Original Article

DOI: 10.7860/JCDR/2016/16996.7889

A Growth and Nutritional Study of HIV Seropositive Children from West Bengal under Direct Care of Medical Caregivers

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ABSTRACT

Aim: To evaluate the nutritional status of HIV seropositive children, aged 2-10 years with age – matched controls and examine the role of nutritional intervention and HRT on their growth indices.

Materials and Methods: It was a cross-sectional study done at a HIV Clinic of a teaching hospital. Fifty six seropositive children (age 2-10 year) classified as cases, and 60 seronegative age - matched controls were taken. Demographic and anthropometric characteristics were collected via valid instruments. HIV grading and adherence to HRT were assessed by using validated questionnaires.

Results: Of the cases majority (87.5%) were infected by vertical transmission from mother to child, the remaining were infected by blood transfusion out of which 1.78% were haemophiliacs and remaining were thalassaemics. The prevalence of underweight among cases was 64.3%, compared to prevalence of 61% among controls. The prevalence of stunting was 44.6% among cases, while the prevalence of severe stunting was 14.3%. The prevalence of wasting among cases was 30.35%, while 7% cases were severely wasted. Only 23.33% controls were wasted. There was a significant difference in the Height- for-age between cases and controls, in the age of 4 years, 5 years and 6 years (p-value <0.05).

Conclusion: There was a significant difference in the Height-for-age between cases and controls, in the age of 4 years, 5 years and 6 years, indicating the need for proper nutritional intervention and timely HIV antiretroviral therapy to prevent stunting.

Keywords: Height for age, Nutrition, Stunting, Wasting, Weight for age

INTRODUCTION

All seropositive children are generally neglected in our society [1]. Considering the ill fate that they will meet some day guardians and relatives seldom give care for their growth and development. They succumb mainly to malnutrition and resulting infectious diseases [1]. Malnutrition continues to be one of the major public health problems throughout the developing world, particularly in India. A high prevalence of poor nutrition and infectious diseases (particularly diarrhea, tuberculosis and HIV) leads to a vicious cycle. HIV has an unacceptably high contribution to the development of severe malnutrition. Diet deficient in macronutrients (protein, carbohydrate and fat) and/or micronutrients (electrolytes, minerals and vitamins) lead to protein-energy malnutrition (PEM) and specific micronutrient deficiencies respectively. Studies from Rwanda and Uganda [2] found that HIV- infected children had stunting, which began early, but no wasting. Reports from other African countries have noted marasmus and kwashiorkor in association with HIV infection. Data on nutritional status in children with HIV infection in India are available in a few studies [3-5], which show that almost half of children were underweight and stunted, micronutrient deficiencies were widely prevalent, and morbidity was more in children not on ART. Authors have concluded that acute, chronic malnutrition and micronutrient deficiencies are very common, especially in children not on ART and having morbidity [6]. Hence, it is time we seriously review the picture in West Bengal.

With the above objective in mind we conducted a comparative study of nutritional status of HIV seropositive children aged 2-10 years with seronegative control group. The aim was to see if they can match their normal counter parts if given adequate nutritional support, counselling of caregivers along with HRT.

MATERIALS AND METHODS

The study was conducted in the Paediatric HIV/AIDS clinic (on Mondays) and Paediatric outpatient department, Medical College, Kolkata, India between June 2008-2009. Each patient aged between 2–10 years attending the outpatient Apex HIV Clinic was included in the study during the study period. It was a cross -sectional study.

Study Population

Study Group

Inclusion criteria

HIV seropositive diagnosed by two (3rd generation) ELISA tests.

All 2-10 years attending HIV clinic on every Monday.

Exclusion criteria

HIV seropositive 2-10 years child who were previously registered in this study.

Control group

1. Age 2-10 years.
2. Not suffering from any chronic non-infective illness.
3. HIV seronegative by single ELISA (3rd generation) test were preferred.
4. Not high risk for HIV as derived by oral questionnaire was included among children attending Paediatric OPD on Tuesday by using random number table, first control was included every day and then every fifth eligible child was taken till the end of OPD working hours in our presence.
5. Seronegative siblings of seropositive study cases were given priority as controls.

Atleast 50 children each for cases and controls were intended to be included in this study.

The children in the study group received HRT along with advices and dietary prescriptions for locally available low cost home based nutritional care to their parents of caregivers. The control group received only dietary counselling.

Serologic Methods

The children's sera were tested for HIV-1 antibodies by a commercial enzyme - linked immunosorbent assay (EIA; Vironostika, Organon Teknika, Boxtel, the Netherlands). Samples that tested positive were further confirmed by a second ELISA test.

