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HAEMOGLOBIN AND BODY MASS INDEX LEVELS OF HIV INFECTED CHILDREN ATTENDING GOVT. GENERAL HOSPITAL, VIJAYAWADA, KRISHNA DISTRICT, ANDHRA PRADESH, INDIA

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ABSTRACT
The present communication deals with the profile of HIV infected children belonging to pre-HAART (pre-Highly Active Anti Retroviral Therapy) era and HAART era to know the status of anemia and growth pattern who attended the ART centre, Govt. General Hospital, Vijayawada, Andhra Pradesh, India. A cross-sectional record based study was carried out in 95 HIV infected children visiting ART centre from April, 2012 to April, 2015. Hemoglobin, height, weight, BMI, waist and hip ratio were calculated according to the standard protocols. According to the present study 95 subjects of age group 1-20 years were chosen. The subjects in pre-HAART era (24) subjects showed low level of Hb content from < 6 to < 8 gm/dL 6.3 gm/dL and the mean BMI level was from < 18.5 to < 24.9. The study patients in HAART era (60 subjects) shown low Hb content from < 6 to < 8 gm/dL at baseline but increased up to 11 to < 12 gm/dL after follow-up treatments and the body mass index (BMI) level in most of the subjects was from < 18.5 to < 24.9 but increased to > 30 after follow-up treatments. But out of 95 children, 11 (12%) children died due to HIV infection during the study period. Among these 11 children, 4 were of male and 7 were of female children. Thus, in our study, the finding of anemia and poor growth in Indian children reinforces the prognostic significance of HIV infection.

KEYWORDS: Pre- HAART era, HAART era, Haemoglobin level, Body Mass Index.

INTRODUCTION
To date, the HIV/AIDS epidemic has not been overcome anywhere in the world, making this disease a serious health challenge for the new millennium. Even more disturbing, is the fact that the vast majority of infected people are unaware of the fact that they have acquired HIV.[1] India is on the threshold of a generalized epidemic as even a small increase in prevalence would lead to an exponential increase in the number of people living with HIV due to the large population base. The adult prevalence of HIV infection in India is 0.91 but the prevalence of pediatric HIV infection in India is unknown.[2,3]

As of December 2015, 17 million people living with HIV were accessing antiretroviral therapy, up from 15.8 million in June 2015 and 7.5 million in 2010. 46% [43–50%] of all adults living with HIV were accessing treatment in 2015, up from 23% [21–25%] in 2010. 49% [42–55%] of all children living with HIV were accessing treatment in 2015, up from 21% [18–23%] in 2010. 77% [69–86%] of pregnant women living with HIV had access to antiretroviral medicines to prevent transmission of HIV to their babies in 2015.[4]

The adverse experiences of HIV-infected children often begin before the death of their parents. After parental death, these infected children are vulnerable to abandonment by the extended family, depression, abuse, malnutrition, lack of health care and schooling, and early entry into child labor.[5] Some of the common complications encountered in HIV-infected people are weight loss, wasting, derangement in biochemical parameters, opportunistic infections like TB, oral candidiasis, bacterial infection, ulcerations, and fungal infections to name a few.[6] Studies have explicitly demonstrated that anemia is associated with decreased survival and increased disease progression in adults with HIV infection.[7]

Independent of other factors, anemia is also associated with a diminished quality of life.[8] In children with HIV infection, the high prevalence of anemia is well known. Given that the negative impact of anemia is magnified on account of its close relation to overall nutrition and growth, there is limited data from Asian countries where HIV infection, malnutrition and nutritional deficiencies co-exist. In HIV-infected children, wasting (i.e., low weight for height/length) has been associated with

reduced length of survival, while weight loss has resulted in increased infectious complications in children with AIDS. Conversely, HIV has been associated with immune status, level of viral replication and nutritional disorders may be important in predicting growth outcomes.[9] Hence, the present study is aimed to study the status of hemoglobin levels and BMI levels in the HIV infected children attending ART centre, Vijayawada of Andhra Pradesh state, India.

MATERIALS AND METHODS

The study was carried out in 125 HIV infected children in ART centre, Government General Hospital, Vijayawada from 2009 to 2011which was a retrospective cross-sectional record based study. Permission from the authorities was taken and the data is highly reliable. The clinical profile of children during the study period was noted. Basically the subjects were divided into two groups HAART era and pre HAART era. HAART medication included SLN, ZLN, SLE and ZLE (S-stavudine, L-lamuvudine, N-nevirapine and E-ephavirenz) combinations.

Hemoglobin was estimated according to Sahli's hemoglobinometric method.[9] The height and weight of the subjects was measured using the method described by Jellife.[10] The weight was expressed in kilograms (kg) up to the nearest 0.1 kg. Height was measured to the nearest 0.1 cm using a standard metal tape. The body mass index (BMI) is calculated for human body fat based on an individual's weight and height. Waist and hip ratio calculated according to the World Health Organization's data gathering protocol. The data collected from the records was analyzed using MINITAB 11.12, 32 Bit and the differences were considered statistically significant at a p value < 0.05 and < 0.001.

