Treatment of HCV Genotype 5 or 6

Introduction

Background

In the United States, fewer than 2% of hepatitis C virus (HCV) infections involve genotype 5 or 6 infection.[1] In contrast, infection with HCV genotype 5 is endemic in Southern Africa, where up to 40% of individuals with chronic HCV have genotype 5 infection.[2,3] Scattered pockets of HCV genotype 5 have also been isolated from regions in Europe and North and Eastern sub-Saharan Africa.[4,5,6] There is only one subtype of HCV genotype 5 (subtype 5a).[2] Little is known about the natural history of individuals with genotype 5 HCV. Infection with HCV genotype 6 has primarily occurred in China, Hong Kong, Korea, Taiwan, and Southeast Asia, including Thailand, Vietnam, Singapore, and Malaysia.[7,8,9] Almost all cases of HCV genotype 6 in the United States have involved immigrants from Asia and Southeast Asia.[10] Available data suggest that adults with HCV genotype 6 infection have a similar natural history as those with genotype 1.[11] Because of the low prevalence of HCV genotype 5 or 6 in clinical trials, less is known about the optimal treatment of HCV genotype 5 or 6 infection compared with the more common genotypes. The following discussion regarding initial treatment and retreatment of patients with genotype 5 or 6 chronic hepatitis C assumes the patient and their clinician have already made the decision to initiate hepatitis C therapy. This topic review does not address the treatment of HCV genotype 5 or 6 in persons with decompensated cirrhosis, renal impairment, acute HCV infection, or post-liver transplantation.

Medications used to Treat Hepatitis C

The HCV Medications section on this web site provides detailed information for each of the FDA-approved medications listed in the treatment recommendations, including links to the full prescribing information and to patient assistance programs. The direct-acting antiviral (DAA) agents exert their action at specific steps in the HCV life cycle. There are three major classes of DAA medications: nonstructural proteins 3/4A (NS3/4A) protease inhibitors, NS5A inhibitors, and NS5B polymerase inhibitors (Figure 1); the NS5B polymerase inhibitors include the nucleoside analogs and nonnucleoside analogs.[12,13] Adherence with the treatment regimen is extremely important. Thus, patients should receive detailed counseling regarding the importance of adherence prior to starting therapy, as well as intensive monitoring and follow-up during therapy.

Approach to Choosing HCV Genotype 5 or 6 Treatment Regimen

For adults with HCV genotype 5 or 6 chronic infection, two key factors influence the choice and duration of therapy: cirrhosis status and prior treatment experience. In addition, the cost of the regimen, insurance coverage, and patient or provider preference can play a major role in the regimen choice. The following treatment recommendations are based on the AASLD-IDSA hepatitis C treatment guidance for adults with HCV genotype 5 or 6 chronic infection.[14,15]
• AASLD-IDSA HCV Guidance for Treatment-Naïve Patients with Genotype 5 or 6 HCV
• AASLD-IDSA HCV Guidance for Treatment-Experienced Patients with Genotype 5 or 6 HCV
HCV Genotype 5 or 6: Initial Treatment

Background

There are relatively few studies dedicated to the treatment of persons with HCV genotype 5 or 6 chronic infection, particularly for DAA therapy. Older studies in treatment-naïve patients with genotype 5 infection that have examined the combination of interferon (or peginterferon) with ribavirin for 48 weeks have reported sustained virologic response rates at 12 weeks post-treatment (SVR12) of approximately 55-70%.[4,16,17,18,19] Most of the older studies that have addressed initial treatment of persons with HCV genotype 6 are observational (with small sample sizes) and have reported sustained virologic response rates at 12-weeks posttreatment (SVR12) of 70-80% with peginterferon plus ribavirin when given for 48 weeks (and only slightly lower when given for 24 weeks).[20,21,22,23] Available data suggest SVR12 rates can exceed 95% with glecaprevir-pibrentasvir, sofosbuvir-velpatasvir, or ledipasvir-sofosbuvir for the initial therapy of HCV genotype 5 or 6 infection.[24,25,26,27,28]

Factors to Consider Prior to Choosing Treatment Regimen

For individuals with HCV genotype 5 or 6 chronic infection, little is known regarding baseline factors that may predict response to therapy, but as with other genotypes, cirrhosis and treatment experience probably play a role.

