Guidelines for the Use of Antiretroviral Agents in Pediatric HIV Infection

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### Dosing Recommendations

**Neonate and Infant Dose:**
- Dolutegravir is not approved for use in neonates/infants.

**Child (Weighing <20 kg) Dose:**
- No dosing recommendations can be made for children weighing <20 kg.

**Child and Adolescent (Weighing ≥20 kg to <40 kg) Dose:**
- The Panel on Antiretroviral Therapy and Medical Management of Children Living with HIV (the Panel) recommends an investigational dose of dolutegravir 50 mg once daily for children and adolescents weighing ≥20 kg who are antiretroviral (ARV)-naive or ARV-experienced (but integrase strand transfer inhibitor [INSTI]-naive) and who are not being treated with uridine diphosphate glucuronyl transferase (UGT) 1A1 or cytochrome P450 3A (CYP3A) inducers or inhibitors.
- Dolutegravir is not approved by the Food and Drug Administration (FDA) for use in children weighing <30 kg. However, interim data from ongoing trials that indicate that using the FDA-approved dose of dolutegravir 35 mg in patients weighing ≥30 kg to 40 kg may result in suboptimal trough concentrations, and additional data supports the 50-mg dose recommended by the Panel (see text). Using a 50-mg dose also avoids the need to administer two tablets with different strengths (i.e., a 10-mg tablet plus a 25-mg tablet).

### Selected Adverse Events

- Insomnia
- Headache
- Neuropsychiatric symptoms (i.e., depression and/or suicidal thoughts or actions), especially in patients with a history of psychiatric illness
- Rare cases of hypersensitivity reactions, including rash and drug reaction (or rash) with eosinophilia and systemic symptoms, constitutional symptoms, and organ dysfunction (including liver injury) have been reported.

### Special Instructions

- Dolutegravir may be taken without regard to meals.
- Dolutegravir should be taken 2 hours before or 6 hours after taking cation-containing antacids or laxatives, sucrafate, oral iron supplements, oral calcium supplements, or buffered medications.
- In patients who have difficulty swallowing tablets whole, 10-mg, 25-mg, and 50-mg tablets may be either split into halves followed by immediate ingestion of both halves of the tablet, or crushed and added to a small amount of semisolid food or liquid, all of which should be consumed immediately.
- The efficacy of dolutegravir 50 mg twice daily is reduced in patients with certain combinations of INSTI-resistance mutations (see the Resistance section below).
### Guidelines for the Use of Antiretroviral Agents in Pediatric HIV Infection

#### Patients should be tested for hepatitis B virus (HBV) infection prior to use of Triumeq or Dovato. Lamivudine-resistant HBV variants have been reported in patients who received lamivudine-containing ARV regimens. Patients with HBV/HIV coinfection who receive Dovato will require additional treatment for chronic HBV infection. Severe exacerbation of hepatitis can occur in patients with HBV/HIV coinfection who discontinue lamivudine.

#### Metabolism/Elimination

- UGT1A1 and CYP3A substrate: Drugs that induce these enzymes and transporters may decrease plasma concentrations of dolutegravir. **Drugs that inhibit these enzymes may increase dolutegravir plasma concentrations.**

#### Dolutegravir Dosing in Patients with Hepatic Impairment:

- No dose adjustment is necessary in patients with mild or moderate hepatic impairment. Due to a lack of data, dolutegravir is not recommended for use in patients with severe hepatic impairment.
- Dolutegravir decreases tubular secretion of creatinine and increases measured serum creatinine, without affecting glomerular filtration.

#### Dolutegravir Dosing in Patients with Renal Impairment:

- No dose adjustment is required in INSTI-naive patients with mild, moderate, or severe renal impairment, or in INSTI-experienced patients with mild or moderate renal impairment.
- Use dolutegravir with caution in INSTI-experienced patients with severe renal impairment (creatinine clearance <30 mL/min), because dolutegravir concentrations will be decreased. The cause of this decrease is unknown.