RESULTS

Out of 95 HIV positive children, 24 (25%) subjects were in pre -HAART era, 60 (63%) subjects were in HAART era and 11 (12%) subjects were mortal cases (Table 1). Out of 24 patients in pre –HAART era; 11 subjects were male and 13 subjects were female. Out of 60 patients in HAART era; 34 subjects were male and 26 subjects were female. And out of 11 death cases, 4 children were male subjects and 7 children were female subjects.

Table 1: Distribution of the study subjects into Pre-HAART and HAART era during April, 2012 to April, 2015.

Status of the subject	Male	Female	Total	%
Subjects in Pre-HAART era	11	13	24	25
Subjects in HAART era	34	26	60	63
Subjects Died	4	7	11	12
Total	**49**	**46**	**95**	**100**

The Table 2 represents the distribution of children under Pre - HAART era and HAART era according to age and gender. Many of the children are in the age group of 11-15 years and 16-20 years. The children not taking HAART medication are progressing with the disease and not reaching the adolescent stage and they either become mortal or go for antiretroviral therapy. Also the children under HAART era reached from childhood to adolescence. Thus after initiation of HAART, children are reaching adolescent stage indicated that HAART is effective in them.

Table 2: Distribution of the study subjects under Pre - HAART era and HAART era according to age and gender during April, 2012 to March, 2015.

Age Group	Pre - HAART Era						HAART Era					
	Male		Female		Total		Male		Female		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
6 months –5 years	1	9	0	0	1	4	0	0	1	4	1	2
6 – 10 Years	1	9	3	23	4	17	1	3	1	4	2	3
11 – 15 Years	9	82	9	69	**18**	**75**	15	44	12	46	27	45
16 – 20 Years	0	0	1	8	1	4	18	53	12	46	**30**	**50**
Total	11	100	13	100	24	100	34	100	26	100	60	100

The Table 3 represents, the haemoglobin levels of HIV infected children under pre-HAART era during the study period. As the disease progresses, most of the children are in anaemic condition (< 10 gm/dL) which indicates that children basically suffers with anemia when infected with HIV.

According to Table 4, the Hb content in the study subjects increased after HAART initiation. The present study clearly indicates that the majority of the patients after taking HAART increased their hemoglobin (11 to <12 gm/dL) content than before initiation of HAART. Hence, due to HAART the study patients restored from anemic condition.

Table: 3 Distribution of the study patients under pre-HAART era basing on baseline and follow-up haemoglobin levels during April, 2012 to April, 2015.

Haemoglobin (gm/dL)	April, 2012 (Baseline)	April, 2013 (Follow-up)	April, 2014 (Follow-up)	April, 2015 (Follow-up)
	No. of Subjects			
<6	**18**	0	0	0
6 to <7	4	**15**	**11**	2
7 to <8	2	5	5	1
8 to <9	0	1	2	6
9 to <10	0	0	3	2
10 to <11	0	1	2	**7**
11 to <12	0	2	1	5
Total	24	24	24	24

Table 5, represents the percentage of the subjects in pre-HAART era distributed in different categories of BMI. Among male subjects only 73% shown underweight condition, but only 27% of male children shown normal weight whereas 62% females shown underweight condition and 38% of the female subjects shown to have normal weight. None of the subjects have shown overweight or obesity condition. This reveals that due to HIV infection, the majority of the children are in underweight condition.

Table 4: Distribution of the study subjects in HAART era basing on baseline and follow-up haemoglobin levels during April, 2012 to April, 2015.

Haemoglobin (gm/dL)	April, 2012 (Baseline)	April, 2013 (Follow-up)	April, 2014 (Follow-up)	April, 2015 (Follow-up)
	No. of Subjects			
<6	11	4	2	0
6 to <7	**37**	**26**	**11**	1
7 to <8	9	12	10	1
8 to <9	3	4	**11**	12
9 to <10	0	8	8	9
10 to <11	0	4	8	**26**
11 to <12	0	2	10	11
Total	**60**	**60**	**60**	**60**

Table 5: Distribution of Pre- HAART era subjects according to Body Mass Index levels during April 2012 to April, 2015. [According to US Department of Health and Human Services (USDHHS) weight status categories]

Body Mass Index (kg/m^2)	Male (n = 11) N (%)	Female (n = 13) N (%)
<18.5 (Underweight)	**8 (73)**	**8 (62)**
18.5 – 24.9 (Normal weight)	3 (27)	5 (38)
25 – 29.9 (Overweight)	0 (0)	0 (0)
>30 (Obesity)	0 (0)	0 (0)
Total	11 (100)	13 (100)

As per Table 6, 28 (47%) subjects shown to have underweight before initiation of HAART but only 15 (25%) subjects shown underweight condition after initiation of HAART. 25 (42%) subjects were having normal weight before HAART but 28 (47%) subjects had normal weight after initiation of HAART. Only 7 (11%) subjects shown overweight before HAART but after HAART medication the number of subjects increased to 11 (18%) after HAART initiation. None of the subjects was found to be obese before HAART but after HAART medication 6 (10%) subjects found to be obese.

