<table>
<thead>
<tr>
<th>Adverse Effects</th>
<th>Associated ARVs</th>
<th>Onset/Clinical Manifestations</th>
<th>Estimated Frequency</th>
<th>Risk Factors</th>
<th>Prevention/Monitoring</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lipodystrophy (Fat Maldistribution)</td>
<td>See below for specific associations.</td>
<td>Onset: Trunk and limb fat are the first sign; peripheral fat wasting may not appear for 12 months–24 months after ART initiation.</td>
<td>Frequency is low (&lt;5%) with current regimens.</td>
<td>Genetic predisposition Puberty HIV-associated inflammation Older age Longer duration of ART Body habitus</td>
<td>Prevention: Initiating a calorically appropriate, low-fat diet and exercise Monitoring: BMI measurement Body circumference and waist-hip ratio</td>
<td>Physicians should perform a regimen review and consider changing the regimen when lipodystrophy occurs. Improvement in fat maldistribution following a regimen change is variable. Improvement may occur after several months or years, or it may not occur at all.</td>
</tr>
</tbody>
</table>
| Central Lipohypertrophy or Lipo-accumulation | Can occur in the absence of ART, but these conditions are most often associated with the use of PIs and EFV. | Presentation: Central fat accumulation with increased abdominal girth, which may include a dorsocervical fat pad (buffalo hump), Gynecomastia in males or breast hypertrophy in females, particularly with the use of EFV. | ≤5% with current regimens | Obesity before initiation of therapy Sedentary lifestyle | Prevention: Initiating a calorically appropriate, low-fat diet and exercise Monitoring: BMI measurement Body circumference and waist-hip ratio | Counsel patient on lifestyle modification and dietary interventions (e.g., maintaining a calorically appropriate, healthy diet that is low in saturated fats and simple carbohydrates, and starting an exercise regimen, especially strength training). Recommend smoking cessation (if applicable) to decrease future CVD risk. Consider using an INSTI instead of a PI or EFV. 
Data are Insufficient to Allow the Panel to Safely Recommend Use of Any of the Following Modalities in Children: Recombinant human growth hormone Growth hormone-releasing hormone Metformin Thiazolidinediones Recombinant human leptin Anabolic steroids Liposuction |
### Table 15h. Antiretroviral Therapy-Associated Adverse Effects and Management Recommendations—Lipodystrophy, Lipohypertrophy, Lipatrophy  *(Last updated April 16, 2019; last reviewed April 16, 2019)* (page 2 of 2)

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<td>Facial/Peripheral Lipoatrophy</td>
<td>Most cases are associated with the use of ZDV, a thymidine analogue NRTI.</td>
<td>Presentation:  • Thinning of subcutaneous fat in the face, buttocks, and extremities, measured as a decrease in trunk/limb fat by DXA or triceps skinfold thickness. Preservation of lean body mass distinguishes lipoatrophy from HIV-associated wasting.</td>
<td>&lt;5% with currently used regimens</td>
<td>Underweight before ART</td>
<td>Prevention:  • Limit the use of ZDV. Monitoring:  • Patient self-report and physical examination are the most sensitive methods of monitoring lipoatrophy.</td>
<td>Replace ZDV with another NRTI if possible. Data are Insufficient to Allow the Panel to Safely Recommend Use of Any of the Following Modalities in Children:  • Injections of poly-L-lactic acid  • Recombinant human leptin  • Autologous fat transplantation  • Thiazolidinediones</td>
</tr>
</tbody>
</table>

**Key to Acronyms:** ART = antiretroviral therapy; ARV = antiretroviral; BMI = body mass index; CVD = cardiovascular disease; DXA = dual energy x-ray absorptiometry; EFV = efavirenz; INSTI = integrase strand transfer inhibitor; NRTI = nucleoside reverse transcriptase inhibitor; PI = protease inhibitor; ZDV = zidovudine

### References

See the archived version of **Supplement III, February 23, 2009, Pediatric Guidelines** on the **AIDSinfo website** for a more complete discussion and reference list.

### General Reviews


**Associated ARVs/Etiology**


**Management**


