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Article type   : Practice Guidance

Title Page

Title: Hepatitis C Guidance 2019 Update: AASLD-IDSA Recommendations for Testing, Managing, and Treating

Hepatitis C Virus Infection

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Keywords: HCV screening; direct-acting antiviral treatment; HCV guidance; chronic HCV treatment

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Abbreviations: AASLD, American Association for the Study of Liver Diseases; ALT, alanine aminotransferase; AST, aspartate aminotransferase; CBC, complete blood count; CDC, U.S. Centers for Disease Control and Prevention; CTP, Child-Turcotte-Pugh; DAA, direct-acting antiviral; FDA, U.S. Food and Drug Administration; HAV, hepatitis A virus; HBsAg, hepatitis B virus surface antigen; HBV, hepatitis B virus; HCC, hepatocellular carcinoma; HCV, hepatitis C virus; HIV, human immunodeficiency virus; IDSA, Infectious Diseases Society of America; INR, international normalized ratio; MSM, men who have sex with men; NASEM, National Academies of Science, Engineering, and Medicine; PWID, people who inject drugs; STI, sexually transmitted infection; SVR, sustained virologic response; USPSTF, U.S. Preventive Services Task Force; WHO, World Health Organization

Preamble

The American Association for the Study of Liver Diseases (AASLD) and the Infectious Diseases Society of America (IDSA) initiated the hepatitis C guidance project (hereafter HCV guidance) in 2013. The AASLD-IDSA HCV guidance website (www.HCVGuidelines.org) disseminates up-to-date, peer-reviewed, unbiased, evidence-based recommendations to aid clinicians making decisions regarding the testing, management, and treatment of hepatitis C virus (HCV) infection. Utilizing a web-based system enables timely and nimble

distribution of the HCV guidance, which is periodically updated in near real time as necessitated by emerging research data, recommendations from public health agencies, the availability of new therapeutic agents, or other significant developments affecting the rapidly evolving hepatitis C arena. The value and utility of the online HCV guidance to the community of hepatitis C care providers throughout the world is evidence by the nearly 10 million pageviews by 1.5 million users originating from 228 countries and territories since the January 2014 launch of the website. A major update of the HCV guidance was released electronically in November 2019. This HCV guidance update summarizes and highlights key new or amended recommendations since the previous October 2018 print publication.[1]

The advent of safe, well tolerated, and highly efficacious (>95% cure rate)[2] direct-acting antiviral (DAA) therapy for HCV infection has ushered in a new era in which elimination of hepatitis C is conceivable. In 2016, the World Health Organization (WHO) proposed a global health sector strategy to eliminate hepatitis C as a public health threat by 2030 and developed an action plan to facilitate this goal.[3] In response to the WHO action plan, the National Academies of Science, Engineering, and Medicine (NASEM) developed a U.S. strategy for the elimination of hepatitis C.[4] Key elements of the elimination plan include improved detection of undiagnosed cases, increased linkage and access to care for newly diagnosed persons, and expanded treatment access. Many of the recommendations included in the latest update to the HCV guidance and highlighted herein align with and support the goals of the NASEM and WHO strategies to move from control to eventual elimination of hepatitis C. Topics addressed include universal and risk-based hepatitis C screening; simplified treatment algorithms for treatment-naive adults without cirrhosis or with compensated cirrhosis; hepatitis C management in the pediatric population; acute hepatitis C testing and management; and transplantation of organs from HCV-viremic donors into HCV-negative recipients. For detailed evidence reviews related to these topics and information addressing other aspects of HCV testing and management, see the online HCV guidance (www.HCVGuidelines.org).

Process

The HCV guidance was developed and is updated by a volunteer panel (representing AASLD and IDSA) of hepatology and infectious diseases clinicians with hepatitis C expertise using an evidence-based review of available data, including information presented at scientific conferences and published in peer-reviewed

journals. Based on scientific evidence and expert opinion, recommendations are rated by the level of evidence (I, II, or III) and the strength of the recommendation (A, B or C) using a system adapted from the American College of Cardiology and American Heart Association.[5, 6] See the original AASLD-IDSA hepatitis C guidance publication[7] or the HCV guidance website for additional details about the processes and methods employed. All recommendations are reviewed and approved by the governing boards of AASLD and IDSA.

The HCV guidance panel classifies therapeutic regimens as recommended, alternative, or not recommended based on patient factors (i.e., treatment naive versus experienced, cirrhosis status, and comorbidities) and viral characteristics (i.e., genotype, subtype, resistance-associated substitutions). Recommended regimens are considered equivalent; alternative regimens are effective but, compared to recommended regimens, have potential disadvantages, limitations for use in certain patient populations, or less supporting data.

Universal and Risk-Based Hepatitis C Screening and Follow-Up

The identification of risk factors associated with contracting HCV infection served as the basis for the risk-based hepatitis C screening recommendations issued by the U.S. Centers for Disease Control and Prevention (CDC) in 1998.[8] Although sensitive for the identification of persons with chronic HCV infection, risk-based screening failed to identify the majority of individuals with HCV infection due to both clinician and patient barriers.[9-12] Analysis of the 2003-2010 National Health and Nutrition Examination Survey (NHANES) prevalence data demonstrated that approximately three fourths of individuals with chronic hepatitis C in the United States belonged to the 1945 through 1965 birth cohort.[13] Based on these data, both CDC and the U.S. Preventive Services Task Force (USPSTF) recommended one-time hepatitis C screening of all individuals in this birth cohort (1945 through 1965) regardless of risk factors.[14, 15] Since these recommendations were established in 2012, HCV epidemiology in the United States has changed. Hepatitis C infection incidence nearly quadrupled from 2010 to 2017, primarily driven by increased injection drug use related to the opioid epidemic.[16-19] CDC viral hepatitis surveillance data indicate progressively increasing acute HCV infection incidence each year from 2009 through 2017. Most of these new HCV infections occurred in persons born after 1965 with those aged 20-39 years accounting for the majority of cases. This ongoing trend has spurred interest in expanding HCV screening among the general U.S. population. Several modeling studies suggest the cost-effectiveness of such an approach.[20-23] Accordingly, the AASLD-IDSA guidance HCV screening and follow-

up recommendations have been updated and include newly recommended universal HCV screening for all adults aged 18 years or older followed by periodic testing for persons with ongoing risk behaviors and/or exposures.

One-Time, Universal Hepatitis C Screening for Adults

Recommendations

1. *One-time, routine, opt out HCV screening is recommended for all individuals aged 18 years or older. (I, B)*

In light of the inadequacy of targeted HCV case finding using risk-based and birth cohort HCV screening,[24, 25] investigators have modeled the cost-effectiveness of one-time universal HCV screening for adults aged ≥18 years. Independent studies using different modeling techniques demonstrate that one-time universal screening for adults aged ≥18 years is cost-effective (<$30,000/quality-adjusted life years) compared with birth-cohort screening.[20, 26] Additionally, the cost-effectiveness of nontargeted HCV screening has proven robust in a variety of venues including correctional,[27] prenatal,[28, 29] and primary care[30] settings, and substance use treatment centers.[31, 32] Given the current epidemiology of HCV disease in the United States, the cost-effectiveness of universal HCV screening, the high efficacy of DAA therapy, and the myriad liver-related and other health benefits of virologic cure,[33-38] the HCV guidance panel recommends universal, one-time, opt out HCV screening of adults aged ≥18 years. Although neither CDC nor the USPSTF currently recommend universal HCV screening in adults, CDC initiated a peer review process to consider such a recommendation in July 2019. Similarly, in August 2019, the USPSTF published a draft recommendation for universal HCV screening among adults aged 18-79 years. The USPSTF draft universal hepatitis C screening recommendation differs from that of the AASLD-IDSA HCV guidance by setting an upper age limit of 79 years. The HCV guidance panel does not recommend an age limit for universal adult HCV screening due to the excellent quality of life of many octogenarians and the association between advanced age and more rapid HCV disease progression.

The HCV guidance panel's new universal screening recommendation is intended to enhance HCV case finding among adults not included in the 1945 through 1965 birth cohort and aligns with the WHO and NASEM goals of eliminating HCV as a public health threat by 2030. This is particularly important for men and women aged

20-39 years due to the disproportionate overlapping impact of the opioid epidemic and associated injection drug use and the rising rate of incident HCV infections in this age group. Universal HCV screening also bypasses the inherent barriers in ascertaining an accurate risk factor assessment.

Risk-Based HCV Testing

Recommendations

2. *One-time HCV testing should be performed for all persons younger than 18 years old with behaviors, exposures, or conditions or circumstances associated with an increased risk of HCV infection. (I, B)*
3. *Periodic repeat HCV testing should be offered to all persons with behaviors, exposures, or conditions or circumstances associated with an increased risk of HCV exposure. (IIa, C)*
4. *Annual HCV testing is recommended for all persons who inject drugs and for men with human immunodeficiency virus (HIV) infection who have unprotected sex with men. (IIa, C)*

One-time, risk-based HCV screening is recommended for persons younger than 18 years old with current or past behaviors, exposures, or conditions or circumstances associated with an increased risk of HCV infection (see Table 1). There is currently insufficient evidence to support universal HCV screening in the pediatric population.

