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A study of effect of HIV status and ART on anthropometric characteristics (Height, Weight, and Body Mass Index) among institutionalised children in Western India

[1] Dr. Amit Ahale, [2] Dr. Marcia Waran, [3] Dr. Paras Zunke, [4] Brig Dr. Arun Tyagi

[1, 3] Resident, Department of Medicine, DVVPF'S Medical College, Vadgaon Gupta, Post-MIDC, Ahmednagar, Maharashtra, India

[2] Associate Professor, Department of Mesicin, DVVPF'S Medical College, Vadgaon Gupta, Post-MIDC, Ahmednagar, Maharashtra, India

[4] Professor & Hod, Associate Professor, Department of Mesicin, DVVPF'S Medical College, Vadgaon Gupta, Post-MIDC, Ahmednagar, Maharashtra, India

Abstract

Background: Advances in management of HIV-infected infants and children have been remarkable, majority of infected children are now surviving into adolescence. Several studies have shown that growth is often impaired among children with HIV/AIDS. Abnormalities include early deficits in height and weight, and delay in skeletal maturation. The magnitude of delayed growth among HIV infected children in India have not been studied.

Objective: To assess growth among HIV infected children amongst institutionalized children.

Study Design: This was a cross section hospital based study at an NGO, SNEHALAYA, in Ahmednagar (Maharashtra, India), that cares for children of commercial sex workers.

Methodology: Anthropometric measurements of growth of children with HIV/AIDS aged between 1 and 18 years were assessed.

Result: In HIV positive males, the mean weight, height and BMI was found to be 36.6±1.0, 143.2±0.9 and 17.36±1.1 respectively. In HIV positive females, the mean weight, height and BMI was found to be 37.4±0.9, 144.6±0.9 and 17.89±0.7 respectively. Comparison with age and sex matched HIV negative children revealed significant difference in weight for age, height for age and body mass index ($p < 0.001$).

Conclusion: Children infected with HIV and AIDS have significant delay in growth. Considering these findings monitoring of growth cannot be over emphasized in this population and should be part of the routine examination.

Keywords: institutionalised, height, weight, HIV positive, HIV negative

Introduction

HIV and AIDS still provide a major global challenge and continue to be a major cause of morbidity and mortality in children and adults alike. The joint United Nations Programme on HIV/AIDS (UNAIDS) estimated about 33 million people worldwide living with HIV or AIDS at the end of 2009 [1]. In 2013 statistics, HIV prevalence in India was an estimated 0.3%. In the same year, an estimated 130,000 people died from AIDS-related illnesses [3]. According to UNAIDS GAP Report 2016, in 2015 there were about 2.1 million HIV positive in India, making the prevalence of approximately 0.26%. Of these 86,000 were new HIV infections. There were almost 44% adults on Anti-retroviral treatment and 68,000 AIDS related deaths occurred in 2015 [2]. India has the third largest HIV epidemic in the world. Overall, India's HIV epidemic is slowing down, with a 32% decline in new HIV infections (130,000 in 2013 and 86000 in 2015), and a 54% decline in AIDS-related deaths between 2007 and 2015. Despite this, 51% of deaths from HIV/AIDS in Asia are in India [3].

Children are infected worldwide with HIV, the data showing increasing number of HIV-infected infants born to infected mothers. The World Health Organization (WHO) estimates that 1000 new pediatric HIV infections occur daily, with 67% in Africa and 30% in South and Southeast Asia [4].

Studies done before the introduction of highly active antiretroviral therapy (HAART) showed that almost 50% of children with perinatally-acquired HIV infection died by age of 2 years without treatment and the majority by 5 years of age [5]. In one population of HIV infected children the median survival was shown to be 32 months from time of diagnosis without any intervention [6]. With the increased access to antiretroviral therapy (ART), a rapidly growing population of adolescences living with HIV/AIDS is expected. However, the burden of caring for patients infected by HIV/AIDS and looking after their many personal, social and health related problems continues to increase.

Clinical interest in the impact of HIV disease and its associated Immunosuppression on the skeletal growth among HIV infected children is important. Studies have shown that Immunosuppression is associated with delayed skeletal growth and pubertal onset among HIV-infected children [7-10]. Infection with HIV-1 causes impaired linear growth, secondary infections, malnutrition and the host's cytokine response [11].

Growth retardation is always seen in children with advanced

HIV infection and is often related to the proinflammatory conditions found in advanced AIDS. Rapid progressors have the highest incidence of growth failure. Growth dysregulation is quite common in HIV-infected children and growth failure is one of the most sensitive indicators of disease progression. Growth impairment is marker of advanced disease and require proper evaluation [12].