STATISTICAL ANALYSIS

Anthropometric indices, weight- for-age, height-for-age, weight-for-length and BMI-for-age were calculated using the growth reference curves developed by the National Centre for Health Statistics and CDC, as recommended by WHO [3,4]. The Z-score was estimated for each of these indices. For weight-for-age, for example, the Z-score is calculated by subtracting the median weight of the reference population at the child's age from the child's weight and dividing by the standard deviation of the weight of the reference population at that age. The Z-scores results were reported as means and standard deviations at each age. HIV-infected and uninfected infants were compared in relation to the mean Z-score using unpaired t-test. The percentage of low anthropometric indices using a cut off value of less than -2 SD was calculated and compared between infected and uninfected infants using student's t-test assuming equal variance. Results were considered statistically significant at p-value < 0.05.

A questionnaire that focused on respondents' social demographic/economic characteristics and their influence on the nutritional status of the children was developed. The questionnaire was validated by the "jury" method. To ensure that good quality data was collected, questionnaires were cross – checked continuously.

RESULTS

Between May 2007 to June 2008, a total of 116 children were entered into the study. All the children were aged between 2–10 years at the time of the study. The cases and controls were compared for variables such as age, birth weight, time of weaning duration of breast feeding and no differences were found (p-value > 0.05) [Table/Fig-1].

The children were classified as 56 infected (cases) and 60 not infected (controls). Cases comprised of 35 boys and 21 girls, while controls consisted of 38 boys and 22 girls. Of the cases 87.5% were infected by vertical transmission, 1.78% was haemophiliac and remaining were thalassaemics.

The weight of the infected group was similar to that of the control group and they compared well with international standards. Although the cases had lower means than the controls, there was no significant difference between the two groups except in the age group of 9 years, where the difference was significant. It is noteworthy that the controls were underweight and had significantly lower mean z- scores than the cases in the age of 9 years [Table/Fig-2].

Variables	Cases (n = 56) Mean± SD	Control (n = 60) Mean± SD	p-value
Age (years)	6.39 ± 2.13	5.68 ± 2.37	0.09
birth weight (kg)	2.52 ± 0.45	2.47 ± 0.18	0.47
Time of weaning (months)	9.52 ± 6.83	9.03 ± 3.65	0.63
Duration of breast feeding (months)	19.6 ± 12.42	18.2 ± 12.76	0.55

[Table/Fig-1]: Comparison of cases and controls.

Age (years)	Cases		Control		p-value
	Mean	SD	Mean	SD	
2y	-0.555	0.48	-1.603	0.87	0.159
3y	-1.552	1.188	-1.174	0.99	0.562
4y	-1.016	0.515	-0.857	0.42	0.52
5y	-1.526	0.938	-1.124	0.736	0.155
6y	-1.409	0.753	-0.937	0.389	0.146
7y	-1.134	0.522	-0.861	0.497	0.18
8y	-0.993	0.549	-1.013	0.681	0.95
9y	-1.032	0.509	-1.274	0.138	0.02
10y	-1.474	0.58	-1.109	0.374	0.16

[Table/Fig-2]: Mean weight-for-age Z-scores in HIV-1 infected (cases) and uninfected (controls) children aged 2-10 years.

Height-for-age

The cases were shorter than the control in all age groups except in the age group of 9 years, where the mean Z-score was higher in cases than in controls. There was a significant difference in the height-for-age between the cases and the controls, particularly in the age 4, 5 and 6 years. Thus, the cases were stunted compared to controls in 4, 5 and 6 years. The proportion of infected children with significant height-for-age Z-scores below – 2 SD were 20% in 3 years, 16% in 4 years, 62.5% in 5 years, 50% in 6 years, 80% in 10 years [Table/Fig-3].

Age	Cases		Controls		p-value
	mean Z-score	SD	mean Z-score	SD	
2y	-1.634	0.067	-0.729	1.725	0.502
3y	-1.122	1.145	-1.220	1.328	0.896
4y	-1.637	0.378	-0.590	1.08	0.041
5y	-1.984	1.267	-0.679	0.524	0.036
6y	-1.562	0.821	-0.563	0.958	0.048
7y	-1.277	0.982	-1.001	0.836	0.595
8y	-1.456	0.684	-1.002	1.115	0.325
9y	-0.880	1.023	-1.394	0.443	0.348
10y	-2.070	1.019	-1.709	0.606	0.554

[Table/Fig-3]: Mean height - for- age in HIV infected and uninfected children aged 2- 10 years.

Age	Cases		Controls		p-value
	Mean Z-score	SD	Mean Z-scores	SD	
2y	0.628	0.889	-1.824	1.03	0.019
3y	-1.514	2.13	-1.023	1.5	0.431
4y	-0.352	0.869	-0.802	1.31	0.591
5y	-1.294	1.202	-0.917	0.45	0.481
6y	-0.857	0.622	-1.089	0.42	0.561
7y	-1.002	0.742	-0.4	0.66	0.143
8y	-0.626	0.819	-0.919	0.98	0.529
9y	-1.393	0.417	-1.239	0.48	0.661
10y	-1.451	1.197	0.0246	0.67	0.057

[Table/Fig-4]: Mean Weight-for-height Z-scores in HIV infected (cases) and uninfected (controls) aged 2-10 years.