People with ongoing risk factor(s) for HCV infection remain vulnerable for as long as the behavior, exposure, condition, or circumstance persists, thereby warranting periodic repeat HCV testing. There is a paucity of data addressing the optimal frequency of repeat testing thereby leaving the periodicity to the clinician's discretion on a case-by-case basis with consideration of an individual's risk for HCV infection or reinfection. People who inject drugs (PWID) and men with HIV infection who have unprotected sex with men are exceptions to this guidance. Because of the high incidence and prevalence of HCV infection in these populations,[39-47] at least annual HCV testing is recommended. Given that many PWID lack access to or eschew traditional healthcare delivery systems, integration of HCV testing services into substance use treatment programs, needle/syringe service programs, and acute detoxification programs expands the opportunities to accomplish periodic HCV testing in this key population.[48-50]

Initial HCV Testing and Follow-Up

Recommendations

5. **HCV-antibody testing with reflex HCV RNA polymerase chain reaction testing is recommended for initial HCV screening. (I, A)**

6. **Among persons with a negative HCV-antibody test who were exposed to HCV within the prior 6 months, HCV-RNA or follow-up HCV-antibody testing 6 months or longer after exposure is recommended. HCV-RNA testing can also be considered for immunocompromised persons. (I, C)**

7. **Among persons at risk for reinfection after previous spontaneous or treatment-related viral clearance, HCV-RNA testing is recommended because a positive HCV-antibody test is expected. (I, C)**

8. **Persons found to have a positive HCV-antibody test and negative results for HCV RNA by polymerase chain reaction should be informed that they do not have evidence of current (active) HCV infection but are not protected from reinfection. (I, A)**

9. **Quantitative HCV-RNA testing is recommended prior to initiation of antiviral therapy to document the baseline level of viremia (i.e., baseline viral load). (I, A)**

10. **HCV genotype testing may be considered for those in whom it may alter treatment recommendations. (I, A)**

HCV-antibody testing using a U.S. Food and Drug Administration (FDA) approved assay (laboratory-based or point-of-care) is recommended for initial HCV screening.[51, 52] The sensitivity and specificity of the lone FDA-approved point-of-care test (OraQuick HCV Rapid Antibody Test; OraSure Technologies Inc., Bethlehem, Pennsylvania) are similar to laboratory-based assays.[53, 54] A positive HCV-antibody test indicates current (active) HCV infection (acute or chronic), a past resolved infection, or rarely a false positive result.[55] A test to detect HCV viremia is necessary to confirm active HCV infection (see Figure 1). Ideally, a positive HCV-antibody test automatically reflexes to HCV-RNA testing. This approach requires a single blood collection and avoids a return visit for confirmatory testing, a major barrier in the continuum of care.[56] Collection of dried blood spots is an option for sequential HCV-antibody and reflex HCV-RNA testing. Dried blood spot collection can be accomplished with a fingerstick rather than venipuncture and transport does not require an intact cold chain, making this an advantageous testing option in rural areas and among people for whom phlebotomy is a testing barrier.[57] An FDA-approved quantitative or qualitative HCV-RNA assay with a detection level of ≤25 IU/mL should be used.

HCV-RNA testing is required to detect reinfection after previous spontaneous or treatment-related viral clearance because HCV-antibody positivity is expected (see Figure 1). Immunocompromised persons and those with possible HCV exposure in the prior 6 months may be HCV antibody negative due to delayed or failed seroconversion[58] or being in the seroconversion window period,[52] respectively. HCV-RNA testing is a consideration for these individuals, particularly for those with known risk factor(s).

Figure 1. Recommended Testing for Diagnosis of Current HCV Infection or Reinfection

[a] For diagnosis of current initial HCV infection, begin with HCV-antibody testing.

[b] For recurrent HCV infection, begin with HCV-RNA testing.

[c] For persons who might have been exposed to HCV within the past 6 months, testing for HCV RNA or follow-up testing for HCV antibody should be performed. For persons who are immunocompromised, testing for HCV RNA should be performed.

[d] To differentiate past, resolved HCV infection from biologic false positivity for HCV antibody, testing with another HCV-antibody assay can be considered. Repeat HCV-RNA testing if the person tested is suspected to have had HCV exposure within the past 6 months or has clinical evidence of HCV disease, or if there is concern regarding the handling or storage of the test specimen.

Adapted from Centers for Disease Control and Prevention.[51]

Persons who have a reactive HCV-antibody test and a negative (not detected) HCV-RNA test should be informed that they do not have evidence of current HCV infection. Although additional testing is typically unnecessary, HCV-RNA testing can be repeated for persons with ongoing HCV infection risk or if there is a high index of suspicion for recent infection. If either the clinician or patient wish to determine whether a positive HCV-antibody test in the absence of HCV viremia represents a resolved HCV infection or a biologic false positive, repeat testing with a different HCV-antibody assay can be undertaken. A false positive typically does not occur with two different assays.[51, 59]

Quantitative HCV-RNA testing is recommended prior to initiating antiviral therapy to determine baseline viremia (viral load), which may affect treatment duration with ledipasvir/sofosbuvir therapy. With the advent of pangenotypic DAA regimens, HCV genotyping is no longer universally required prior to treatment initiation. Pretreatment genotyping is recommended for persons with a prior HCV treatment failure because DAA

regimen selection and duration may differ by genotype. Pretreatment genotyping is not required for treatment-naive patients without cirrhosis if a pangenotypic regimen is used.

Counseling and Clinical Care for Persons With Active HCV Infection

Recommendations

11. *Persons with current HCV infection should receive education and interventions aimed at reducing liver disease progression and preventing HCV transmission. (IIa, B)*

12. *Abstinence from alcohol and, when appropriate, interventions to facilitate cessation of alcohol consumption should be advised for all persons with HCV infection. (IIa, B)*

13. *All persons with HCV infection should be provided education about how to prevent HCV transmission to others. (I, C)*

14. *Evaluation for advanced fibrosis using noninvasive markers (or liver biopsy, if required) is recommended for all persons with HCV infection to facilitate an appropriate decision regarding HCV treatment strategy, and to determine the need for initiating additional measures for cirrhosis management (e.g., hepatocellular carcinoma screening). (I, A)*

15. *Evaluation for other conditions that may accelerate liver fibrosis, including hepatitis B and HIV infections, is recommended for all persons with active HCV infection. (IIb, B)*

16. *Vaccination against hepatitis A and hepatitis B is recommended for all susceptible persons with HCV infection. (IIa, C)*

17. *Vaccination against pneumococcal infection is recommended for all persons with cirrhosis. (IIa, C)*

Upon diagnosis of active HCV infection, patients require counseling and certain clinical interventions prior to initiation of antiviral therapy. Prevention of further liver damage is crucial. To that end, counseling patients to abstain from alcohol takes priority because of associations between excess alcohol use and incident or progressive fibrosis, and the development of hepatocellular carcinoma (HCC).[60-69] There is no known safe level of alcohol use for patients with chronic hepatitis C. All patients with chronic hepatitis C, especially those with advanced fibrosis or cirrhosis, should be advised to abstain from alcohol use.[70-72] Persons suffering from alcohol use disorder require treatment for this condition; consider referring these individuals to an addiction specialist. Ongoing alcohol use, however, is not a contraindication to antiviral therapy. Data indicate that

ongoing alcohol use does not affect therapeutic outcomes with DAA regimens among treatment-adherent patients.[73]

From a public health perspective, educating persons with HCV infection about how to avoid transmitting the virus to others (Table 2) serves as an essential primary prevention measure to curb and eventually eliminate the hepatitis C epidemic. Exposure to infected blood is the primary mode of HCV transmission. Epidemics of acute HCV due to sexual transmission in men with HIV infection who have sex with men have also been described.[74-77]

Assessing liver disease severity is an essential component of the workup for all persons with newly diagnosed chronic hepatitis C as this factor influences initial and follow-up evaluation. This assessment (i.e., presence or absence of cirrhosis) can usually be accomplished with noninvasive tests (Table 3). Liver biopsy is rarely required but is a consideration if other causes of liver disease are suspected.

Persons with known or suspected cirrhosis are at increased risk for complications of advanced liver disease and require frequent follow-up. They should also avoid hepatotoxic drugs, such as excessive acetaminophen (>2 g/d) and certain herbal supplements. Nephrotoxic drugs (e.g., nonsteroidal anti-inflammatory drugs) should also be avoided. Ongoing imaging surveillance for HCC and gastroesophageal varices is recommended for patients with cirrhosis.[78-80] Cirrhosis with portal hypertension portends a greater likelihood of developing future hepatic complications in untreated patients.[81, 82] Transient elastography provides point-of-care information regarding liver stiffness and can reliably distinguish patients with a high versus low likelihood of cirrhosis.[83-85]

Screening for hepatitis B virus (HBV) with an FDA-approved hepatitis B surface antigen (HBsAg) assay and HIV with an FDA-approved HIV-antigen/antibody test is recommended because these coinfections are associated with a poorer HCV prognosis.[86-90] Persons who test positive for HBsAg require additional monitoring during HCV treatment due to HBV reactivation risk.[91] Anti-HBV therapy is another consideration for these patients. For persons who test negative for HBsAg but positive for hepatitis B core antibodies (with or without hepatitis B surface antibodies) have resolved HBV infection and no further workup or additional monitoring is needed.[92]

Primary prevention measures for persons without coinfection include counseling about how to avoid contracting HIV and HBV, and immunization against HBV and hepatitis A virus (HAV) as needed. CDC also recommends pneumococcal vaccination for all persons with chronic liver disease.[93]

Universal Treatment of Adults With Chronic Hepatitis C and Simplified Treatment Algorithms

Chronic HCV infection is an important infectious cause of death in the United States and a major contributor to morbidity and mortality from viral hepatitis globally. The availability of safe, effective, well tolerated therapy substantially facilitates the goal of expanding HCV treatment as recommended in the HCV elimination strategies of WHO[3] and NASEM.[4] Overall, DAA regimens successfully cure HCV infection in >95% of treated persons.[2] Moreover, the development of coformulated, pangenotypic regimens that require relatively short treatment durations has greatly simplified HCV antiviral therapy administration. Despite these remarkable therapeutic improvements, in 2015, only 7.4% of persons with diagnosed HCV had begun antiviral treatment.[94] Although more recent limited data indicate increased DAA access and uptake, this has been uneven geographically and across different patient populations.[95-97] Thus, only a minority of persons with HCV infection obtain the many health benefits of successful treatment. From a public health perspective, successful HCV treatment also supports primary prevention by decreasing the population of persons capable of transmitting the virus, thereby reducing the incidence of HCV infection.