Table 6: Distribution of HAART era subjects according to Body Mass Index levels during April 2012 to April, 2015. [According to US Department of Health and Human Services (USDHHS) weight status categories]

Body Mass Index (kg/m^2)	Before HAART (n = 60) N (%)	After HAART (n = 60) N (%)
<18.5 (Underweight)	**28 (47)**	15 (25)
18.5 – 24.9 (Normal weight)	25 (42)	**28 (47)**
25 – 29.9 (Overweight)	7 (11)	11 (18)
>30 (Obesity)	0(0)	6 (10)
Total	**60 (100)**	**60 (100)**

DISCUSSION

The study patients in HAART era, initiated ART when their CD4 counts were below 300 cells/cmm. It is also recommended by WHO[11] to initiate ART for all HIV-infected children between 12 and 24 months of age irrespective of CD4 count or WHO clinical stage, to initiate ART for all HIV-infected children more than 5 years of age with a CD4 count of ≤350 cells/mm^3 (as in adults), irrespective of WHO clinical stage and initiate ART for all HIV-infected children with WHO clinical stages 3 and 4, irrespective of CD4 count.

The present study reveals that children, who initiated HAART, gradually reached to adolescence whereas those children not initiated HAART, progressing with the disease and subjected to AIDS defining illness. Our study correlates with the study of Weiner et al. (1998),[12] where thirty-nine caregivers of HIV-infected youth (ages 10–18yrs) and twelve youth over the age of 18 years were interviewed at two time points. Barriers associated with transition were identified and addressed between visits. Transition readiness improved and state anxiety decreased significantly from the first time point to the last visit (approximately 7 months later).

Thus, as the treatment options for HIV/AIDS have improved, many HIV-infected children who are not expected to survive childhood are entering into adolescence and young adulthood (Fewer than 300 children annually are born infected with HIV in the United States while >8500 previously infected children and youth <19 years old living with HIV/AIDS continue to age up in the health care system.[13]

A decade ago, there was a dismal direction to the illness. Almost all children died before their young adult years. Today, the outcome is much more favorable. A significant number of children are expected to live well into their adolescent years and hopefully beyond. Despite the many stresses inherent in living with HIV/AIDS, these young adults need to be given the opportunity to develop and pursue individual aspirations and goals. If recognized and nurtured, they have the potency to significantly contribute to the society.[14]

Hemoglobin content of the study subjects was lower than the normal value and all were anemic at the time of initiation of ART and few subjects shown stunted growth according to BMI. The above finding is supported by Anita Shet et al.[15] that there is a high prevalence of anemia and growth failure among children living with HIV infection in India. In a meticulously conducted review on global prevalence of HIV- associated anemia, Calis et al.[8] reported that anemia was a common complication occurring in 50-90% of children living with HIV in both resource-limited and resource-rich settings and that anemia prevalence was over three times higher among these children when compared with those without HIV infection.National reports also indicate that the rural population has higher HIV prevalence than the urban population[16] which supports our results where most of the children in the present study hailed from the rural background. Also, it is reported that decline of CD4 count to below 200 cells/mm^3 increases the risk of incidence of anemia.[10] Thus HIV infected children and adults are associated with poor clinical outcomes, anemia is associated with more rapid progression to AIDS.[17]

According to WHO[18] HIV-infected children on or off HAART who are symptomatic, have conditions requiring increased energy (e.g., TB, chronic lung disease, chronic OIs or malignancies) or have weight loss or have evidence of poor growth, should be provided with 25 – 30% additional energy. HIV-infected children who are severely malnourished should be managed as per the guidelines for uninfected children and provided with 50 – 100% additional energy.

As per the present results, the study subjects in pre-HAART group are progressing with HIV infection with low levels of hemoglobin. The body mass index (BMI) reveals that most of the male children have normal weight but female children fall in underweight category. But majority of the subjects have shown normal weight and underweight condition. According to the study made by Newell et al.[19] illustrates that neither height nor weight was associated significantly with the main effects of HIV infection status at birth, but differences between infected and uninfected children increased with age. Between 6 and 12 months, uninfected children grew an

estimated 1.6% faster in height and 6.2% in weight than infected children; between ages 8 and 10 years, these figures were 16% and 44%, respectively. By 10 years, uninfected children were on average an estimated 7 kg heavier 7.5 cm taller than infected children.

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