Nutritional status of children living with HIV

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An Overview

• Nutrition and HIV: An introduction
• The HAART era: From the nutrition perspective
• The situation in Asia
• The way forward
Nutrition and HIV

• Good nutrition plays an important role in the health of the immune system and its ability to fight infections

• Malnutrition can have adverse, even devastating effects upon the antigen-specific arms of the immune system, as well as on many of the more generalized mechanisms used for host defence (Beisel, 1996; Scrimshaw, Taylor & Gordon, 1968)

• Weight loss, malnutrition, and wasting syndrome have long been associated with Human Immunodeficiency Virus (HIV) (Heller & Shattuck, 1997; Miller, 1996)
Nutrition and HIV

• Both malnutrition and HIV have deleterious effects on the immune system:
  – Reduced CD4 and CD8 T-lymphocyte numbers
  – Delayed cutaneous sensitivity
  – Reduced bacteriocidal properties
  – Impaired serological response after immunizations

(Colecraft, 2008)
Effects of HIV on Nutrition

- Increased energy requirement
- Increased nutrient requirement
- Recurrent secondary infections
- Anorexia, oral pathology
- Frequent diarrhea episodes
- Adverse drug effects
- Mal-absorption
- Inflammatory response

Adopted from: Fanta, 2003
Effects of Nutrition on HIV

- Immune function
- Healing process
- Cost of treatment
- Disease progression

Adopted from: Fanta, 2003
Children living with HIV

• Most HIV+ children acquired the virus
  – during pregnancy, at delivery, or through breastfeeding
  – some are infected through HIV-contaminated blood or medical equipment
  – some are infected through child sexual abuse

• By 2009 more than 2.5 million [1.7 million – 3.4 million] children were estimated to be living with HIV, about 6.4% of them in Asia

(Source: UNAIDS, 2010)
Nutrition and HIV

• Providing adequate nutrition for children living with HIV is important because:
  – it provides the greatest opportunity for normal growth and development to take place
  – it supports the optimal functioning of the immune system
The HAART era: From the nutrition perspective

- In clinical setting, HIV treatment include the administration of **highly active antiretroviral therapy (HAART)**
- Initiation of HAART among children living with HIV has transformed HIV from an acute infection to a **chronic morbidity**
  - suppresses the **viral load**
  - reduces the incidence of **opportunistic infections**
  - extends the **life expectancy** of the children
The HAART era

- In a US based study
  - use of Protease Inhibitors in HIV infected children not only decreased viral load but also had a positive effect on growth parameters including weight, weight for height and muscle mass (Miller et al., 2001)
Use of Protease inhibitors promotes positive growth in a multivariate model

<table>
<thead>
<tr>
<th>Growth Endpoint</th>
<th>Overall PI Effect (SE)</th>
<th>P Value</th>
<th>Ritonavir Effect (SE)</th>
<th>P Value</th>
<th>Indinavir Effect (SE)</th>
<th>P Value</th>
<th>Nelfinavir Effect (SE)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height z score</td>
<td>0.17 (0.10)</td>
<td>.10</td>
<td>0.30 (0.13)</td>
<td>.024</td>
<td>-0.07 (0.13)</td>
<td>.59</td>
<td>0.08 (0.11)</td>
<td>.48</td>
</tr>
<tr>
<td>Weight z score</td>
<td>0.46 (0.11)</td>
<td>&lt;.001</td>
<td>0.41 (0.12)</td>
<td>.001</td>
<td>0.42 (0.21)</td>
<td>.049</td>
<td>0.45 (0.11)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Weight-for-height z score</td>
<td>0.49 (0.20)</td>
<td>.016</td>
<td>0.31 (0.31)</td>
<td>.32</td>
<td>0.88 (0.39)</td>
<td>.023</td>
<td>0.53 (0.18)</td>
<td>.003</td>
</tr>
<tr>
<td>AMC percentile</td>
<td>11.5 (3.8)</td>
<td>.003</td>
<td>8.2 (5.7)</td>
<td>.15</td>
<td>12.8 (4.7)</td>
<td>.006</td>
<td>12.1 (3.6)</td>
<td>.001</td>
</tr>
<tr>
<td>TSF percentile</td>
<td>1.9 (4.0)</td>
<td>.63</td>
<td>-2.8 (5.4)</td>
<td>.60</td>
<td>-1.4 (5.7)</td>
<td>.80</td>
<td>5.3 (4.9)</td>
<td>.28</td>
</tr>
</tbody>
</table>

* Model was adjusted for sex, age, Tanner stage, race, route of infection, CDC stage, HIV RNA PCR, CD4 z score, time with HIV infection, Megace use, NRTI, NNRTI, and energy intake.