AASLD-IDSA HCV Guidance for Initial Treatment of HCV Genotype 5 and 6

The following is a summary of AASLD-IDSA HCV Guidance for initial treatment of adults with HCV genotype 5 or 6 infection, including those with compensated cirrhosis.[29] For individuals with cirrhosis, the AASLD-IDSA HCV Guidance defines compensated cirrhosis as Child-Turcotte-Pugh class A and decompensated cirrhosis as Child-Turcotte-Pugh class B or class C. The recommended regimens are listed by evidence level; when the evidence level is considered equivalent, the regimens are listed alphabetically.

Table 1. AASLD-IDSA HCV Guidance for Genotype 5 or 6: Initial Treatment Treatment-Naïve Genotype 5 or 6 Patients With and Without Compensated Cirrhosis

Recommended regimens listed by evidence level and alphabetically

<table>
<thead>
<tr>
<th>Recommended for Treatment-Naïve Genotype 5 or 6 Patients With and Without Compensated Cirrhosis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Glecaprevir-Pibrentasvir</strong></td>
</tr>
<tr>
<td><em>Fixed-dose combination of glecaprevir (300 mg)/pibrentasvir (120 mg) once daily for 8 weeks</em></td>
</tr>
<tr>
<td>For patients without cirrhosis</td>
</tr>
<tr>
<td>Rating: <strong>Class I, Level A</strong></td>
</tr>
<tr>
<td>Note: <em>This is taken as 3 tablets once daily with each fixed-dose tablet containing glecaprevir (100 mg)/pibrentasvir (40 mg).</em></td>
</tr>
</tbody>
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<tbody>
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<td><strong>Glecaprevir-Pibrentasvir</strong></td>
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<tr>
<td><em>Fixed-dose combination of glecaprevir (300 mg)/pibrentasvir (120 mg) once daily for 12 weeks</em></td>
</tr>
<tr>
<td>For patients with compensated cirrhosis</td>
</tr>
</tbody>
</table>
Rating: Class I, Level A
Note: *This is taken as 3 tablets once daily with each fixed-dose tablet containing glecaprevir (100 mg)/pibrentasvir (40 mg).

**Recommended for Treatment-Naïve Genotype 5 or 6 Patients With and Without Compensated Cirrhosis**

**Sofosbuvir-Velpatasvir**
*Fixed-dose combination of sofosbuvir (400 mg)/velpatasvir (100 mg) one tablet once daily for 12 weeks*

For patients with and without compensated cirrhosis

Rating: Class I, Level B

**Recommended for Treatment-Naïve Genotype 5 or 6 Patients With and Without Compensated Cirrhosis**

**Ledipasvir-Sofosbuvir**
*Fixed-dose combination of ledipasvir (90 mg)/sofosbuvir (400 mg) one tablet once daily for 12 weeks*

For patients with and without compensated cirrhosis

Rating: Class Ia, Level B

^For treatment of patients with decompensated cirrhosis, see the AASLD-IDSA Guidance: Unique Populations—Patients with Decompensated Cirrhosis.

Studies of Initial Treatment of Adults with HCV Genotype 5 or 6

The following key studies support the recommendations for treatment of patients with chronic hepatitis C and genotype 5 or 6 infection who are treatment naïve.

Glecaprevir-Pibrentasvir

- **SURVEYOR-I and SURVEYOR-II**: The SURVEYOR-I (HCV genotype 1, 4, 5, or 6) and SURVEYOR-II (HCV genotypes 2 or 3) were phase 2 open-label trials of treatment-naïve and treatment-experienced adults without cirrhosis. In the SURVEYOR-I trial, participants with HCV genotype 4, 5, or 6 received 12 weeks of glecaprevir-pibrentasvir. Among those enrolled and treated, one had HCV genotype 5 and 11 had HCV genotype 6. For the participants with HCV genotype 5 or 6, 100% (12 of 12) achieved an SVR12.[30]