### Child and Adolescent (Weighing ≥40 kg) and Adult Dose

<table>
<thead>
<tr>
<th>Population</th>
<th>Recommended Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARV-naive or ARV-experienced/INSTI-naive patients</td>
<td>Dolutegravir 50 mg once daily</td>
</tr>
<tr>
<td>ARV-naive or ARV-experienced/INSTI-naive patients who are also receiving one of the following potent UGT1A1/CYP3A inducers: efavirenz, fosamprenavir/ritonavir, tipranavir/ritonavir, or rifampin</td>
<td>Dolutegravir 50 mg twice daily</td>
</tr>
<tr>
<td>INSTI-experienced patients with any INSTI-associated resistance substitutions or clinically suspected INSTI resistance</td>
<td>Dolutegravir 50 mg twice daily&lt;sup&gt;a,b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup> The 50-mg, twice-daily dose should not be used in patients weighing <40 kg.

<sup>b</sup> These patients should receive drug combinations that do not include metabolic inducers when possible.

#### [Dovato] Dolutegravir/Lamivudine

**Adult Dose:**

- One tablet once daily with or without food as a complete regimen in ARV-naive adults with no known substitutions associated with resistance to the individual components of Dovato.
- Dovato is not approved for use in children or adolescents. See the Simplification of Treatment section below.

#### [Juluca] Dolutegravir/Rilpivirine

**Adult Dose:**

- One tablet once daily with a meal as a complete regimen to replace the current ARV regimen in patients who have been virologically suppressed (HIV RNA <50 copies/mL) on a stable ARV regimen for at least 6 months with no history of treatment failure and no known substitutions associated with resistance to the individual components of Juluca.
- Juluca is not approved for use in children or adolescents. See the Simplification of Treatment section below.

#### [Triumeq] Abacavir/Dolutegravir/Lamivudine

**Child and Adolescent (Weighing ≥25 kg) and Adult Dose:**

- One tablet once daily with or without food.
- For use in patients who are ARV-naive or ARV-experienced (but INSTI-naive) and who are not being treated with UGT1A1 or CYP3A inducers.
- See the abacavir section for special instructions about testing for abacavir hypersensitivity.
- The FDA-approved dose for pediatric patients weighing ≥40 kg is one tablet once daily.
Drug Interactions (see also the Adult and Adolescent Antiretroviral Guidelines and the HIV Drug Interaction Checker)

• Metabolism: Dolutegravir is a uridine diphosphate glucuronyl transferase (UGT) 1A1 and cytochrome P450 3A (CYP3A) substrate and may require dose adjustments when administered with UGT1A-modulating or CYP3A-modulating medications. Because etravirine significantly reduces plasma concentrations of dolutegravir, dolutegravir should not be administered with etravirine without coadministration of atazanavir/ritonavir, darunavir/ritonavir, or lopinavir/ritonavir, which counteract this effect on dolutegravir concentrations. Dolutegravir should not be administered with nevirapine because of insufficient data on interactions between these drugs.

• Atazanavir is an inhibitor of UGT1A1. In a recent pharmacologic survey of adult patients who were receiving dolutegravir, patients who also received atazanavir had plasma concentrations of dolutegravir that were two-fold to four-fold higher than those of patients who received other antiretroviral (ARV) drugs.2

• Before administering dolutegravir, clinicians should carefully review a patient’s medication profile for potential drug interactions.

Major Toxicities

• More common: Insomnia and headache.