Universal Treatment of Adults With HCV Infection

Recommendation

18. *Antiviral treatment is recommended for all adults with acute or chronic HCV infection, except those with a short life expectancy that cannot be remediated by HCV therapy, liver transplantation, or another directed therapy. (I, A)*

Eradicating hepatitis C infection results in numerous health benefits, including reduced rates of all-cause mortality, cirrhosis, hepatic decompensation, and HCC.[33, 37, 98-110] Successful treatment also confers improvement in extrahepatic manifestations of HCV disease, including cryoglobulinemic vasculitis[111-116] and

HCV-related non-Hodgkin lymphoma and other lymphoproliferative disorders,[117-125] as well as improved productivity and quality of life.[34, 35, 126-131] Given these and other benefits associated with virologic cure, the HCV guidance panel strongly recommends antiviral treatment for all adults with acute or chronic HCV infection (except those with a short life expectancy that cannot be remediated). Importantly, this recommendation includes persons with ongoing substance use (alcohol or drugs). Several studies demonstrate that treatment-committed individuals in this disproportionately affected population achieve sustained virologic response (SVR) rates with DAA therapy comparable to those without known, current substance use.[73, 132-139] The universal treatment recommendation represents a principal tenet of the HCV guidance along with newly recommended universal hepatitis C screening of adults. The HCV guidance panel urges healthcare providers caring for adults to encourage hepatitis C screening and treatment (if positive) because DAA therapy is safe and cures HCV infection in most people.[2]

Simplified HCV Treatment Algorithms for Treatment-Naive Adults Without Cirrhosis or With Compensated Cirrhosis

One approach to improving access to curative HCV treatment is expanding the number of healthcare providers administering antiviral therapy. Data demonstrate that HCV treatment can be effectively provided by a broad range of healthcare professionals with differing expertise—including specialists, primary care physicians, nurse practitioners, clinical pharmacy specialists, physician assistants, and registered nurses—without compromising treatment efficacy or safety.[95, 140] Consequently, the HCV guidance panel developed simplified HCV treatment algorithms for treatment-naive adults (without cirrhosis or with compensated cirrhosis), which align with the NASEM plan to eliminate HCV as a U.S. public health burden by 2030. These simplified treatment algorithms are designed to be used by any healthcare provider knowledgeable about HCV disease and treatment, including those without extensive experience who have timely access to a specialist. The simplified treatment algorithms provide concise, clear guidance on pretreatment assessment, on-treatment monitoring, assessment of response, and post-treatment management (see Figures 2 and 3).

Simplified HCV Treatment Algorithm for Treatment-Naive Adults Without Cirrhosis

The simplified HCV treatment algorithm for adults without cirrhosis (see Figure 2) applies to persons aged ≥18 years who have not been previously treated for their infection and do not have evidence of cirrhosis as defined by the noninvasive parameters specified in the HCV guidance. Evidence of cirrhosis includes a FIB-4

score >3.25 or any of the following findings from a previously performed test: transient elastography indicating cirrhosis (e.g., FibroScan [Echosens, Paris, France] stiffness >12.5 kPa); noninvasive serologic tests that exceed proprietary cutoffs (e.g., FibroSure [BioPredictive, Paris, France], Enhanced Liver Fibrosis Test [Siemens Healthcare, Erlangen, Germany], etc.); clinical evidence of cirrhosis (e.g., liver nodularity and/or splenomegaly on imaging, platelet count <150,000/mm^3, etc.); and/or prior liver biopsy showing cirrhosis. This simplified treatment algorithm is not recommended for persons with HIV and/or HBV infection, prior liver transplantation, HCC, end-stage renal disease (i.e., eGFR <30 mL/min/m^2), and/or current pregnancy because they require more nuanced care. See the online HCV guidance for management and treatment recommendations for these patients.

Figure 2. Recommended Simplified HCV Treatment Algorithm for Treatment-Naive Adults Without Cirrhosis

The pretreatment evaluation should include an assessment for cirrhosis, medication reconciliation, drug-drug interactions, and patient education regarding treatment administration and the importance of adherence, and transmission prevention. Recommended pretreatment laboratory testing is conducted to confirm chronic HCV infection and exclude decompensated liver disease, HBV and/or HIV coinfection, end-stage renal disease, and pregnancy prior to treatment initiation.

Clearance of HCV infection with DAA therapy can improve hepatic function and thereby affect the safety and efficacy of some concomitantly administered medications. Real-world data indicate an association between DAA therapy and reduced glycemia, particularly among people with diabetes.[141-144] Patients taking diabetes medication(s) should be informed of the potential for symptomatic hypoglycemia during and after DAA therapy. Glucose monitoring during and after DAA treatment is recommended; dosage adjustments of diabetes medication(s) may be needed. Real-world data also indicate an association between DAA therapy and a clinically significant reduction in warfarin dose-response.[145, 146] Patients taking warfarin should be informed of the potential for a change in their anticoagulation status. INR monitoring for subtherapeutic anticoagulation is recommended during and after DAA treatment; warfarin dosage adjustments may be needed. For others, on-treatment laboratory monitoring is not required unless a patient experiences treatment-related side effects or there are adherence concerns.

Several well-designed, robust clinical trials have demonstrated the safety[147] and high curative efficacy of glecaprevir/pibrentasvir[148-158] and sofosbuvir/velpatasvir[159-164] among treatment-naive persons without cirrhosis regardless of HCV genotype. These findings have been confirmed in real-world cohort studies for both glecaprevir/pibrentasvir[165-167] and sofosbuvir/velpatasvir.[167-171] Based on these data, 8 weeks of glecaprevir/pibrentasvir or 12 weeks of sofosbuvir/velpatasvir is recommended for adults eligible for the simplified treatment algorithm.

To assess treatment response, HCV-RNA and hepatic aminotransferase testing is recommended 12 or more weeks after completing DAA treatment. Undetectable HCV RNA represents SVR and virologic cure. In the absence of cirrhosis, persons who attain SVR require no liver-specific follow-up. For those with ongoing HCV risk factors, risk-reduction counseling is recommended as well as HCV-RNA testing annually or anytime an increase in hepatic aminotransferase levels occurs. Recurrent HCV viremia after attainment of SVR represents either reinfection or a relapse (i.e., reemergence of the originally infecting HCV strain).[172, 173] With reinfection, treatment approaches are identical to those for initial treatment. If relapse is suspected or cannot be ruled out, such patients should be managed by clinicians with expertise in managing HCV treatment failure.

Persons who attain SVR but have persistently elevated hepatic aminotransferase levels require evaluation for other causes of liver disease. Individuals for whom treatment fails can often be successfully retreated; see the online HCV guidance for management and antiviral regimen recommendations for treatment-experienced persons. If retreatment is delayed or not feasible, assessment for liver disease progression every 6-12 months is recommended as specified in Figure 2. Advise all patients, regardless of SVR, to avoid excess alcohol intake to prevent liver damage.

Simplified HCV Treatment Algorithm for Treatment-Naive Adults With Compensated Cirrhosis

The simplified HCV treatment algorithm for adults with compensated cirrhosis (see Figure 3) applies to persons aged ≥18 years who have not been previously treated for their infection and have evidence of compensated cirrhosis (i.e., Child-Turcotte-Pugh [CTP] class A) but not decompensated cirrhosis (i.e., CTP class B or C). Noninvasive evidence of cirrhosis mirrors the parameters specified in the previous section and are shown in Figure 3. Calculation of the CTP score is recommended to differentiate compensated versus

decompensated cirrhosis. A CTP score ≥7 or any history of decompensation disqualifies these patients for the simplified treatment algorithm. Recommended pretreatment assessment also includes clinical evaluation for ascites and hepatic encephalopathy, and ultrasound imaging of the liver within the prior 6 months to evaluate for HCC and subclinical ascites; any of these clinical or imaging findings are contraindications to use of the simplified treatment algorithm. See the online HCV guidance for treatment and management of persons with decompensated cirrhosis. Other circumstances and comorbid conditions that disqualify a patient for use of the simplified treatment algorithm mirror those described in the previous section and are shown in Figure 3. Similarly, medication reconciliation, assessment for potential drug-drug interactions, and pretreatment education and counseling are the same as for treatment-naive patients without cirrhosis (see Figure 3).

Figure 3. Recommended Simplified HCV Treatment Algorithm for Treatment-Naive Adults With Compensated Cirrhosis

Pretreatment laboratory assessment of patients with compensated cirrhosis eligible for use of the simplified treatment algorithm includes CBC, INR, a hepatic function panel, and eGFR within 3 months of initiating antiviral therapy. Quantitative HCV RNA, HIV antigen/antibody, and HBsAg tests are recommended any time prior to initiating DAA therapy. Notably, pretreatment genotype testing is recommended if sofosbuvir/velpatasvir therapy is planned because of the necessity for baseline RAS testing in persons with cirrhosis and genotype 3 infection.

Because new-onset hepatic decompensation develops rarely during HCV DAA treatment, clinicians may opt for on-treatment blood tests to detect liver injury. Patients who experience deteriorating hepatic laboratory parameters and/or new-onset jaundice, ascites, encephalopathy, or other new liver-related signs or symptoms should promptly see a liver specialist. On-treatment monitoring of blood glucose levels and INR are recommended for persons on diabetes medications or warfarin, respectively, with dosage adjustments as warranted (see previous section for a more detailed discussion).

Multiple rigorous clinical trials have demonstrated the safety[139] and high curative efficacy of glecaprevir/pibrentasvir[148, 174-177] and sofosbuvir/velpatasvir[160, 162-164, 171, 178-180] among treatment-naive adults with compensated cirrhosis, regardless of HCV genotype. These findings have been confirmed in real-world

cohort studies for both glecaprevir/pibrentasvir[153, 165-167, 181-183] and sofosbuvir/velpatasvir.[169, 170, 184-189] Based on these data, recommended regimens for adults eligible for the simplified treatment algorithm are 8 weeks of glecaprevir/pibrentasvir for patients with genotype 1-6, or 12 weeks of sofosbuvir/velpatasvir for those with genotype 1, 2, 4, 5, or 6. Pretreatment RAS testing is recommended for persons with genotype 3 because only those without a baseline NS5A Y93H RAS are eligible for a 12-week course of sofosbuvir/velpatasvir. Patients with genotype 3 and a baseline Y93H RAS should be treated with glecaprevir/pibrentasvir or an alternative regimen (see the online HCV guidance).