HIV-infected infants often have smaller size and lower birth weight than uninfected children born to HIV-infected women even at birth. The causes of growth dysregulation are varied, and can be due to alterations in gastrointestinal function, chronic or repetitive infections, and alterations in metabolic and endocrine function [12].

The introduction of highly active antiretroviral therapy (HAART) for treatment of acquired immunodeficiency syndrome (AIDS) has resulted in long survival of children infected with the human immunodeficiency virus (HIV) [13].

A lot of positive people are from low a socioeconomic background and are also prone to OI's. Human Immunodeficiency virus (HIV) is severely affecting life of the poorly educated and economically deprived in Indian society. When children start developing clinical manifestations, needing treatment, care and support, they have to travel long distances to access medical care and support at the health care facility. This places a huge financial burden on patients and care givers who are already struggling to cope with their illness.

AIMS and objectives

The present study was undertaken to assess the growth among HIV infected children aged 1–18 yrs. and compared with age and sex matched HIV negative controls.

Material & Methods

This study was conducted in an Institution "SNEHALAYA" in Western India. SNEHALAYA is an NGO that looks after children of commercial sex workers who may be HIV positive or negative. The author has worked with the institution since 1991 shortly after the inception of the NGO. A total of 650 children have been institutionalized in SNEHALAYA from 1989 to 2017. The study was conducted from June 2015 to June 2017.

Study Design

This is a community based descriptive cross- sectional study. The study was conducted at SNEHALAYA by the department of Medicine of a tertiary care teaching hospital in western India as done between June 2015 to June 2017. The anthropometric measurements of HIV positive children were compared with their HIV negative counterparts. 240 children between the age of 1 to 18 years were studied; 150 were HIV positive and 90 were HIV negative. Their height, weight and BMI were monitored on a monthly basis. Adolescents of more than 18 years were excluded from the study as they reach adult height and weight by 18 years of age.

Inclusion criteria and exclusion criteria

Inclusion criteria

1. Children and adolescents with HIV aged 1-18 years institutionalized at SNEHALAYA.

Exclusion criteria

1. Children with physical disability, which affect skeletal development and growth (like Rickets and Pott's Spine) and may reflect inaccurate anthropometric measurements.
2. Children more than 18 years of age were excluded from the study since they have achieved adult parameters of height and weight.

Anthropometric measurements

Anthropometric measurements included weight and height. These measurements were performed after the participants had removed their shoes and with minimal clothing.

Weight was measured to the nearest 0.1 kg using weighing scale, TANITA® UM 075, which was periodically checked for accuracy and calibrated as necessary. Height was measured to the nearest 1 mm with a portable Leicester® stadiometer. BMI (kg/m^2) was computed using weight (in kilogram) divided by height (in meters squared).

$$BMI = \frac{Weight\ (kg)}{Height^2\ (m^2)}$$

The height, weight and BMI were than compared with the growth chart for Indian children as authenticated by the Indian Association of Pediatrics.

Observations

Anthropometric characteristics of study population by sex.

During the study period 240 participants were enrolled. 150 were HIV positive and 90 were HIV negative. Of these 83 (55.4%) were males and 67 (44.6%) were females. All participants enrolled had confirmed HIV infection and were on ART. The median age was 12.0 years for both males and females. There was significant difference in weight for age, height for age and body mass index ($p < 0.001$) when compared with HIV Negative children (Table 1A & 1B).

Table 1A: Anthropometric characteristics among HIV infected children with standard deviation (SD) by sex

Variable	Male	Female
Median Age in Years	12.0	12.0
Median Weight in Kg	32.0	28.0

Variable (Growth Parameter)	Male 83 (55.4%)	Female 67 (44.6%)	P value
Mean Age in Years (SD)	12.4 (±1.0)	13.05 (±1.0)	0.0001
Mean Weight in Kg (SD)	35.6 (±1.0)	37.4 (±0.9)	0.0001
Mean Height in Cm (SD)	143.2 (±0.9)	144.6 (±0.9)	0.0001
Mean BMI in Kg/m^2 (SD)	17.36 (±1.1)	17.89 (±0.7)	0.0008