• Less common (more severe): Hypersensitivity reactions characterized by rash, constitutional findings, and sometimes organ dysfunction. Neuropsychiatric symptoms, especially in patients with a history of psychiatric illness. Multiple post-marketing reports note neuropsychiatric adverse effects (AEs) following initiation of dolutegravir-based therapy in adults.3,4

• Immune reconstitution inflammatory syndrome (IRIS): In retrospective observational studies, severe cases of IRIS that required hospitalization appeared to be more frequent in patients who presented with advanced disease and who initiated treatment with integrase inhibitors, particularly dolutegravir.5,6 This phenomenon is presumed to be linked to the rapid decline in HIV RNA observed in patients receiving integrase inhibitor therapy.

• Rare: Hepatotoxicity has been reported; two cases of liver injury were presumed to be related to the use of dolutegravir. One of these cases required liver transplantation.7,8

• Rare: A single case of drug reaction (or rash) with eosinophilia and systemic symptoms (DRESS) has been reported.9

• Rare: In a prospective surveillance study of birth outcomes among pregnant women on antiretroviral therapy (ART) in Botswana, an increased number of neural tube defects was observed among infants born to women who were receiving dolutegravir at the time of conception.10 Further data collection is ongoing, and additional analyses from this study and from other investigations will be required to confirm this potential safety signal. Before patients become sexually active, pediatric and adolescent providers should discuss this potential risk of neural tube defects with patients who are receiving or initiating dolutegravir and their caregivers. Specific recommendations about the initiation and use of dolutegravir in women of childbearing potential and in pregnant women are available in the Adult and Adolescent Antiretroviral Guidelines (see Table 6b and Adolescents and Young Adults with HIV) and in the Perinatal Guidelines (see Teratogenicity and Recommendations for Use of Antiretroviral Drugs During Pregnancy).

Resistance

The International Antiviral Society-USA (IAS-USA) maintains a list of updated resistance mutations, and the Stanford University HIV Drug Resistance database offers a discussion of each mutation.

The efficacy of dolutegravir 50 mg twice daily is reduced in patients with the integrase strand transfer inhibitor (INSTI)-resistance Q148 substitution plus two or more additional INSTI-resistance mutations.
Pediatric Use

Approval

Dolutegravir is approved by the Food and Drug Administration (FDA) for use in combination with other ARV drugs in children and adolescents weighing ≥30 kg who are treatment-naive or treatment-experienced but INSTI-naive at dolutegravir doses that are lower than the adult dose, although the Panel on Antiretroviral Therapy and Medical Management of Children Living with HIV (the Panel) recommends using the adult dose in children and adolescents weighing ≥20 kg (see Appendix A, Table 2). The World Health Organization (WHO) also recommends using dolutegravir at the adult dose of 50 mg in children weighing ≥20 kg. These recommendations are based on pharmacokinetic (PK) and safety data from two ongoing clinical trials (IMPAACT P1093 and ODYSSEY) that are described below. The combination tablet abacavir/dolutegravir/lamivudine (Triumeq) is approved by the FDA for use in children and adolescents weighing ≥40 kg, although the Panel recommends using it in children and adolescents weighing ≥25 kg (see Appendix A, Table 2). The combination tablets dolutegravir/rilpivirine (Juluca) and dolutegravir/lamivudine (Dovato) are not approved by the FDA for use in children or adolescents at the time of this review, and the Panel does not recommend using these drugs.

Table A. Comparison of FDA, EMA, WHO, and Panel Dosing Recommendations for Dolutegravir Film-Coated Tablets

<table>
<thead>
<tr>
<th>Weight (kg)</th>
<th>FDA-Recommended Dose (mg)a</th>
<th>EMA-Recommended Dose (mg)b</th>
<th>WHO-Recommended Dose (mg)c</th>
<th>Panel-Recommended Dose (mg)c</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 to &lt;20</td>
<td>NRS</td>
<td>20</td>
<td>NRS</td>
<td>NRS</td>
</tr>
<tr>
<td>20 to &lt;30</td>
<td>NRS</td>
<td>25</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>30 to &lt;40</td>
<td>35d</td>
<td>35</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>≥40</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

a All doses are administered once daily.

b Administered as two 10-mg film-coated tablets.

c Administered as one 25-mg film-coated tablet and one 10-mg film-coated tablet.

d Weight categories have been altered to fit this table. Both WHO and the Panel recommend DTG 50 mg for children weighing 20 kg to <40 kg.

