

## Persistence of Stunting After Highly Active Antiretroviral Therapy in HIV-Infected Children in South India

After one year of antiretroviral treatment in 49 HIV-infected children compared to 53 children without, weight for age improved significantly and was highly correlated with baseline immune status and CD4% increase but height for age did not change. Stunting is a common feature of pediatric HIV, both on and off HAART.

**Key words:** *Anti-retroviral treatment, Children, HIV, Stunting, Undernutrition.*

Growth failure is a common feature of children with HIV-1 infection [1,2], and the only effective treatment is to treat the infection [3]. We investigated the effect of highly active antiretroviral treatment (HAART) on growth and immunologic parameters in HIV-infected children over a period of one year. We also examined the impact of baseline immune status on post-HAART improvement in under-weight, stunting and wasting.

A cohort of HIV-infected children was followed at the Tuberculosis Research Centre clinic, Madurai, every three months with clinical monitoring and every 6 months with laboratory investigations including complete blood counts and CD4, CD8 counts. Nutritional counseling, iron, folic acid and multivitamin supplements and cotrimoxazole prophylaxis were provided to all children. Children were referred to the nearest government antiretroviral treatment centre, where they were initiated on treatment as per NACO guidelines [4]. The study was approved by the TRC Institutional Ethics committee.

Of 102 children, 49 were started on treatment (HAART group) after assessment at the ART centre while 53 were considered not to require ART (non HAART group). The median age of the entire group was 74 months (>60% between 5-10 years). The prevalence of underweight (WAZ <-2) and wasting

(WHZ<-2) at baseline in the HAART group (81% and 56%) was significantly higher than in the non-HAART group (59% and 29%) while rates of stunting (HAZ<-2) were not different (52% and 50%, respectively). ART eligible children had lower baseline median CD4% and CD4 counts indicating their worse immune status.

The change in nutritional status at one year was compared using proportions and median values (**Table I**). While WAZ, WHZ and BMI improved significantly in the children on HAART, rates or degree of stunting did not change. Children who were initiated on HAART at CD4>15% had less severe stunting after one year than those at CD4 <15%. WAZ and BMI worsened in the group not started on HAART. The correlation coefficient between increase in CD4% and percent increase in weight at one year was 0.35,  $P<0.02$ .

While we found an overall beneficial effect of HAART on growth and immunologic parameters, a substantial proportion of children were under-nourished even at the end of one year and stunting persisted. It is possible that height takes longer to show catch-up growth and that a longer follow-up would show improvement. However, we showed earlier that stunting and undernutrition occur early in the course of HIV [5], and the negative impact of chronic infection and malnutrition on height may be irreversible.

Most children in this cohort were over 5 years of age and belonged to the lower socioeconomic strata. However, we believe that our results are generalizable to the population of HIV-infected children currently accessing care through the government ART centers in India as well as in other resource-poor countries, because of the similar high prevalence of malnutrition described in other cohorts [6-9]. Strategies to prevent irreversible stunting such as earlier initiation of HAART and/or nutritional supplementation must be explored.

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**TABLE I** NUTRITIONAL STATUS AT BASELINE AND THE END OF 1 YEAR IN CHILDREN ON HAART AND THOSE NOT ELIGIBLE

Growth parameter	HAART (n = 49)		Non-HAART (n = 53)	
	Baseline	1 year	Baseline	1 year
Weight for age 'Z' score				
Median (IQR)	-2.84 (-3.25, -2.21)	-2.18* (-2.80, -1.72)	-1.85 (-2.82, -1.28)	-2.12 (-2.48, -1.68)
< -2 SD (%)	82	57*	43	57**
Height for age 'Z' score				
Median (IQR)	-2.02 (-3.38, -0.68)	-2.27 (-3.35, -1.16)	-1.76 (-3.18, -1.10)	1.80 (-2.84, -1.22)
< -2 SD (%)	50	62	46	46
Weight for height 'Z' score				
Median (IQR)	-2.41 (-3.12, -1.63)	-1.08 (-1.75, -0.26)	-1.08 (-1.50, -0.07)	-1.32 (-1.78, -0.92)
< -2 SD (%)	59	12*	17	17
BMI 'Z' score				
Median (IQR)	-3.04 (-5.24, -2.24)	-1.50* (-3.14, -1.50)	-1.15 (-2.13, -0.37)	-1.73 (-2.54, -0.98)
< -2 SD (%)	79	42*	27	42**
CD4 cell%				
Median (IQR)	14 (8.0, 18.0)	30* (25.0, 36.0)	23 (18.5, 30.5)	25** (21.0, 33.5)
CD4 cell count				
Median (IQR)	408 (195, 896)	1138* (726, 1506)	946 (591.5, 1315.0)	863 (542.5, 1253.0)
Hemoglobin				
Median (IQR)	10.0 (8.85, 11.35)	11.7* (10.10, 12.40)	11.2 (9.8, 11.8)	11.5* (10.92, 12.2)

\*  $P < 0.01$  and \*\*  $P < 0.05$ ; median values compared using Wilcoxon Signed Rank Test, proportions compared using chi square test.

*Acknowledgments:* Dr C Padmapriyadarsini and Dr Sheik Iliayas for their valuable contributions at various stages of the study.

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