HCV-RNA and aminotransferase testing are recommended 12 or more weeks after completion of DAA therapy to assess treatment response. Undetectable HCV RNA represents SVR and virologic cure. Ultrasound surveillance for HCC (with or without alpha-fetoprotein testing) every 6 months after treatment completion is recommended for patients with cirrhosis, regardless of achieving SVR.[78] Upper endoscopic surveillance for esophageal varices is recommended, consistent with AASLD guidance on portal hypertensive bleeding in cirrhosis.[190] Advise all patients to abstain from alcohol use to reduce the risk of liver disease progression. Risk-reduction counseling is recommended for persons with ongoing HCV risk factors. HCV-RNA testing annually or anytime an increase in hepatic aminotransferase levels occurs is also recommended for these persons. Recurrent HCV viremia after attainment of SVR represents either reinfection or a relapse.[172, 173] With reinfection, the treatment approaches are identical to those for initial treatment. If relapse is suspected or cannot be ruled out, such patients should be managed by clinicians with expertise in managing HCV treatment failure. Persons who attain SVR but experience persistently elevated hepatic aminotransferase levels require evaluation for other causes of liver disease.

Individuals in whom initial treatment fails should be evaluated by a specialist for retreatment, which often proves successful. See the online HCV guidance for management and antiviral regimen recommendations for treatment-experienced persons. If retreatment is delayed or not feasible, assessment for liver disease progression every 6-12 months is recommended as specified in Figure 3.

HCV in the Pediatric Population

An estimated 3.5 million to 5.0 million children and adolescents worldwide have chronic HCV infection,[191, 192] including an estimated 23,000 to 46,000 pediatric patients in the United States.[193] Vertical transmission accounts for most HCV infections in the pediatric population.[194] The rate of mother-to-child transmission of HCV infection is approximately 5%, although rates are higher among women with inadequately controlled HIV coinfection, and in women with HCV RNA >6 $\log_{10}$ IU/mL.[195-201] Universal prenatal hepatitis C screening, as recommended by the HCV guidance panel, is expected to facilitate improved identification of at-risk infants who require HCV testing.[202-204] This will likely result in better HCV disease case finding in the pediatric population.

Antiviral treatment of children and adolescents with HCV infection has been previously limited to adolescents aged ≥12 years due to the absence of FDA-approved regimens for younger children. Recent and anticipated FDA approval of additional regimens for children aged 3 through 11 years present an opportunity to expand HCV treatment in the pediatric population. Modeling data indicate that HCV DAA therapy is cost-effective in children as young as 12 years[205] and is anticipated to be so for the 3- through 11-year-old age group.

Testing of Perinatally Exposed Children and Siblings of Children With HCV Infection

Recommendations

19. **All children born to women with acute or chronic hepatitis C should be tested for HCV infection. Antibody-based testing is recommended at or after 18 months of age. (I, A)**

20. **Testing with an HCV-RNA assay can be considered in the first year of life, but the optimal timing of such testing is unknown. (IIa, C)**

21. **Testing with an HCV-RNA assay can be considered as early as 2 months of age. (IIa, B)**

22. **Repetitive HCV-RNA testing prior to 18 months of age is not recommended. (III, A)**

23. **Children who are anti-HCV positive after 18 months of age should be tested with an HCV-RNA assay after age 3 to confirm chronic hepatitis C infection. (I, A)**

24. **The siblings of children with vertically acquired chronic hepatitis C should be tested for HCV infection, if born from the same mother. (I, C)**

The HCV guidance panel recommends HCV-antibody testing at age ≥18 months for children born to women with HCV infection. Earlier antibody testing is not recommended due to maternal anti-HCV, which can persist

in the infant's serum for up to 18 months.[206, 207] For infants with a positive HCV-antibody test at or after 18 months of age, the HCV guidance panel recommends HCV-RNA testing at age ≥3 years to determine chronic infection versus spontaneous viral clearance. Approximately 25%-50% of vertically infected infants spontaneously resolve HCV infection by 4 years of age,[191, 200, 208-211] although spontaneous viral clearance can occur later in childhood.[212-214]

HCV-RNA testing can be considered in the first year beginning at 2 months of age, particularly in the setting of concern about loss to follow-up. Detectable HCV RNA during the first year of life reliably correlates to anti-HCV positivity at 18 months.[215] Repetitive HCV-RNA testing prior to 18 months of age is not recommended. Hepatitis C screening is indicated for siblings of children with vertically acquired, chronic HCV infection if born to the same mother and not previously tested for HCV infection.

Counseling Parents and Children Regarding HCV Transmission and Prevention *Recommendations*

25. *Parents should be informed that hepatitis C is not transmitted by casual contact and, as such, children with HCV infection do not pose a risk to other children and can participate in school, sports, and athletic activities, and engage in all other regular childhood activities without restrictions. (I, B)*

26. *Parents should be informed that universal precautions should be followed at school and in the home of children with HCV infection. Educate families and children about the risk and routes of HCV transmission, and the techniques for avoiding blood exposure, such as avoiding the sharing of toothbrushes, razors, and nail clippers, and the use of gloves and dilute bleach to clean up blood. (I, B)*

Children with HCV infection often face discrimination and stigmatization in school and child-care settings, usually driven by public misconceptions about contracting hepatitis C. Further, well-intentioned parents and caregivers may limit the activities of a child with HCV infection due to concerns about their health.[216, 217] Clinicians caring for these children should counsel and assure parents that their child poses no threat to others because HCV is not transmitted by casual contact in the absence of blood exposure. Children with HCV infection can and should fully participate in school and extracurricular activities of their choosing without restrictions. Educate parents and appropriately aged children and adolescents about how to prevent HCV transmission in the home and at school. This includes implementing universal precautions for preventing transmission of bloodborne pathogens, covering open wounds, cleaning blood-contaminated surfaces with

dilute bleach, and avoiding sharing personal hygiene items that might be contaminated with blood, such as toothbrushes, razors, nail clippers, and so on (see Table 2).

Sexual transmission of HCV occurs but inefficiently except among men with HIV infection who have unprotected sex with men.[218-220] Encourage adolescents with HIV/HCV coinfection and those with multiple sexual partners and/or sexually transmitted infections (STIs) to use barrier precautions to prevent transmission of HCV and other STIs. Counsel other adolescents with HCV infection that the risk of sexual transmission is low, but barrier precautions are recommended to prevent HIV and other STIs.

Monitoring and Medical Management

Recommendations

27. *Routine liver biochemistries at initial diagnosis and at least annually thereafter are recommended to assess for HCV disease progression. (I, C)*

28. *Appropriate vaccinations are recommended for children with HCV infection who are not immune to HBV and/or HAV to prevent these infections. (I, C)*

29. *Disease severity assessment via routine laboratory testing and physical examination, as well as use of evolving noninvasive modalities (i.e., transient elastography, imaging, or serum fibrosis markers) is recommended for all children with chronic hepatitis C. (I, B)*

30. *Children with cirrhosis should undergo HCC surveillance and endoscopic surveillance for varices per standard recommendations. (I, B)*

31. *Hepatotoxic drugs should be used with caution in children with chronic hepatitis C after assessment of potential risks versus benefits of treatment. Use of corticosteroids, cytotoxic chemotherapy, or therapeutic doses of acetaminophen are not contraindicated in children with chronic hepatitis C. (II, C)*

32. *Solid organ transplantation and bone marrow transplantation are not contraindicated in children with chronic hepatitis C. (II, C)*

33. *Anticipatory guidance about the potential risks of alcohol for progression of liver disease is recommended for adolescents with chronic HCV infection and their families. Abstinence from alcohol and interventions to facilitate cessation of alcohol consumption, when appropriate, are advised for all persons with chronic HCV infection. (I, C)*

The initial assessment of children with chronic HCV infection includes exclusion of other causes of liver disease, assessment of HCV disease severity, and detection of extrahepatic manifestations of HCV (uncommon in children). Children with chronic HCV infection usually appear clinically well on physical examination; hepatomegaly occurs in ≤10% of patients.[221, 222] Assessment of hepatic laboratory parameters, including albumin, aminotransferase levels, total bilirubin, INR, and platelet count, is recommended every 6-12 months. Persistently or intermittently elevated hepatic aminotransferase levels occur in approximately 50% of children with chronic HCV infection.[221] Serum aminotransferase levels, however, do not consistently correlate with HCV liver disease severity.[223] Laboratory testing for concomitant infections with HBV (i.e., HBsAg, anti-HBc, and anti-HBs testing) and HIV (i.e., anti-HIV), and immunity to HAV (i.e., anti-HAV IgG) are also recommended due to shared risk factors and the need to vaccinate nonimmune children against HAV and HBV. Serum fibrosis markers hold promise to assess hepatic disease severity but require further validation in the pediatric population.[224-226]

For pediatric patients with suspected advanced liver disease, initial assessment using liver ultrasound imaging to evaluate for splenomegaly and/or venous collaterals is recommended to avoid ionizing radiation exposure. Although liver biopsy remains the gold standard to assess inflammation grade and fibrosis stage, sampling variability and potential adverse events (e.g., bleeding) are problematic.[227-231] Additionally, most clinicians and patients (or their parents) prefer noninvasive alternatives to determine the presence or absence of cirrhosis, particularly in the pediatric population. Ultrasound-based, liver elastography appears increasingly promising for monitoring children and adolescents with chronic HCV infection.[232-236]

HCV-related liver disease generally progresses more slowly in children and adolescents compared to adults, although disease progression is unpredictable.[191, 221, 237-239] Despite a paucity of data evaluating risk factors for HCV disease progression in the pediatric population, children with comorbid conditions (e.g., obesity with nonalcoholic fatty liver disease, congenital heart disease with elevated right heart pressures, and HIV and/or HBV coinfection) and those receiving hepatotoxic drugs require careful monitoring.[87-90, 191, 226, 240]

Advanced HCV-related liver disease develops infrequently in children and teens, usually occurring more than 30 years after initial infection.[241-243] Cirrhosis is uncommon and HCC even more rare, occurring almost exclusively in those with cirrhosis.[213, 214, 242, 244-253] Limited evidence suggests that children with chronic

hepatitis C and a history of childhood leukemia may be at increased risk of developing HCC.[254, 255] The HCV guidance panel recommends HCC surveillance using liver ultrasound imaging (with or without alpha-fetoprotein testing) every 6 months for pediatric HCV patients with cirrhosis, consistent with AASLD guidance for HCC surveillance in adults.[78] A baseline endoscopy to detect esophageal varices and every 3 years thereafter (in the absence viral clearance) is advisable for these patients. Successful HCV DAA therapy substantially reduces the risk for cirrhosis complications.[256, 257]

In children with HCV-related advanced fibrosis or cirrhosis, medications known to accelerate hepatic fibrosis (e.g., methotrexate) should be avoided, if possible. Although corticosteroids and other immunosuppressants may enhance HCV replication, they are not contraindicated in children with HCV infection and should be prescribed for appropriate indications based on the overall risks versus benefits. Notably, icteric flares of HCV—as reported in children and adults with chronic HBV infection—have not been reported in children receiving an organ transplant or cytotoxic chemotherapy. Although underlying liver disease is a risk factor for the development of hepatic veno-occlusive disease following bone marrow transplantation,[258, 259] chronic HCV infection should not delay this therapy.