Key: DTG = dolutegravir; EMA = European Medicines Agency; FDA = Food and Drug Administration; NRS = no recommendation specified; Panel = Panel on Antiretroviral Therapy and Medical Management of Children Living with HIV; WHO = World Health Organization

Formulation Differences: Film-Coated Tablet Compared to Dispersible Tablet

Dolutegravir is currently available as a film-coated tablet. A dispersible tablet has been developed and is being studied for use in those who cannot swallow tablets. The dispersible tablet has 60% to 80% greater bioavailability in adults than the film-coated tablet, so doses studied using the dispersible tablet cannot be directly compared to those using the film-coated tablet. The drug exposure of the 50-mg film-coated tablet is approximately equal to the drug exposure of 30 mg of dolutegravir administered as dispersible tablets. A previously investigated dolutegravir granule formulation is no longer being studied.

Efficacy and Pharmacokinetics

Children and Adolescents Aged ≥12 Years and Weighing ≥40 kg

IMPAACT P1093 is an ongoing open-label trial of dolutegravir in children with HIV. Initial FDA approval of dolutegravir for use in adolescents weighing ≥40 kg was based on data from 23 treatment-experienced, INSTI-naive adolescents. Intensive PK evaluations were performed on the first 10 participants, nine of whom weighed ≥40 kg and received dolutegravir 50 mg and one of whom weighed 37 kg and received dolutegravir 35 mg. These doses resulted in exposures comparable to those seen in adults receiving 50 mg once daily. Nine of 10 participants achieved HIV RNA concentrations <400 copies/mL at Week 4 (optimal
background therapy was added 5 days–10 days after dolutegravir was started). An additional 13 participants were then enrolled for evaluation of long-term outcomes. At 48 weeks, 61% of participants had achieved HIV RNA concentrations <50 copies/mL. No safety or tolerability concerns were identified. By Week 144, 39% and 30% of participants had achieved HIV RNA concentrations <400 copies/mL and <50 copies/mL, respectively. All participants who experienced virologic failure were nonadherent.

Additional long-term safety and efficacy data for this age/weight group comes from a French, retrospective, multicenter cohort study that evaluated 50 adolescents who initiated dolutegravir-based ART. Of 17 adolescents who were virologically suppressed at the time of dolutegravir-based treatment, 14 (82%) maintained suppression and three had transient viral rebound prior to re-achieving a plasma viral load <50 copies/mL. Of the 33 viremic adolescents who initiated dolutegravir, 19 (58%) achieved sustained virologic success. Overall, 66% of patients achieved sustained virologic suppression and 78% had undetectable plasma viral load by the last study visit. Adolescents with virologic failure were more likely to be from sub-Saharan Africa and had more frequently detectable viremia in the 6 months prior to dolutegravir initiation. No resistance mutations emerged in patients with virologic failure, and only one patient discontinued dolutegravir-based treatment because of a significant AE (dizziness and sleep disturbance).19

Another cohort of adolescents in Barcelona received the fixed-dose combination (FDC) product abacavir 600 mg/dolutegravir 50 mg/lamivudine 300 mg (Triumeq). Of the twelve patients reported, one received Triumeq for initial ART, six received Triumeq for treatment simplification, and five received Triumeq because of previous treatment failure. Nine of the 12 patients achieved or maintained viral suppression after switching to Triumeq; three patients failed to achieve suppression due to suboptimal adherence. Of note, patients complained about the size of the tablet and six reported having to crush or split the tablet in order to swallow it (see Appendix A, Table 2).20