Source: Miller et al., 2001
The HAART era

• In a prospective multicenter study conducted in the Netherlands
  • the initiation of HAART has **positive effect** on the **growth** of HIV-1-infected children. This effect is sustained for at least **96 weeks** (Verweel et al., 2002)
Sustained positive growth over 96 weeks among virologic responders towards HAART treatment
BMI z-score change among virologic responders towards HAART treatment
The HAART era

- A study conducted among 173 HIV-1-infected children initiating HAART at an HIV treatment clinic in Kenya
  - Following HAART initiation, younger children had more rapid catch-up to the population-average weight of their peers than older children, demonstrating growth benefit of earlier HAART

  (McGrath, Chung, Richardson, Benki-Nugent, Warui, & John-Stewart, 2011)
Kaplan–Meier estimates of the cumulative proportion of HIV-1-infected children with catch-up growth (Z-score ≥0) by age at HAART initiation

(McGrath et al., 2011)
The HAART Era

• However, these successes pose new challenges as perinatally HIV-infected youth survive into adulthood.
  – maintaining adherence to long-term, likely life-long therapy;
  – selecting successive antiretroviral drug regimens, given the limited availability of paediatric formulations and the lack of pharmacokinetic and safety data in children;
  – overcoming extensive drug resistance in multi-drug-experienced children
  – managing the side effects as a result of long-term use of the medications
Nutrition-related side effects

• Pediatric HIV care now focuses on morbidity related to long-term HIV infection and its treatment
• Side effects as a result of the treatment are common
• Mostly have an adverse effect on the nutritional status
The common side effects* include:

- Nausea
- Vomiting
- Diarrhea
- Anemia
- Depression
- Insomnia
- Dyslipidemia
- Lipidystrophy
- Osteoporosis

*Varies according to the types of HAART regimen used

Source: Montessori et al., 2004
• A comparison study between 30 HIV+ children and 30 healthy children with mean age of 9.1 years in Sao Paolo, Brazil noted that:
  – 53.3% of the HIV+ children had lipodystrophy, and dyslipidemia was detected in 60% and 23% of subjects with HIV and control subjects, respectively (p = 0.004).
  – A higher prevalence of retinol deficiency (60% versus 26.7%, p = 0.009) and b-carotene deficiency (23.3% versus 3.3%, p = 0.026) was found in the group with HIV than in the control group

(Beraldo Battistini et al., 2009)
Dyslipidemia, retinol and b-carotene deficiency evidenced in HIV+ children on HAART

<table>
<thead>
<tr>
<th>Variable</th>
<th>AIDS (n = 30)</th>
<th>Controls (n = 30)</th>
<th>P†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retinol* (n = 60)</td>
<td>&lt;1.05 μmol/L</td>
<td>18 (60%)</td>
<td>8 (26.7%)</td>
</tr>
<tr>
<td>Lycopene (n = 60)</td>
<td>&lt;0.20 μmol/L</td>
<td>8 (26.7%)</td>
<td>4 (13.3%)</td>
</tr>
<tr>
<td>β-Carotene (n = 60)</td>
<td>&lt;0.10 μmol/L</td>
<td>7 (23.3%)</td>
<td>1 (3.3%)</td>
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<tr>
<td>LDL cholesterol (n = 60)</td>
<td>≥130 mg/dL</td>
<td>6 (20%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>HDL cholesterol (n = 60)</td>
<td>≤45 mg/dL</td>
<td>4 (13.3%)</td>
<td>1 (3.3%)</td>
</tr>
<tr>
<td>Triacylglycerols (n = 60)</td>
<td>≥130 mg/dL</td>
<td>13 (43.3%)</td>
<td>7 (23.3%)</td>
</tr>
<tr>
<td>TBARS (n = 55)</td>
<td>&gt;5.0 nmol/L</td>
<td>1 (3.8%)</td>
<td>4 (13.7%)</td>
</tr>
<tr>
<td>HOMA-IR (n = 60)</td>
<td>≥3</td>
<td>1 (3.3%)</td>
<td>2 (6.7%)</td>
</tr>
</tbody>
</table>