No dosage adjustments are necessary for commonly prescribed medications such as antimicrobial, antiepileptic, and cardiovascular agents. Nonsteroidal anti-inflammatory drugs and aspirin should be avoided, if possible, for patients with cirrhosis and esophageal varices due gastrointestinal bleeding and nephrotoxicity risks. Acetaminophen is a safe and effective analgesic for children and adolescents with chronic HCV infection when dosed per packaging recommendations.

Alcohol abstinence is strongly advised to reduce the risk for liver disease progression.[61, 63, 64, 66-72] Similarly, counsel appropriately aged, untreated pediatric patients and their parents about the importance of maintaining a healthy body weight due to the deleterious effects of insulin resistance on HCV-related fibrosis progression.[260-271]

Whom and When to Treat Among Children and Adolescents With HCV Infection

Recommendations

34. **DAA treatment with an approved regimen is recommended for all children and adolescents with HCV infection aged ≥3 years as they will benefit from antiviral therapy, regardless of disease severity. (I, B)**

35. **The presence of extrahepatic manifestations—such as cryoglobulinemia, rashes, and glomerulonephritis—as well as advanced fibrosis should lead to early antiviral therapy to minimize future morbidity and mortality. (I, C)**

Although advanced HCV-related liver disease occurs uncommonly in children and adolescents, hepatic fibrosis progresses over time and complications may develop during early adulthood. The rationale for treating persons with HCV infection in the pediatric population mirrors that for adults, i.e., to reduce disease-related morbidity and mortality. Additionally, curative DAA therapy during childhood or adolescence supports the HCV treatment as transmission prevention paradigm, a pillar of the 2017 NASEM hepatitis C elimination strategy.[4] The extension of pediatric HCV antiviral treatment to 3- through 11-year-olds comes at a critical inflexion point in the hepatitis C epidemic, given the recent increase in HCV infection among women of childbearing age[272-275] and the fact that an estimated 29,000 women with HCV infection gave birth each year from 2011 to 2014.[18]

HCV Antiviral Therapy for Children and Adolescents Aged ≥3 Years, Without Cirrhosis or With Compensated Cirrhosis (Child-Pugh A)

Recommendations for Treatment-Naive and Interferon-Experienced Patients

36. **An 8-week course of the daily fixed-dose combination of glecaprevir (300 mg)/pibrentasvir (120 mg) is recommended for treatment-naive adolescents aged ≥12 years or weighing ≥45 kg with any HCV genotype, without cirrhosis or with compensated cirrhosis. (I, B)**

37. **A 12-week course of the combination of ledipasvir/sofosbuvir (weight-based dosing, see Table 4) is recommended for treatment-naive or interferon-experienced children aged ≥3 years with HCV genotype 1, 4, 5, or 6 infection, without cirrhosis or with compensated cirrhosis. (I, B)**

The high rate of HCV clearance with DAA regimens previously demonstrated in adults are increasingly being replicated in the pediatric population. Eight weeks of the daily fixed-dose combination of glecaprevir (300 mg)/pibrentasvir (120 mg) gained FDA approval for use in treatment-naive or interferon-experienced adolescents aged ≥12 years or weighing ≥45 kg with any HCV genotype infection, without cirrhosis or with

compensated cirrhosis (Child-Pugh A). Although the registration trial included only adolescents with genotype 1 through 4,[276] glecaprevir/pibrentasvir garnered FDA approval for all genotypes based on the safety and efficacy of the regimen demonstrated in adults.[148-150, 152-157, 165-167, 277] The recommendations for use of glecaprevir/pibrentasvir in treatment-experienced adolescents is also based on clinical trial data from adults.[154, 156, 176, 278-280] Given its pangenotypic activity, and safety and efficacy records in adults, the HCV guidance panel recommends glecaprevir/pibrentasvir as the first choice for adolescent HCV treatment. Coadministration of carbamazepine, efavirenz-containing regimens, and St. John's wort should be avoided because these compounds may decrease circulating concentrations of glecaprevir and pibrentasvir.

In August 2019, the FDA approved an expansion of pediatric indications for ledipasvir/sofosbuvir to include the 3- through 11-year-old age group in addition to the ≥12 years adolescent group for specific clinical scenarios. Dosing is weight based (see Table 4). Twelve weeks of ledipasvir/sofosbuvir is recommended for treatment-naive children and adolescents aged ≥3 years with genotype 1, 4, 5, or 6, without cirrhosis or with compensated cirrhosis (Child-Pugh A). This regimen is also recommended for interferon-experienced (± ribavirin, with or without an HCV protease inhibitor) children and adolescents aged ≥3 years with genotype 1 or 4. A 12-week course is recommended for patients without cirrhosis; 24 weeks is recommended for those with compensated cirrhosis. Three clinical trials supporting the approval of ledipasvir/sofosbuvir in the pediatric population aged ≥3 years demonstrated high SVR12 rates comparable to those observed in adults.[281-283] Limited real-world data further corroborate these findings.[284, 285]

In September 2019, the FDA newly approved weight-based sofosbuvir plus ribavirin for treatment-naive and interferon-experienced (± ribavirin) children aged ≥3 years with genotype 2 or 3, without cirrhosis or with compensated cirrhosis (Child-Pugh A). A 12-week course is recommended for pediatric patients without cirrhosis and 24 weeks is recommended for those with compensated cirrhosis (see the online HCV guidance for dosing recommendations). The registration trial conducted in children aged 3 to <12 years demonstrated an SVR12 of 98%.[286] The use of sofosbuvir plus ribavirin is further supported by clinical trial data involving adolescents[287] and adults with genotype 2 or 3 infection.[288-291] At the time of manuscript preparation, sofosbuvir (plus ribavirin) remained the only FDA-approved DAA for children 3 through 11 years with genotype 2 or 3 infection. However, recent clinical trials evaluating weight-based dosing of sofosbuvir/velpatasvir[292] and glecaprevir/pibrentasvir[293] are expected to lead to FDA approval for children

aged 3 through 11 years. The HCV guidance panel recommends awaiting approval of a pangenotypic regimen unless there is a compelling need for immediate antiviral treatment of children aged 3 through 11 years with genotype 2 or 3 infection.

DAA-experienced pediatric HCV patients are rarely encountered in clinical practice. Due to a paucity of data in the pediatric population, DAA-experienced children and adolescents with HCV infection should be treated using the adult HCV guidance while under the supervision of a pediatric HCV specialist. Similarly, decompensated cirrhosis and recurrent HCV after liver transplantation are rare clinical scenarios; children and adolescents with these conditions require specialty care. See the online HCV guidance for additional information about treatment of these children and adolescents.

As with adults, testing for active HBV infection (i.e., HBsAg, anti-HBc, and anti-HBs) is recommended prior to initiating HCV DAA therapy in pediatric patients due to the risk for HBV reactivation during or after treatment.[92, 294, 295] Additionally, on-treatment and post-treatment glucose monitoring for hypoglycemia in children and adolescents with diabetes and INR monitoring in those taking warfarin is recommended due to potential alterations in dose-response relationships associated with DAA-related HCV viral clearance.[141-146]

Acute HCV Infection

Acute HCV infection is arbitrarily defined as the first 6 months of infection. Patients are often minimally symptomatic or experience nonspecific symptoms (e.g., fatigue, anorexia, mild or moderate abdominal pain, low-grade fever, nausea, and/or vomiting) with mild to moderate elevations in hepatic aminotransferases.[296] Jaundice occurs in a minority of patients (< 25%) and fulminant hepatic failure is extremely rare.[297, 298] Despite difficulties in diagnosis and reporting, CDC estimates that 44,300 acute HCV infections occurred in the United States in 2017 with the upper limit of the confidence interval being 151,000 cases.[299] As previously noted, increased injection drug use associated with the opioid epidemic accounts for much of the recent increase in acute HCV infection incidence. An estimated 75% of persons acutely infected with HCV progress to chronic infection, although this number varies depending on host factors (e.g., age at exposure, sex, HIV coinfection, and IL28B genotype).

Substantial fluctuations in viremia during acute HCV infection may lead to higher HCV RNA levels in this phase of the infection compared with those seen during chronic infection.[300, 301] Drawing on the analogy from HIV infection and limited evidence with HCV, acute HCV infection may be associated with an increased risk for transmission.[302] Conversely, antiviral treatment during acute infection has the potential to reduce transmission to other susceptible individuals (i.e., treatment as prevention). Modeling studies support treatment of acute HCV infection, demonstrating cost-effectiveness assuming high treatment efficacy with a relatively short treatment duration—requisite conditions that currently exist.[303, 304] Successful HCV treatment as prevention of transmission has been demonstrated in several cohorts of HIV-positive men who have sex with men (MSM) where unrestricted access to DAA therapy resulted in an approximately 50% decrease in acute HCV infections.[305]

Data addressing optimal treatment approaches for acute HCV infection continue to evolve. In the interim, current guidance is to treat with regimens and durations as recommended for chronic HCV infection until additional data on abbreviated treatment regimens become available.