- **ENDURANCE 5.6**: This phase 3b, open-label trial examined the safety and efficacy of glecaprevir-pibrentasvir in treatment-naïve and treatment-experienced adults with HCV genotype 5 or 6. The duration of treatment was 8 weeks in participants without cirrhosis (n=75) and 12 weeks in those with compensated cirrhosis (n=9). Overall, 97.6% (82 of 84) of individuals who received treatment achieved an SVR12; treatment success occurred in 96% of participants with HCV genotype 5 and in 98% of those with HCV genotype 6. High efficacy was noted across 14 different HCV genotype 6 subtypes.[31]

- **EXPEDITION-1**: This phase 3, single-arm, open-label trial evaluated the safety and efficacy of 12 weeks of glecaprevir-pibrentasvir in treatment-naïve and treatment-experienced adults with compensated cirrhosis and HCV genotype 1, 2, 4, 5, or 6 infection. All (100%) of patients with genotype 5 (n=2) or genotype 6 (n = 7) achieved an SVR12.[26]

Ledipasvir-Sofosbuvir

- **New Zealand Genotype 3 and 6 Study**: In this open-label, phase 2 study performed at two centers in New Zealand, investigators enrolled treatment-naïve and treatment-experienced adults with HCV genotype 3 or 6 infection. One arm of this study enrolled 25 participants with HCV genotype 6 to receive a 12-week course of ledipasvir-sofosbuvir. Overall, 96% (24 of 25) individuals with HCV genotype 6 achieved an SVR12; the one person in this cohort who did not achieve an SRV12 withdrew from the study at week 8. Only two of the treatment-naïve individuals with HCV genotype 6 had cirrhosis.[24]

- **Ledipasvir-Sofosbuvir for Genotype 5 Infection**: In a phase 2, open-label study conducted in France, investigators enrolled 21 treatment-naïve and 20 treatment-experienced adults with HCV genotype 5 infection to receive a 12-week course of ledipasvir-sofosbuvir. For the treatment-naïve individuals with HCV genotype 5 infection, 95% (20 of 21) achieved an SVR12. For individuals with cirrhosis, 89% (8 of 9) achieved an SVR12 compared with 97% (31 of 32) without cirrhosis who achieved an SVR12.[28]

Sofosbuvir-Velpatasvir

- **ASTRAL-1**: In the phase 3 ASTRAL-1 trial, investigators randomized treatment-naïve and treatment-experienced adults with chronic HCV genotype 1, 2, 4, 5, or 6 infection in a 5:1 ratio to receive a 12-week course of either sofosbuvir-velpatasvir or placebo. The study enrollment included 34 individuals with HCV genotype 5 infection and 41 with HCV genotype 6. Among the treatment-naïve participants treated with sofosbuvir-velpatasvir, 96% (23 of 24) with HCV genotype 5 infection achieved an SVR12 and 100% (38 of 38) with HCV genotype 6 achieved an SVR12.[27]

- **POLARIS-2**: In this phase 3, open-labeled trial, 94% (17 of 18) adults with HCV genotype 5 who received 8 weeks of sofosbuvir-velpatasvir-voxilaprevir achieved an SVR12. All 30 patients with genotype 6 who received 8 weeks of sofosbuvir-velpatasvir-voxilaprevir and all
9 patients with genotype 6 who received a 12-week course of sofosbuvir-velpatasvir achieved an SVR12.[32]
HCV Genotype 5 or 6: Retreating Persons who Failed Prior Therapy

Background

Given the very low prevalence of genotypes 5 and 6 in settings where HCV therapy is accessible, limited data and experience exist with retreatment of patients with genotype 5 or 6. Recommendations are primarily based on available data in small numbers of treatment-experienced individuals with genotype 5 or 6 from clinical studies, and by extrapolating from experience with other HCV genotypes.

Factors to Consider Prior to Choosing Treatment Regimen

For patients chronically infected with genotype 5 or 6 hepatitis C, insufficient data exist regarding the impact of cirrhosis on the optimal retreatment regimen or duration of therapy given the small numbers of patients in these trials. The retreatment of genotype 5 or 6 patients with decompensated cirrhosis, renal impairment, HIV coinfection, acute hepatitis C infection, or post-liver transplantation is not addressed in this lesson.