Children and Adolescents Aged <12 Years

A younger cohort of children aged ≥6 years to <12 years underwent PK assessment and remains in longer-term follow up in IMPAACT P1093, with those weighing ≥30 kg to <40 kg receiving the 35-mg dose and those weighing ≥40 kg receiving the 50-mg dose. At 48 weeks, data from 23 participants demonstrated a favorable safety profile, adequate PKs, and virologic efficacy, with HIV RNA concentrations of <50 copies/mL achieved in 17 of 23 participants (74%).18,21 These data led to FDA approval of the lower-strength, film-coated dolutegravir tablets at a dose of 35 mg for use in children with HIV who weigh ≥30 kg to <40 kg. The FDA did not approve dosing for children weighing <30 kg because the available PK data in lower weight bands were minimal and the observed Ctrough concentrations were lower than expected.

The ODYSSEY trial, conducted by the Pediatric European Network for the Treatment of AIDS (PENTA) is enrolling both treatment-naive and treatment-experienced pediatric patients in the European Union (EU), Thailand, and several African countries; this trial initially evaluated doses approved by the European Medicines Agency (EMA; see Table A above). A total of 674 children aged <18 years were enrolled; 282 children started dolutegravir as first-line therapy and 392 started dolutegravir as second-line therapy.22 Nested PK substudies within ODYSSEY are also evaluating simplified pediatric dosing that aligns with WHO-recommended weight bands. PK data are available from a cohort of children weighing >25 kg who switched to the 50-mg dolutegravir tablet (N = 27). Children weighing ≥25 kg who received the 50-mg, film-coated tablet achieved exposures similar to those seen in adults who received the same dose. When given to children weighing 14 kg to <25 kg, the dolutegravir 25-mg, film-coated tablet resulted in drug exposures that were lower than the target exposure for adults, particularly Ctrough. The median Ctrough was lower in the 20 kg to <25 kg group than in the 14 kg to <20 kg group.23,24 Data from ODYSSEY was recently reported on children weighing 20 kg to <25 kg who received either the 50-mg film-coated tablet or 30 mg of dolutegravir administered as six 5-mg dispersible tablets. Both of these doses achieved AUC and Cmax values that were higher than adult PK reference values, but still acceptable, and both doses achieved Ctrough values that were similar to adult reference values.25 At this time, neither the FDA nor the EMA have reviewed the data supporting the use of the 50-mg film-coated tablet in children weighing between 20 kg and <40 kg.
The EMA used the IMPAACT P1093 data to inform population PK modelling and simulation analyses to approve the lower-strength, film-coated dolutegravir tablets for use in children aged ≥6 years and weighing ≥15 kg. The EMA approved doses of dolutegravir 20 mg for children weighing 15 kg to <20 kg and doses of 25 mg for those weighing 20 kg to <30 kg (see Table A above). As noted, evaluation of these doses during the ODYSSEY study indicated that many children failed to achieve adequate trough concentrations. The Panel does not recommend use of dolutegravir in children weighing <20 kg until further data are available to determine an appropriate dose for this weight group.

The safety and effectiveness of the EMA dosing strategy was evaluated in a cohort of children aged 6 years to <18 years in the United Kingdom and Ireland who were followed during the CHIPS study. Between January 2014 and March 2018, 174 children in the cohort received dolutegravir at the EU-licensed doses (see Table A above). Of these 174 children, 53% were female, 91% had perinatally acquired HIV, and the median age was 15.5 years at dolutegravir initiation (interquartile range: 13.5 years–16.7 years). Only 6% of the cohort was treatment-naive, and 38% had previous exposure to three classes of ARVs. Overall, nine participants (5%) discontinued dolutegravir; three discontinued because of toxicity, three because an alternative regimen was available, and three for other or unknown reasons. Viral suppression was reported in 80 of 95 participants (84%) who remained on dolutegravir for 6 months, and viral suppression was reported in 41 of 49 participants (84%) who remained on dolutegravir for 12 months. Median changes in CD4 T lymphocyte cell counts were -9 cells/mm³ at 6 months (N = 81) and +47 cells/mm³ at 12 months (N = 41) of dolutegravir treatment.