Diagnosis of Acute HCV Infection

Recommendation

38. ***HCV-antibody and HCV-RNA testing are recommended when acute HCV infection is suspected due to known exposure, clinical presentation, or elevated aminotransferase levels (see Figure 4). (I, C)***

HCV RNA typically becomes reliably detectable within 2-3 weeks after viral exposure[306-309]; HCV antibody seroconversion among immunocompetent persons typically occurs 2-3 months after exposure, on average.[308-311] Therefore, the best laboratory evidence to support a diagnosis of acute HCV infection is a positive HCV-RNA test in the setting of a negative HCV-antibody test (identification during the seronegative window period) or a positive HCV-antibody test after a prior negative anti-HCV test (seroconversion).[51, 52, 312] Rarely, these approaches may be misleading such as in immunosuppressed individuals with impaired antibody production.[58, 313, 314]

Laboratory-based diagnosis of acute HCV infection is most straightforward when there has been a discrete, known or suspected exposure (e.g., after new onset or a change in drug injection practice, a percutaneous

needlestick exposure to HCV-infected blood, a potentially nonsterile tattoo, or sexual contact). Baseline HCV-antibody and HCV-RNA testing should be performed within 48 hours of the exposure to document baseline HCV infection status (see Figure 4).

Figure 4. Testing Algorithm for Discrete, Recognized HCV Exposure[a]

[a] Often there is no discrete exposure and/or the entry to healthcare occurs with jaundice or elevated liver enzymes. In those instances, baseline testing cannot be performed and the diagnosis of acute HCV infection is based on clinical criteria (see text).

[b] Repeat HCV Ab is not needed if the test is positive at baseline. Frequency of testing can be tailored based on risk of exposure.

[c] If there were additional exposures in the preceding 6 months, a newly diagnosed patient who is HCV RNA and HCV Ab positive may still be in the acute phase. Symptoms, elevated ALT, and/or fluctuations in virus levels may distinguish acute from chronic HCV infection.

[d] Baseline testing should be performed within 48 hours of exposure to determine existing infection status, including HCV RNA, HCV Ab, and ALT.

If baseline testing is negative, repeat testing for HCV antibody and HCV RNA is recommended. The frequency can be tailored based on management objectives (e.g., monthly testing to identify and treat acute infection). If the baseline HCV-antibody test is positive but HCV RNA is undetectable, repeat HCV-RNA and ALT testing is recommended to identify acute reinfection. When baseline HCV-antibody and HCV-RNA testing are both positive, the person most likely already has chronic infection from a prior exposure.

Individuals suspected of having acute HCV infection often do not have a discrete exposure and/or have no prior baseline testing, making a definitive diagnosis of acute infection more challenging (see Table 5). Acute infection should be suspected if there is a new rise in the ALT level without an alternative cause.[315, 316] Acute infection should also be suspected when there are low (especially $<10^4$ IU/mL) or fluctuating (>1 $\log_{10}$ IU/mL) HCV-RNA levels, or spontaneous clearance during follow-up. These patterns do not commonly occur outside of the acute phase of HCV infection.[300, 301, 317] Patients suspected of having acute HCV infection also require laboratory evaluation to exclude other or coexisting causes of acute hepatitis (e.g., HAV, HBV, hepatitis delta

virus superinfection if chronically infected with HBV, hepatitis E virus [in the correct clinical scenario], and autoimmune hepatitis).[318] HIV testing is also recommended.

Medical Management and Transmission Prevention

Recommendations

39. ***After the initial diagnosis of acute HCV with viremia (defined as quantifiable RNA), HCV treatment should be initiated without awaiting spontaneous resolution. (I, B)***

40. ***Counseling is recommended for patients with acute HCV infection to avoid hepatotoxic insults, including hepatotoxic drugs (e.g., acetaminophen) and alcohol consumption, and to reduce the risk of HCV transmission to others. (I, C)***

41. ***Referral to an addiction medicine specialist is recommended for patients with acute HCV infection related to substance use. (I, B)***

The HCV guidance panel newly recommends initiating DAA therapy upon initial diagnosis of acute HCV infection without awaiting possible spontaneous clearance (i.e., a test and treat strategy). Real-world data demonstrate a reduction in HCV viremia incidence and prevalence with unrestricted access to HCV therapy.[305, 319] Mathematical modeling studies also suggest that scaling up DAA treatment can reduce HCV incidence and prevalence, especially among populations at highest risk of onward transmission (e.g., MSM and PWID).[303, 320-322] Additionally, delay introduced by waiting for spontaneous clearance may increase the number of patients lost to follow-up.

Counseling persons with acute HCV infection to reduce behaviors that could result in virus transmission (e.g., sharing injection equipment and engaging in high-risk sexual practices) is recommended. Because the risk of transmission of other bloodborne, sexually transmitted infections (e.g., HIV and HBV) is higher in the acute phase of infection, some experts counsel persons with acute HCV to consider using barrier precautions, even in a stable monogamous relationship. For persons with acute HCV infection who have a history of recent injection drug use, referral to harm reduction services and an addiction medicine specialist is recommended as needed.[323-326]

Monitoring with hepatic panels (ALT, AST, bilirubin, and INR in the setting of an increasing bilirubin level) is recommended at 2-week to 4-week intervals until resolution of acute hepatitis C.[316] Hepatic laboratory parameters typically improve rapidly with antiviral treatment. Alteration of dosages of concomitant medications that are metabolized by hepatic enzymes is unnecessary unless there is concern for developing acute liver failure (e.g., increasing bilirubin level and prolongation of INR). Acetaminophen and alcohol consumption should be avoided during acute HCV infection.[327-329]

Patients with acute HCV infection rarely require hospitalization unless nausea and vomiting are severe. Although acute liver failure is very rare (<1%), it represents a serious and life-threatening complication of acute HCV infection. Patients with an INR >1.5 and those who exhibit any signs of acute liver failure (e.g., hepatic encephalopathy) should be immediately referred to a liver transplant center. Use of HCV antiviral regimens in acute liver failure should be managed by a clinician experienced in HCV treatment, ideally in consultation with a liver transplant specialist.

HCV infection spontaneously clears in 20%-50% of untreated patients.[330] Clearance of acute HCV infection usually occurs within 6 months of the estimated time of infection. Only 11%-14% of those who remain viremic at 6 months spontaneously clear the infection at a later time.[331, 332] Predictors of spontaneous clearance include presentation with jaundice, elevated ALT, HBsAg positivity, female sex, younger age, genotype 1 infection, and host genetic polymorphisms, most notably those near the IL28B gene.[330, 333]

Patients who experience spontaneous clearance do not require antiviral therapy. They do, however, require counseling about the risk of reinfection and testing at least annually for this development in the setting of ongoing risk behaviors. Notably, transient suppression of viremia sometimes occurs in persons with acute HCV infection, even among those who progress to chronic infection. Thus, a single undetectable HCV-RNA test result is insufficient to declare spontaneous clearance.[300, 333, 334]

Acute HCV Infection Treatment

Recommendation

42. Due to high efficacy and safety, the same regimens that are recommended for chronic HCV infection are recommended for acute infection. (IIa, C)

Data are emerging regarding treatment of acute HCV infection with abbreviated courses of DAA regimens in both HCV monoinfection and HIV/HCV coinfection.[335-338] There are presently insufficient data, however, to recommend abbreviated courses of any approved DAA regimens. Until more definitive data are available, recommended treatment is as described for chronic hepatitis C infection in the online HCV guidance. Pangenotypic regimens, as recommended in the simplified HCV treatment section, represent the preferred choice for eligible patients. For patients who are ineligible for simplified HCV treatment, genotyping may be considered to guide DAA regimen selection.

Organ Transplantation From HCV-Viremic Donors to HCV-Negative Recipients

In 2018, 8,250 liver transplantations were performed in the United States, the largest number ever performed in a single year.[339] Despite annual increases in the number of liver transplantations performed in the United States in the 10-year period from 2009 through 2018, more than 14,000 liver transplantation candidates died awaiting the procedure.[339] Given the sizable chasm between the number of waitlisted liver transplantation candidates and the pool of available organs, some transplant programs are turning to a previously untapped pool of organs from deceased HCV-viremic donors; historically, these organs were discarded with rare exception.[340] Coincident with the marked increase in drug overdose deaths among PWID in the United States,[341] this pool of donor organs has sadly increased substantially.[342] In stark contrast to this tragic loss of life, the development of safe and highly effective[2] DAA therapy provides an opportunity to consider use of allografts from HCV-viremic donors in HCV-negative recipients because iatrogenic HCV infection can be cured with retention of allograft function in the majority of cases. Recent data indicate increasing acceptance of these organs among HCV-negative recipients.[340, 343, 344] Although early outcome data are encouraging, the overall experience is limited and many ethical issues and scientific questions remain, such as avoidance of selection bias, the optimal timing of DAA therapy, detailed evaluation of drug-drug interactions between DAAs and immunosuppressants, and long-term graft and patient outcomes. Additional research is needed to clarify short-term and long-term risks and benefits, and to determine and refine optimal clinical management practices.