AASLD-IDSA HCV Guidance for Retreatment of HCV Genotype 5 or 6

The following is a summary of AASLD-IDSA HCV Guidance for retreatment of adults with hepatitis C genotype 5 or 6 infection, including those without cirrhosis and those with compensated cirrhosis.[33,34] For individuals with cirrhosis, the AASLD-IDSA HCV Guidance defines compensated cirrhosis as Child-Turcotte-Pugh class A and decompensated cirrhosis as Child-Turcotte-Pugh class B or class C. The recommended regimens are listed by evidence level; when the evidence level is considered equivalent, the regimens are listed alphabetically.

Table 2. AASLD-IDSA HCV Guidance for Genotype 5 or 6: Retreatment Peginterferon plus Ribavirin-Experienced, Genotype 5 or 6 Patients With or Without Compensated Cirrhosis

Recommended and alternative regimens listed by evidence level and alphabetically

<table>
<thead>
<tr>
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**Recommended for Peginterferon plus Ribavirin-Experienced, Genotype 5 or 6 Patients**

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<th>Ledipasvir-Sofosbuvir</th>
</tr>
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<tbody>
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</tr>
</tbody>
</table>

for patients with or without compensated cirrhosis

Rating: **Class IIa, Level B**

— For treatment of patients with decompensated cirrhosis, see the AASLD-IDSA Guidance: Unique Populations—Patients with Decompensated Cirrhosis.

Source: AASLD-IDSA. Recommendations for testing, management, and treating hepatitis C. Retreatment of persons in whom prior therapy has failed: peginterferon plus ribavirin-experienced, genotype 5 or 6 patients with or without compensated cirrhosis [AASLD-IDSA Hepatitis C Guidance] - Accessed April 28, 2019.

**Table 3. AASLD-IDSA HCV Guidance for Genotype 5 or 6: Retreatment DAA-Experienced (Including NS5A Inhibitors), Genotype 5 or 6 Patients**

<table>
<thead>
<tr>
<th>Sofosbuvir-Velpatasvir-Voxilaprevir</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed-dose combination of sofosbuvir (400 mg)/velpatasvir (100 mg)/voxilaprevir (100 mg) one tablet once daily for 12 weeks</td>
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for patients with or without compensated cirrhosis

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Studies of Retreatment of Adults with HCV Genotype 5 or 6

There are limited data from studies that adequately address the retreatment of adults with HCV genotype 5 or 6 infection who failed prior therapy.

Glecaprevir-Pibrentasvir

- **SURVEYOR-I and SURVEYOR-II**: The SURVEYOR-I (genotypes 1, 4, 5, and 6) and SURVEYOR-II (genotypes 2 and 3) were phase 2 open-label trials that enrolled treatment-naïve and treatment adults without cirrhosis.[30] In the SURVEYOR-I trial, participants with HCV genotype 4, 5, or 6 received 12 weeks of glecaprevir-pibrentasvir. Among those enrolled and treated, one had HCV genotype 5 and the other 11 had HCV genotype 6. All (100%) with genotype 5 or 6 achieved an SVR12 (data not provided for number of treatment-naïve versus treatment-experienced patients with genotype 5 or 6).[30]
- **ENDURANCE-5,6**: This phase 3b, open-label trial examined the safety and efficacy of glecaprevir-pibrentasvir exclusively in treatment-naïve and treatment-experienced adults with HCV genotype 5 or 6.[31] Duration of treatment was 8 weeks in participants without cirrhosis (n = 75) and 12 weeks in those with compensated cirrhosis (n = 9). Overall, 97.6% (82 of 84) of individuals enrolled achieved an SVR12; treatment success occurred in 96% of participants with HCV genotype 5 and in 98% of those with HCV genotype 6.[31] High efficacy was noted across 14 different HCV genotype 6 subtypes.[31]
- **EXPEDITION-1**: In this phase 3 single-arm open-label trial evaluated the safety and efficacy of 12 weeks of glecaprevir-pibrentasvir in treatment-naïve and treatment-experienced adults with compensated cirrhosis and genotype 1, 2, 4, 5, or 6 HCV infection.[26] All (100%) of participants with HCV genotype 5 (n=2) or HCV genotype 6 (n=7) achieved an SVR12 (data not provided for number of treatment-naïve versus treatment-experienced individuals with HCV genotype 5 or 6).[26]