Children Aged <6 Years Who Are Not Able to Swallow Tablets: Dolutegravir Dispersible Tablets

The first presentation of the data on dolutegravir dispersible tablets reported that three age cohorts of 10 patients (≥4 weeks to <6 months, ≥6 months to <2 years, and ≥2 years to <6 years) received protocol-defined, weight-based dosing using combinations of 5-mg, dispersible tablets. While target AUC₂₄h and C₂₄h levels were achieved in the youngest cohort, C₂₄h levels were low in children 6 months to <6 years of age. The dispersible tablet formulation was well-tolerated by all age groups. Higher doses are being evaluated in some age/weight groups.

Simplification of Treatment

Two trials in adults (SWORD-1 and SWORD-2) supported the approval of a dolutegravir 50 mg/rilpivirine 25 mg FDC tablet (Juluca) as a complete regimen for treatment simplification or maintenance therapy in selected patients. The two identical SWORD trials enrolled 1,024 patients with suppressed viral replication who had been on stable ART for at least 6 months and who had no history of treatment failure or evidence of resistance mutations. The participants were randomized to either receive dolutegravir/rilpivirine or to continue their suppressive ARV regimen. After 48 weeks of treatment, 95% of patients in both arms maintained HIV RNA <50 copies/mL. More AEs were reported and led to discontinuation in the dolutegravir/rilpivirine arm. In a subgroup of SWORD study patients whose original ARV regimen contained tenofovir disoproxil fumarate, small but statistically significant increases in hip and spine bone mineral density were observed.

The approval of dolutegravir 50 mg/lamivudine 300 mg (Dovato) as a complete regimen was supported by data from two randomized, double-blind, controlled trials (GEMINI-1 and GEMINI-2) in ARV-naive adults with HIV. GEMINI-1 and GEMINI-2 are identical, 148-week trials that enrolled a total of 1,433 adults with HIV who had plasma HIV RNA between 1,000 copies/mL and ≤500,000 copies/mL at screening and no evidence of major resistance-associated mutations or hepatitis B virus infection. Participants were randomized to receive either dolutegravir plus lamivudine or dolutegravir plus lamivudine/tenofovir disoproxil fumarate (TDF). During 48 weeks of treatment, 91% of patients who received dolutegravir plus lamivudine and 93% of patients who received dolutegravir plus lamivudine/TDF achieved HIV RNA <50 copies/mL. Similar proportions of patients discontinued treatment due to adverse events or other reasons in the two treatment arms.

Although neither Juluca nor Dovato is approved by the FDA for use in adolescents, both products contain doses of dolutegravir plus rilpivirine or lamivudine that are approved for use in adolescents as single drugs. The Panel usually endorses the use of adult formulations in adolescents, and these products may be appropriate for use in certain adolescents. However, because the strategy of treatment simplification has not been evaluated...
in adolescents, who may have difficulty adhering to therapy, the Panel does not currently recommend using two-drug simplification regimens in adolescents and children until more data are available.

**Crushing Film-Coated Tablets for Administration**

In patients who have difficulty swallowing whole tablets, 50-mg tablets (and 10-mg or 25-mg tablets, should they need to be used) may be either split into halves followed by immediate ingestion of both halves of the tablet, or crushed and added to a small amount of semisolid food or liquid, all of which should be consumed immediately. Crushing and mixing film-coated tablets would not be expected to adversely impact the product’s pharmaceutical quality, and therefore would not be expected to alter the intended clinical effect. This conclusion is based on the physicochemical and PK characteristics of the active ingredient, and the in vitro dissolution behavior of the film-coated tablets in water. In healthy adults, the use of crushed tablets resulted in slightly higher exposures than the use of whole tablets.

**References**


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