bone marrow and it was commonly seen in AIDS than in non – AIDS patients.
- 70.3% of patients had increased plasma cells in bone marrow and it was more commonly seen in AIDS than in non- AIDS patients.

8. References

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