AIDS, acquired immunodeficiency syndrome; HDL, high-density lipoprotein; HOMA-IR, homeostasis model assessment for insulin resistance; LDL, low-density lipoprotein; TBARS, thiobarbituric acid-reactive substances
* Retinol adjusted for nutritional state (P = 0.042).
† Level of significance of chi-square test.

Beraldo Battistini et al., 2009
Management of side effects is crucial

• For improved drugs efficacy
  – studies noted that HIV+ children with good nutritional status have better compliance to drugs regimen
  – they also responded better to treatment (Sutcliffe, van Dijk, Bolton, Persaud, & Moss, 2008)

• Maintenance of good nutritional status

• Increased tolerance to drugs over the long term
Nutritional Data from several Asian countries
In India,

• A study among 248 HIV-infected children aged 1–12 years attending three outpatient clinics in rural South India highlighted that:
  – the proportion of underweight and stunted children in the infected children was 55% and 46% respectively

(Shet et al., 2009)
In Thailand,

- A study among 388 HIV/AIDS orphans who were maternal or paternal or double orphans aged 6–12 years old indicated that:
  - nearly 50% of infected orphans were rather short
  - 42% were underweight and light

(Isaranurug & Chompikul, 2009)
In Malaysia,

- A local study conducted in the Klang Valley among 95 HIV-infected children on HAART showed that:
  - 31.0% were overweight
  - 35.4% were stunted
  - 10.4% had deficiency in vitamin A
  - 3 in 10 had elevated total cholesterol level
  - 10.5% had low HDL-C level

(Mohd Nasir et al., 2010)
Summary

• The prevalence of poor growth is still widespread in this region even with the increased availability of HAART

• Abnormalities in growth may be multifactorial and these include:
  – HIV infection
  – inadequate dietary intake
  – presence of acute infections
  – loss of appetite
  – Hypercatabolism
  – malabsorption

• This demonstrates that treatment, care and support should be multi-faceted
The Way Forward

• A holistic approach should be incorporated into the current settings of treatment, care and support with the following nutritional goals:
  • Provide well-baby care and monitor growth of all children born to HIV-infected mothers
  • Follow the same nutritional recommendations as for all young children with necessary adjustment as recommended by WHO, 2003
  • Introduce solid foods gradually to match the age and developmental characteristics of the child
  • Ensure that the young child’s diet contains as much variety as possible to increase the intake of essential vitamins and minerals
Con’t.

• **Assess the child’s nutritional status regularly** to ensure adequate growth
  – body weight, height should be monitored regularly *(at least monthly)*
  – arm circumference and triceps skin fold should be monitored periodically if possible

• **Review the child’s diet** at every well-child and sick-child health visit
  – Conditions affecting appetite and food intake should be discussed and treated as appropriate. *Advice on how to improve the diet*, taking into consideration the child’s age, local resources and the family circumstances, should be given
Con’t.

• Promptly treat all secondary infections, such as tuberculosis, oral thrush, persistent diarrhea, pneumonia
  – The nutritional impact of these infections should be minimized by maintaining food and fluid intake to the degree possible

• Use of multivitamin supplementation whenever necessary
Conclusion

- Early nutritional screening and optimum nutritional support in the treatment, care and support system for children living with HIV may serve as a possible approach:
  - to alleviate the side effects of the medications,
  - improve their nutritional status and growth
  - and eventually lead to a better quality of life for the children
CHILD SURVIVAL THROUGH EARLY DIAGNOSIS
Thank you
References