Weight-for-height

The mean Z-scores of cases were lower than controls in the ages of 3 years, 5 years, 7 years, 9 years and 10 years but the difference was not significant. It is also noteworthy that the means were significantly higher in the age group of 2 years in cases as compared to controls [Table/Fig-4].

DISCUSSION

In this cross-sectional case control study, we described the anthropometric indices of 56 children infected with HIV- 1 aged 2- 10 years attending our Apex HIV clinic and compared them with 60 healthy controls and found that children infected with HIV-1, had significant stunting (low height-for-age Z-score) particularly in the age of 4-6 years but did not have significant wasting (low weight-for-height Z-score) nor were they significantly underweight (low weight-for-age Z-score) [Table/Fig-1]. Among the nine-year-old cases in our study improved attention to diet and nutrition in our clinic has enhanced ART acceptability and adherence which has subsequently led to growth parameters within normal range for age and sex in these patients. Indeed antiretroviral treatment has a positive impact on weight growth rates [5]. It was extremely

difficult for us to make mothers attentive towards their diseased children.

Our results confirm and extend data from other studies. Studies from Rwanda and Uganda found that children with vertically acquired HIV-1 infection were frequently undernourished and were stunted but not wasted [6,7]. While on one hand the Height-Age mean z-scores were lower in cases compared to controls, on the other hand the Weight-Height z scores of HIV- infected children from our study were comparable to the figures obtained with uninfected ones or to international standards [Table/Fig-2-4]. A cross–sectional study of malnourished children with HIV-1 seroprevalence 14% in Butare, Rwanda, also showed that seropositivity was found more frequently among children with low W-A and H-A than among those with low W-H [8].

It is not clear why HIV - infected children have growth failure. A study from New York [9] suggested that an increased viral load is probably a contributory factor. Children in their cohort had disturbed linear growth corresponding to higher viral loads. They did not find a difference in growth related to the use of antiretroviral agents. Although we did not measure viral load, it is possible that it is one of the factors associated with the growth disturbances we detected.

Studies from Africa [10,11] have previously shown that the mean birth weight and the mean birth length of HIV - infected children was lower than among uninfected newborns of HIV - seronegative mother [12]. When we calculated the mean birth weight of cases versus controls [Table/Fig-1] we found that the mean birth weight for cases (in kg) was (2.52 ± 0.45) while that for controls was (2.47 ± 0.18), although this data was collected by us from mothers through recall method, which led to confounding as most of the guardians did not have any document to confirm the same. In the United States McKinney et al., have retrospectively analysed the growth of children born to seropositive mothers and observed diminished stature and weight gain in HIV - infected children when they were compared to seroverters [13]. However, two - thirds of the HIV - infected children included in their study were referred for antiretroviral therapy after 3 months of age; therefore the design of this study was not optimal to evaluate the general impact of HIV on the nutritional status of young HIV - infected children [10].

In the European Collaborative Study [12] HIV – infected children were shorter and weighed less than their uninfected counterparts. Although statistically insignificant, the difference between infected and uninfected children was small in this study.

The pathogenesis of malnutrition in HIV-1 infection is poorly understood and the respective roles of infections, endocrinologic dysfunctions and the possibility of increased resting energy expenditure in infected patients remain to be delineated [14-16].

The Rwandan study [5] noted an association between growth failure and infection. Infected children with low weight and length- for- age were more likely to have had persistent diarrhea, chronic fever and pneumonia. Persistent or recurrent diarrhea and malabsorption have been associated with growth failure in HIV- infected children. As described in our study the prevalence of wasting was higher in cases of recurrent diarrhea (18%) as compared to 12% in those cases where recurrent diarrhea was absent though this difference is small and statistically insignificant. Cross-sectional [17] and longitudinal [18] data from Zaire have also shown that diarrhea was strongly associated with severe malnutrition and HIV-1 infection. Our study had several limitations, being a cross-sectional study, the effects of nutritional intervention, counselling and HRT could not be incorporated and thus longitudinal studies are needed to validate our results. Similarly documenting the CD4 + counts may have also shown a relationship between degree of immunosuppression and malnutrition.

Malnutrition has been shown to affect immunity, which predisposes to opportunistic infection. An association between growth failure and opportunistic infection has been shown in haemophiliac children. The combination of malnutrition and opportunistic infection aggravates the problem of growth failure in HIV- infected children.

CONCLUSION

The seropositive children of the age group 4, 5 and 6 years were found to have a significantly low height as per their age. Nutritional counselling and adequate supplementation is important for the normal growth and development of seropositive children.

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FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Sep 25, 2015**
Date of Peer Review: **Dec 17, 2015**
Date of Acceptance: **Jan 14, 2016**
Date of Publishing: **May 01, 2016**