Considerations for Use of HCV-Viremic Donor Organs in HCV-Negative Recipients

Recommendations

43. Informed consent should include the following elements (I, C):

- **Risk of transmission from an HCV-viremic donor (and with a U.S. Public Health Service defined increased risk donor, the potential risks for other viral infections)**

- **Risk of liver disease if HCV treatment is not available or treatment is unsuccessful**

- **Benefits, specifically reduced waiting time and possibly lower waiting list mortality**

- **Unknown long-term consequences (hepatic and extrahepatic) of HCV exposure (even if cure is attained)**

- **Risk of allograft failure**

- **Risk of HCV transmission to partner**

44. Transplant centers should have a programmatic strategy to (I, C):

- **Document informed consent**

- **Assure access to HCV treatment and retreatment(s), as necessary**

- **Ensure long-term follow-up of recipients (beyond SVR12)**

The informed consent process for HCV-negative patients contemplating accepting an organ from an HCV-viremic donor must address not only the potential benefits and risks of the procedure itself but also the known HCV-specific risks as well as long-term uncertainties. Given the mismatch between the number of organ transplantation candidates and the pool of available organs, willingness to accept an allograft from an HCV-viremic donor can reduce waitlist time[345, 346] and improve access to transplantation,[347] thereby reducing the risk of dying while awaiting an available organ.[348-350]

To make an informed decision to consent to accepting an organ from an HCV-viremic donor, the recipient needs to understand the high risk of HCV infection. All donors undergo HCV-antibody testing and nucleic acid testing for HCV RNA. Donors who are HCV antibody positive and HCV RNA negative pose a very low risk of HCV transmission to the recipient.[351-353] Rarely, high risk donors with very recent HCV exposure who are anti-HCV positive and HCV RNA negative may pose a transmission risk.[354] These increased risk donors are identified according to guidelines issued by the U.S. Public Health Service.[355] Increased risk donors may also pose a risk for HIV and HBV transmission depending on their specific risk factors. Patients who receive an allograft from an increased risk donor require monitoring after transplantation to detect HCV transmission[353,

[355]) as well as possible HBV and/or HIV infection if the donor was at increased risk for these infections. HCV-viremic donors pose the highest risk for HCV transmission to allograft recipients.

Transplant recipients need to understand the risks conferred on them in the event of iatrogenic HCV infection from the allograft. This includes the necessity of HCV antiviral therapy and the risk of liver disease if such treatment is unavailable or unsuccessful. Additionally, there is a risk of DAA-associated allograft rejection and possible loss,[356-362] and/or reduced allograft function.[361, 363-366] Because use of allografts from HCV-viremic donors in HCV-negative recipients is a recent development in transplant medicine, there are no data on possible long-term hepatic and extrahepatic adverse effects associated with HCV exposure, even among those cured of the infection. Allograft recipients who are HCV viremic can potentially sexually transmit the virus to their partner(s), particularly among MSM.[74, 367-372]

The HCV guidance panel recommends that all programs performing HCV-viremia discordant solid organ transplantations have a strategy to execute and document a rigorous informed consent process; assure access to HCV treatment and retreatment, as needed; and ensure long-term follow-up of organ recipients to monitor for potential late consequences of HCV exposure and allograft function.

Treatment of HCV-Negative Recipients of Allografts from HCV-Viremic Donors
Recommendation Regarding Timing of DAA Therapy
45. Prophylactic/preemptive DAA therapy with a pangenotypic regimen is recommended. (II, B)
Recommendations for DAA Therapy
46. An 8-week course of the pangenotypic daily fixed-dose combination of glecaprevir (300 mg)/pibrentasvir (120 mg) is recommended. (I, C)
47. A 12-week course of the pangenotypic daily fixed-dose combination of sofosbuvir (400 mg)/velpatasvir (100 mg) is recommended. (I, C)
48. A 12-week course of the daily fixed-dose combination of ledipasvir (90 mg)/sofosbuvir (400 mg) is recommended for patients with genotype 1, 4, 5, or 6 only. (I, C)

Initiation of DAA therapy for HCV-negative recipients of an allograft from an HCV-viremic donor can occur prophylactically/preemptively (i.e., perioperatively without confirmation of HCV viremia in the recipient) or

reactively after documentation of HCV viremia. The goal is to undertake DAA therapy as early as clinically possible to avoid the development of acute hepatitis and other complications of HCV infection. Emerging data suggest that initiating prophylactic/preemptive DAA therapy before viremia occurs reduces the likelihood of complications, such as fibrosing cholestatic hepatitis.[359, 373-376] The prophylactic/preemptive approach may also allow for a shorter duration of DAA treatment,[359, 377] although this is not currently recommended outside of a clinical trial setting.

Because genotyping of HCV-viremic donors is not routinely performed, only a pangenotypic DAA regimen (i.e., glecaprevir/pibrentasvir or sofosbuvir/velpatasvir) should be used if opting for a prophylactic/preemptive treatment approach. With the reactive treatment approach, genotyping can be used to guide DAA regimen selection if a pangenotypic regimen is not utilized. Although clinical trial data demonstrate the safety and efficacy of elbasvir/grazoprevir among HCV-negative kidney transplant recipients of allografts from HCV-viremic donors,[378-381] it is recommended as an alternative regimen due to the necessity for baseline RAS testing and the need for addition of ribavirin to the regimen if RASs are present.

Several other important considerations should be taken account when selecting a DAA regimen for these patients. Protease inhibitors should be avoided in the presence of moderate to severe liver dysfunction (i.e., Child-Pugh B or C).[382] Assessment of drug-drug interactions is crucial as some medications are contraindicated or not recommended during DAA therapy (e.g., high-dose proton pump inhibitors [twice daily dosing], amiodarone [contraindicated with sofosbuvir-inclusive regimens], and certain statins [eg, atorvastatin], among others). Importantly, complex interactions occur between DAAs and calcineurin inhibitors.[383-388] Coadministration of elbasvir/grazoprevir and cyclosporine leads to a 15-fold increase in grazoprevir and a 2-fold increase in elbasvir area under the concentration-time curve;[389] this DAA regimen and immunosuppressant combination should be avoided. A 40%-50% increase in tacrolimus level is predicted with coadministration of elbasvir/grazoprevir[389]; no dosing adjustments are anticipated but tacrolimus levels should be monitored. Please see the online HCV guidance for additional information about drug-drug interactions between DAAs and immunosuppressants as well as other medications.

Limited short-term data from liver,[340, 357, 390, 391] kidney,[358, 378-380, 390-394] heart,[359, 373, 390, 395] and lung[359, 374] transplant programs performing solid organ transplantations involving HCV-viremic donors and HCV-negative

recipients are encouraging. However, the overall number of published cases is limited and treatment approaches varied. Known risks include DAA treatment failure with emergence of complex RASs and possible severe or rapidly progressive liver disease.[358, 374, 396, 397] Due to the limited, heterogeneous experience to date and lack of long-term safety data, strong consideration should be given to performing these transplantations under institutional review board approved protocols as recommended by the American Society of Transplantation consensus panel.[353]

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Table 1. Behaviors, Exposures, or Conditions or Circumstances Associated With an Increased Risk of HCV Infection	
Risk Behaviors	• Injection drug use (current or ever, including those who injected only once) • Intranasal illicit drug use • Men who have sex with men

Risk Exposures	• Persons on long-term hemodialysis (ever)
	• Persons with percutaneous/parenteral exposures in an unregulated setting
	• Healthcare, emergency medical, and public safety workers after needle stick, sharps, or mucosal exposures to HCV-infected blood
	• Children born to HCV-infected women
	• Persons who were ever incarcerated
	• Prior recipients of blood transfusion(s) or organ transplant, including persons who:
	   o Were notified that they received blood from a donor who later tested positive for HCV
	   o Received a transfusion of blood or blood components, or underwent an organ transplant prior to July 1992
	   o Received clotting factor concentrates produced prior to 1987

Risk Conditions and Circumstances	• HIV infection • Sexually active persons about to start pre-exposure prophylaxis (PrEP) for HIV • Unexplained chronic liver disease and/or chronic hepatitis, including elevated alanine aminotransferase (ALT) levels • Solid organ donors (deceased and living) and solid organ transplant recipients

| Table 2. Measures to Prevent HCV Transmission |
| --- |
| HCV-infected persons should be counseled to avoid sharing toothbrushes and dental or shaving equipment, and be cautioned to cover any bleeding wound to prevent the possibility of others coming into contact with their blood. |
| Persons should be counseled to stop using illicit drugs and enter substance abuse treatment. Those who continue to inject drugs should be counseled to: Avoid reusing or sharing syringes, needles, water, cotton, and other drug preparation equipment. Use new sterile syringes and filters, and disinfected cookers. Clean the injection site with a new alcohol swab. Dispose of syringes and needles after 1 use in a safe, puncture-proof container. |
| Persons with HCV infection should be advised not to donate blood and to discuss HCV serostatus prior to donation of body organs, other tissue, or semen. |
| Persons with HIV/HCV coinfection and those with multiple sexual partners or sexually transmitted infections should be encouraged to use barrier precautions to prevent sexual transmission. Other persons with HCV infection should be counseled that the risk of sexual transmission is low and may not warrant barrier protection. |
| Household surfaces and implements contaminated with visible blood from an HCV-infected person should be cleaned using a dilution of one part household bleach to nine parts water. Gloves should be worn when cleaning up blood spills. |

Table 3. Noninvasive Tests to Assess Liver Disease Severity
Liver-directed physical exam (normal in most patients)
Routine blood tests (eg, ALT, AST, albumin, bilirubin, international normalized ratio [INR], and CBC with platelet count)
Serum fibrosis marker panels
Transient elastography
Liver imaging (eg, ultrasound or CT scan)
AST-to-platelet ratio index (APRI)
FIB-4 score

Table 4. Weight-Based Dosing of Ledipasvir/Sofosbuvir for Children Aged ≥3 Years	
Body Weight	**Once Daily Dose of Ledipasvir/Sofosbuvir**
<17 kg	33.75 mg/150 mg
17 to <35 kg	45 mg/200 mg
≥35 kg	90 mg/400 mg per day