Table 1B: Anthropometric characteristics among HIV negative children by sex

Variable (Growth Parameter)	Male 50 (55.6%)	Female 40 (44.4%)	P value
Mean Age in Years (SD)	12.3 (±1.0)	12.8 (±1.0)	0.0206
Mean Weight in Kg (SD)	47.9 (±1.0)	51.9 (±1.0)	0.0001
Mean Height in Cm (SD)	157.3 (±1.1)	159.6 (±1.1)	0.0001
Mean BMI in Kg/m^2 (SD)	19.36 (±1.1)	20.38 (±1.0)	0.0001

HIV infected Children were compared to the reference population. Among HIV infected males there were no significant difference in age compared to the reference population. However, there was significant difference in weight for age, height for age and body mass index ($p < 0.01$). The reference population had higher weight and BMI as well as they were taller compared to HIV infected children. There was no significant difference in the mean age among HIV infected females. HIV infected females were underweight, shorter and low BMI compared to the reference population with $P < 0.01$. (Table 2A & 2B)

Table 2A: comparison of the mean z-score and confidence interval (ci) of HIV infected and HIV negative male children.

Male	HIV Positive Mean n = 83	Reference Population Mean n = 50	Confidence Interval Of difference	P Value
Age	12.4	12.3	-0.254 to 0.454	0.5774
WA z-score	-0.57	0.72	-1.644 to -0.935	0.0001
HA z-score	-0.99	0.96	-2.339 to -1.560.	0.0001
BMI z-score	-0.17	0.45	-0.996 to -0.243	0.0014

Table 2B: Comparison of the mean z-score and confidence interval (CI) of HIV infected and HIV negative female children

Female	HIV Positive Mean n = 67	Reference Population Mean n = 40	Confidence Interval Of difference	P Value
Age	13.05	12.8	-0.146 to 0.646	0.213
WA z-score	-0.63	0.91	-1.922 to -1.158	0.0001
HA z-score	-1.23	1.20	-2.430 to -2.058	0.0001
BMI z-score	-0.10	0.56	-0.986 to -0.333	0.0001

Results

From June 2015 to June 2017 a total of 240 children, of age 1 to 18 years, institutionalized in SNEHALAYA were studied. In this study, Indian parameters of height, weight and BMI we used. It was found that HIV positive children were smaller height, had less weight and had lower BMI than the negative counterparts. In HIV positive males, the mean weight, height and BMI was found to be 36.6±1.0, 143.2±0.9 and 17.36±1.1 respectively. In HIV positive females, the mean weight, height and BMI was found to be 37.4±0.9, 144.6±0.9 and 17.89±0.7 respectively. When HIV infected children compared with HIV negative counterparts it was found that there was significant difference in weight for age, height for age and body mass index with $p < 0.001$; in spite of getting the same nutrition and diet they still were found to be anthropometrically lower than their HIV negative counterparts.

However, the monthly monitoring has helped reduce the death rate. There have been no deaths in the last 2 years since the study was started. We also interestingly found, as a fall out from the study, that due to the close monitoring and follow-up there were-

- fewer inpatient admissions in the group
- no deaths in this group in the last 2 years from June 2015 to June 2017
- fewer cases of tuberculosis which the commonest OI among PLHA
- fewer skin infections like scabies and pediculosis.

Discussion

Major improvement in access to antiretroviral therapy (ART) over the years and better nutrition has made it possible for children infected with human immunodeficiency virus (HIV) to reach adolescence [14]. It is the lack of one or both of these that bring children and adolescents to a health care facility. The HIV-infected adolescents, unlike their HIV negative counterparts, are more likely to be admitted with chronic complications including stunted growth or pubertal delay [15].

In this study, we established that growth among HIV infected children is different from that of reference population amongst the institutionalized subjects. In this study children infected with HIV infection had delayed growth as compared to the reference population.

A study of growth patterns among HIV-positive children in Europe demonstrated that, even in a high-resource setting, growth faltering is apparent among HIV infected children affecting both weight and height (although weight differences were more obvious), and overall differences between HIV-positive and HIV-negative children increased with age. Children with more advanced HIV disease also had much poorer growth at all ages [16, 17]. Common problems for HIV-positive children include poor growth compared to peers and a higher risk of becoming malnourished. Reductions in length or height of HIV-positive children are common, and poor growth (slow weight gain or decreasing weight) is often apparent even before opportunistic infections or other AIDS symptoms appear [18].

Conclusion

Children with HIV and AIDS have significantly poorer growth, as evidenced by shorter height and lower weight, even when they live in same environment and are provided same nourishment as their HIV negative counterparts.These findings suggest that monitoring of growth in this population cannot be overemphasized.

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