Ledipasvir-Sofosbuvir

- **Ledipasvir-Sofosbuvir for Genotype 5 Infection**: In a small, open-label study conducted in France, investigators enrolled 21 treatment-naïve adults and 20 treatment experienced adults with HCV genotype 5 infection to receive a 12-week course of ledipasvir-sofosbuvir.[28] For the treatment-experienced participants with HCV genotype 5 infection, 95% (19 of 20) achieved an SVR12; cirrhosis status did not impact the SVR12 rates.[28] Analysis of treatment response by cirrhosis status showed SVR12 rates of 89% (8 of 9) for participants with cirrhosis compared with 97% (31 of 32) for those without cirrhosis.[28]

Sofosbuvir-Velpatasvir

- **ASTRAL-1**: In the phase 3 ASTRAL-1 trial, investigators randomized treatment-naïve and treatment-experienced adults with HCV genotype 1, 2, 4, 5, or 6 infection in a 5:1 ratio to receive a 12-week course of either sofosbuvir-velpatasvir or placebo.[27] The study included 34 individuals with HCV genotype 5 and 41 with HCV genotype 6. The SVR12 rates for the treatment-experienced participants treated with sofosbuvir-velpatasvir were 100% (11 of 11) in those with HCV genotype 5 and 100% 3 of 3 with HCV genotype 6.[27]

Sofosbuvir-Velpatasvir-Voxilaprevir

- **POLARIS-1**: In this phase 3 placebo-controlled trial, investigators enrolled adults with HCV genotype 1, 2, 3, 4, 5, or 6 who had previously received treatment that included an NS5A inhibitor to receive sofosbuvir-velpatasvir-voxilaprevir for 12 weeks.[35] Individuals with HCV genotype 2, 3, 4, 5, or 6 were all assigned to the active arm. Most participants were either
ledipasvir- or daclatasvir-experienced (51% and 27%, respectively) and compensated cirrhosis was present in 46% of individuals in the active arm. For the participants with HCV genotype 5 (n=1) or genotype 6 infection (n= 6), all (100%) achieved an SRV12.\[35\]
Summary Points

- Infection with HCV genotype 5 is uncommon in the United States, but endemic in Southern Africa.
- Infection with HCV genotype 6 is also infrequently seen in the United States and primarily found in China, Korea, Taiwan, and Southeast Asia.
- Recommendations for initial treatment or retreatment of individuals with HCV genotype 5 or 6 are based on in vitro data, limited data from clinical trials, and observational studies.
- The recommended regimens for initial treatment of adults with HCV genotype 5 or 6 include:
  - glecaprevir-pibrentasvir for 8 weeks in those without cirrhosis and 12 weeks in those with compensated cirrhosis,
  - sofosbuvir-velpatasvir for 12 weeks,
  - ledipasvir-sofosbuvir for 12 weeks.
- The recommended regimens for retreatment of peginterferon plus ribavirin-experienced adults with HCV genotype 5 or 6 infection are the same as for initial treatment.
- The recommended regimen for retreatment of DAA-experienced (including NS5A inhibitors) adults with HCV genotype 5 or 6 is sofosbuvir-velpatasvir-voxilaprevir.
Citations


13. Scheel TK, Rice CM. Understanding the hepatitis C virus life cycle paves the way for highly
[PubMed Abstract] -

14. AASLD-IDSA. Recommendations for testing, management, and treating hepatitis C. Treatment-Naive Genotype 5 or 6.  
[AASLD-IDSA Hepatitis C Guidance] -

15. AASLD-IDSA. Recommendations for testing, management, and treating hepatitis C. Treatment-Experienced Genotype 5 or 6.  
[AASLD-IDSA Hepatitis C Guidance] -

[PubMed Abstract] -

[PubMed Abstract] -

[PubMed Abstract] -

[PubMed Abstract] -

[PubMed Abstract] -

[PubMed Abstract] -

[PubMed Abstract] -

[PubMed Abstract] -

[PubMed Abstract] -

25. Asselah T, Kowdley KV, Zadeikis N, et al. Efficacy of Glecaprevir/Pibrentasvir for 8 or 12
References

- European Association for the Study of the Liver. EASL recommendations on treatment of hepatitis C 2015. [EASL] -


