Table 15j. Antiretroviral Therapy-Associated Adverse Effects and Management Recommendations—Osteopenia and Osteoporosis  *(Last updated April 16, 2019; last reviewed April 16, 2019)*

<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>Osteopenia and Osteoporosis</td>
<td>Any ART regimen</td>
<td>Onset: Any age; decrease in BMD is usually seen soon after initiation of ART. Presentation: Usually asymptomatic. Rarely presents as osteoporosis, a clinical diagnosis defined by evidence of bone fragility (e.g., fracture with minimal trauma)</td>
<td>Longer duration and greater severity of HIV disease. Vitamin D insufficiency/deficiency. Delayed growth or pubertal delay. Low BMI. Lipodystrophy. Non-black race. Smoking. Prolonged systemic corticosteroid use. Medroxyprogesterone use. Lack of weight-bearing exercise.</td>
<td>BMD z Score Less Than -2.0. &lt;10% in U.S. cohorts. Approximately 20% to 30% in international cohorts.</td>
<td>Prevention: Ensure that the patient has sufficient intake and levels of both calcium and vitamin D. Encourage weight-bearing exercise. Minimize modifiable risk factors (e.g., smoking, low BMI, use of steroids or medroxyprogesterone). Use TAF instead of TDF whenever possible. Use TDF with EFV or an un-boosted INSTI. When using TDF in a regimen, consider supplementing with vitamin D3 at a daily dose of 1,000–4,000 IU. Monitoring: Assess nutritional intake (calcium, vitamin D, and total calories). Strongly consider measuring serum 25-OH-vitamin D levels, particularly in patients who are taking ARV drugs of concern.* Obtain a DXA.**</td>
<td>Same options as for prevention. Consider changing the ARV regimen (e.g., switching from TDF to TAF, and/or from LPV/r to EFV or an un-boosted INSTI whenever possible). Treat patient with vitamin D3 to raise serum 25-OH-vitamin D concentrations to &gt;30 ng/mL. Vitamin D3 levels should be monitored in patients who are receiving a daily dose of vitamin D3 &gt;4,000 IU. The role of bisphosphonates in managing osteopenia and osteoporosis in children with HIV has not been established.</td>
</tr>
</tbody>
</table>

---

* Some experts periodically measure 25-OH-vitamin D. This is especially important in children and adolescents with HIV who live in urban areas; the prevalence of vitamin D insufficiency is high in that population.

** Until more data are available on the long-term effects of TDF on bone mineral acquisition in childhood, DXA scanning is not usually recommended for children who are being treated with TDF. Obtaining a DXA could be considered for adolescent women who are receiving TDF and medroxyprogesterone and for children with indications that are not uniquely related to HIV infection (such as cerebral palsy).

**Key to Acronyms:** ART = antiretroviral therapy; ARV = antiretroviral; BMD = bone mineral density; BMI = body mass index; COBI = cobicistat; DXA = dual-energy x-ray absorptiometry; EFV = efavirenz; INSTI = integrase strand transfer inhibitor; IU = international unit; LPV/r = lopinavir/ritonavir; PI = protease inhibitor; RTV = ritonavir; TAF = tenofovir alafenamide; TDF = tenofovir disoproxil fumarate.
References