### Figures

**Figure 1 Classes of Direct-Acting Antiviral Agents Used to Treat HCV**

<table>
<thead>
<tr>
<th>NS3/4A Protease Inhibitors</th>
<th>NS5A Inhibitors</th>
<th>NS5B Polymerase Inhibitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boceprevir</td>
<td>Daclatasvir</td>
<td>Dasabuvir</td>
</tr>
<tr>
<td>Glecaprevir</td>
<td>Elbasvir</td>
<td>Sofosbuvir</td>
</tr>
<tr>
<td>Grazoprevir</td>
<td>Ledipasvir</td>
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</tr>
<tr>
<td>Paritaprevir</td>
<td>Ombitasvir</td>
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<tr>
<td>Simeprevir</td>
<td>Pibrentasvir</td>
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</tr>
<tr>
<td>Telaprevir</td>
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<tr>
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Treatment-Naïve Genotype 5 or 6 Patients With and Without Compensated Cirrhosis

Recommended regimens listed by evidence level and alphabetically

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</table>
| **Glecaprevir-Pibrentasvir**  
*Fixed-dose combination of glecaprevir (300 mg)/pibrentasvir (120 mg) once daily for 8 weeks*  
For patients without cirrhosis |
| Rating: **Class I, Level A** |
| Note: *This is taken as 3 tablets once daily with each fixed-dose tablet containing glecaprevir (100 mg)/pibrentasvir (40 mg).* |

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<tr>
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| **Glecaprevir-Pibrentasvir**  
*Fixed-dose combination of glecaprevir (300 mg)/pibrentasvir (120 mg) once daily for 12 weeks*  
For patients with compensated cirrhosis |
| Rating: **Class I, Level A** |
| Note: *This is taken as 3 tablets once daily with each fixed-dose tablet containing glecaprevir (100 mg)/pibrentasvir (40 mg).* |

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For patients with and without compensated cirrhosis |
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For patients with and without compensated cirrhosis |
| Rating: **Class IIa, Level B** |

^For treatment of patients with decompensated cirrhosis, see the AASLD-IDSA Guidance: Unique Populations—Patients with Decompensated Cirrhosis.

Source: AASLD-IDSA. Recommendations for testing, management, and treating hepatitis C. Initial
### Table 2. AASLD-IDSA HCV Guidance for Genotype 5 or 6: Retreatment

**Peginterferon plus Ribavirin-Experienced, Genotype 5 or 6 Patients** With or Without Compensated Cirrhosis

Recommended and alternative regimens listed by evidence level and alphabetically

<table>
<thead>
<tr>
<th>Regimen</th>
<th>Dosing Details</th>
<th>Rating</th>
<th>Note</th>
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<tbody>
<tr>
<td><strong>Glecaprevir-Pibrentasvir</strong></td>
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Table 3. AASLD-IDSA HCV Guidance for Genotype 5 or 6: Retreatment DAA-Experienced (Including NS5A Inhibitors), Genotype 5 or 6 Patients With or Without Compensated Cirrhosis

Recommended for DAA-Experienced (Including NS5A Inhibitors), Genotype 5 or 6 Patients With or Without Compensated Cirrhosis

**Sofosbuvir-Velpatasvir-Voxilaprevir**

*Fixed-dose combination of sofosbuvir (400 mg)/velpatasvir (100 mg)/voxilaprevir (100 mg) one tablet once daily for 12 weeks*

Rating: **Class IIa, Level B**

^For treatment of patients with decompensated cirrhosis, see the AASLD-IDSA Guidance: Unique Populations—Patients with Decompensated Cirrhosis.

Source: AASLD-IDSA. Recommendations for testing, management, and treating hepatitis C. Retreatment of persons in whom prior therapy has failed: DAA-experienced (including NS5A inhibitors), genotype 5 or 6 patients with or without compensated cirrhosis. [AASLD-IDSA Hepatitis C Guidance] - Accessed April 28, 2019.