Table 5. Interpretation of Blood Tests for Diagnosis of Acute HCV Infection	
Test	**Interpretation for Diagnosis of Acute HCV**
HCV antibody	• Test may be negative during the first 6 weeks after exposure. • Seroconversion may be delayed or absent in immunosuppressed individuals. • Presence of HCV antibody alone does not distinguish between acute vs chronic infection.
HCV RNA	• Viral fluctuations >1 $\log_{10}$ IU/mL may indicate acute HCV infection. • HCV RNA may be transiently negative during acute HCV infection. • Presence of HCV RNA alone does not distinguish between acute vs chronic infection.
ALT	• Fluctuating ALT peaks suggest acute infection. • ALT may be normal during acute HCV infection. • ALT may be elevated due to other liver insults, such as alcohol consumption.
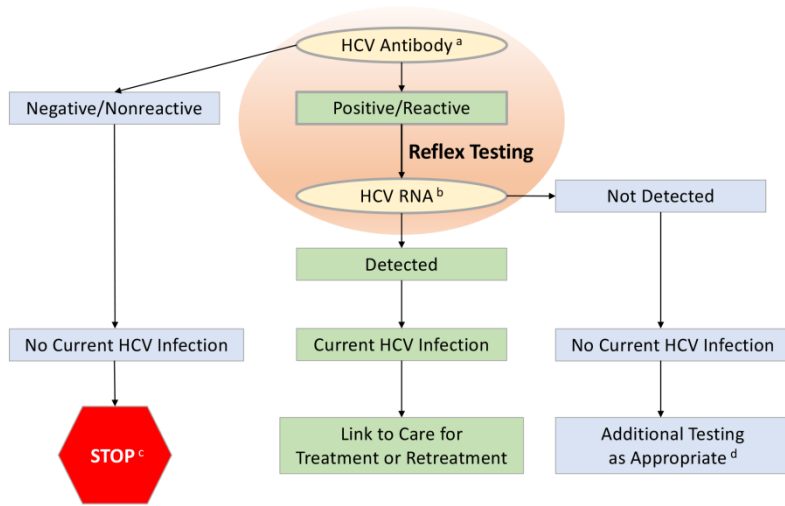
hep_31060_f1.tif

WHO IS ELIGIBLE FOR SIMPLIFIED TREATMENT	WHO IS *NOT* ELIGIBLE FOR SIMPLIFIED TREATMENT
Adults with chronic hepatitis C (any genotype) who do not have cirrhosis and have not previously received hepatitis C treatment	Patients who have any of the following characteristics: • Prior hepatitis C treatment • Cirrhosis (see simplified treatment for treatment-naive adults with compensated cirrhosis) • End-stage renal disease (ie, eGFR <30 mL/min/m^2) (see Patients with Renal Impairment section) • HIV or HBsAg positive • Current pregnancy • Known or suspected hepatocellular carcinoma • Prior liver transplantation

PRETREATMENT ASSESSMENT *

- **Calculate FIB-4 score.**
- **Cirrhosis assessment**: Liver biopsy is not required. For the purpose of this guidance, a patient is presumed to have cirrhosis if they have a FIB-4 score >3.25 **or** any of the following findings from a previously performed test.
  - Transient elastography indicating cirrhosis (eg, FibroScan stiffness >12.5 kPa)
  - Noninvasive serologic tests above proprietary cutoffs indicating cirrhosis (eg, FibroSure, Enhanced Liver Fibrosis Test, etc)
  - Clinical evidence of cirrhosis (eg, liver nodularity and/or splenomegaly on imaging, platelet count <150,000/mm^3, etc)
  - Prior liver biopsy showing cirrhosis
- **Medication reconciliation:** Record current medications, including over-the-counter drugs, and herbal/dietary supplements.
- **Potential drug-drug interaction assessment:** Drug-drug interactions can be assessed using the AASLD/IDSA guidance or the University of Liverpool drug interaction checker.
- **Education:** Educate the patient about proper administration of medications, adherence, and prevention of reinfection.

- **Pretreatment laboratory testing**

  Within 6 months of initiating treatment:
  - Complete blood count (CBC)
  - Hepatic function panel (ie, albumin, total and direct bilirubin, alanine aminotransferase [ALT], and aspartate aminotransferase [AST])
  - Calculated glomerular filtration rate (eGFR)

  Any time prior to starting antiviral therapy:
  - Quantitative HCV RNA (HCV viral load)
  - HIV antigen/antibody test
  - Hepatitis B surface antigen

  Before initiating antiviral therapy:
  - Serum pregnancy testing and counseling about pregnancy risks of HCV medication should be offered to women of childbearing age.

RECOMMENDED REGIMENS*

Glecaprevir (300 mg) / pibrentasvir (120 mg)
taken with food for a duration of 8 weeks

Sofosbuvir (400 mg) / velpatasvir (100 mg)
for a duration of 12 weeks

ON-TREATMENT MONITORING

- Inform patients taking diabetes medication of the potential for symptomatic hypoglycemia. Monitoring for hypoglycemia is recommended
- Inform patients taking warfarin of the potential for changes in their anticoagulation status. Monitoring INR for subtherapeutic anticoagulation is recommended.
- No laboratory monitoring is required for other patients.
- An in-person or telehealth/phone visit may be scheduled, if needed, for patient support, assessment of symptoms, and/or new medications.

POST-TREATMENT ASSESSMENT OF CURE (SVR)	FOLLOW-UP AFTER ACHIEVING VIROLOGIC CURE (SVR)	FOLLOW-UP FOR PATIENTS WHO DO *NOT* ACHIEVE A VIROLOGIC CURE
• Assessment of quantitative HCV RNA and a hepatic function panel are recommended 12 weeks or later following completion of therapy to confirm HCV RNA is undetectable (virologic cure) and transaminase normalization. • Assessment for other causes of liver disease is recommended for patients with elevated transaminase levels after achieving SVR.	• No liver-related follow-up is recommended for noncirrhotic patients who achieve SVR. • Patients with ongoing risk for HCV infection (eg, intravenous drug use or MSM engaging in unprotected sex) should be counseled about risk reduction, and tested for HCV RNA annually and whenever they develop elevated ALT, AST, or bilirubin. • Advise patients to avoid excess alcohol use.	• Patients in whom initial HCV treatment fails to achieve cure (SVR) should be evaluated for retreatment by a specialist, in accordance with AASLD/IDSA guidance. • For patients unable to be retreated, assessment for disease progression every 6 to 12 months with a hepatic function panel, CBC, and INR is recommended. • Advise patients to avoid excess alcohol use.

WHO IS *NOT* ELIGIBLE FOR SIMPLIFIED TREATMENT

Patients who have <u>any</u> of the following characteristics:

- **Current or prior** episode of decompensated cirrhosis, defined as Child-Turcotte-Pugh (CTP) score ≥7 (ascites, hepatic encephalopathy, total bilirubin >2.0 mg/dL, albumin ≤3.5 g/dL, or INR ≥1.7)
- Prior hepatitis C treatment
- End-stage renal disease (ie, eGFR <30 mL/min/m^2) (see Patients with Renal Impairment section)
- HIV or HBsAg positive
- Current pregnancy
- Known or suspected hepatocellular carcinoma
- Prior liver transplantation

(See HCV guidance for treatment recommendations for these patients.)

WHO IS ELIGIBLE FOR SIMPLIFIED TREATMENT

- Adults with chronic hepatitis C (any genotype) who have compensated cirrhosis (Child-Pugh A) and have <u>not</u> previously received hepatitis C treatment
- Liver biopsy is not required. For the purpose of this guidance, a patient is presumed to have cirrhosis if they have a FIB-4 score >3.25 **or** any of the following findings from a <u>previously performed</u> test.
  - ‣ Transient elastography indicating cirrhosis (eg, FibroScan stiffness >12.5 kPa)
  - ‣ Noninvasive serologic tests above proprietary cutoffs indicating cirrhosis (eg, FibroSure, Enhanced Liver Fibrosis Test, etc)
  - ‣ Clinical evidence of cirrhosis (eg, liver nodularity and/or splenomegaly on imaging, platelet count <150,000/mm^3, etc)
  - ‣ Prior liver biopsy showing cirrhosis

PRETREATMENT ASSESSMENT *

- **Calculate FIB-4 score.**
- **Calculate CTP score:** Patients with a CTP score ≥7 (ie, CTP B or C) have decompensated cirrhosis and this simplified treatment approach is <u>not</u> recommended.
- **Ultrasound of the liver** (conducted within the prior 6 months): Evaluate to exclude HCC and subclinical ascites.
- **Medication reconciliation**: Record current medications, including over-the-counter drugs and herbal/dietary supplements.
- **Potential drug-drug interaction assessment:** Drug-drug interactions can be assessed using the AASLD/IDSA guidance or the University of Liverpool drug interaction checker.
- **Education:** Educate the patient about proper administration of medications, adherence, and prevention of reinfection.
- **Pretreatment laboratory testing** (see next column)

Within 3 months of initiating treatment
  - ‣ Complete blood count (CBC)
  - ‣ International normalized ratio (INR)
  - ‣ Hepatic function panel (ie, albumin, total and direct bilirubin, alanine aminotransferase [ALT], and aspartate aminotransferase [AST])
  - ‣ Calculated glomerular filtration rate (eGFR)

Any time prior to starting antiviral therapy
  - ‣ Quantitative HCV RNA (HCV viral load)
  - ‣ HIV antigen/antibody test
  - ‣ Hepatitis B surface antigen
  - ‣ HCV genotype (if treating with sofosbuvir/velpatasvir)

Before initiating antiviral therapy
  - ‣ Serum pregnancy testing and counseling about pregnancy risks of HCV medication should be offered to women of childbearing age.

RECOMMENDED REGIMENS*

Genotype 1-6:
Glecaprevir (300 mg) / pibrentasvir (120 mg) taken with food for a duration of 8 weeks

Genotype 1, 2, 4, 5, or 6:
Sofosbuvir (400 mg) / velpatasvir (100 mg) for a duration of 12 weeks

NOTE: Patients with genotype 3 require baseline NS5A resistance-associated substitution (RAS) testing. Those <u>without</u> Y93H can be treated with 12 weeks of sofosbuvir/velpatasvir. If Y93H is present, see HCV guidance for treatment recommendations.

ON-TREATMENT MONITORING

- Providers may order blood tests to monitor for liver injury during treatment because hepatic decompensation (eg, jaundice, etc) occurs rarely among patients with cirrhosis receiving HCV antiviral treatment.
- Patients should see a specialist if they develop worsening liver blood tests (eg, bilirubin, AST, ALT, etc); jaundice, ascites, or encephalopathy; or new liver-related symptoms.
- Inform patients taking diabetes medication of the potential for symptomatic hypoglycemia. Monitoring for hypoglycemia is recommended.
- Inform patients taking warfarin of the potential for changes in their anticoagulation status. Monitoring INR for subtherapeutic anticoagulation is recommended.
- An in-person or telehealth/phone visit may be scheduled, if needed, for patient support, assessment of symptoms, and/or new medications.
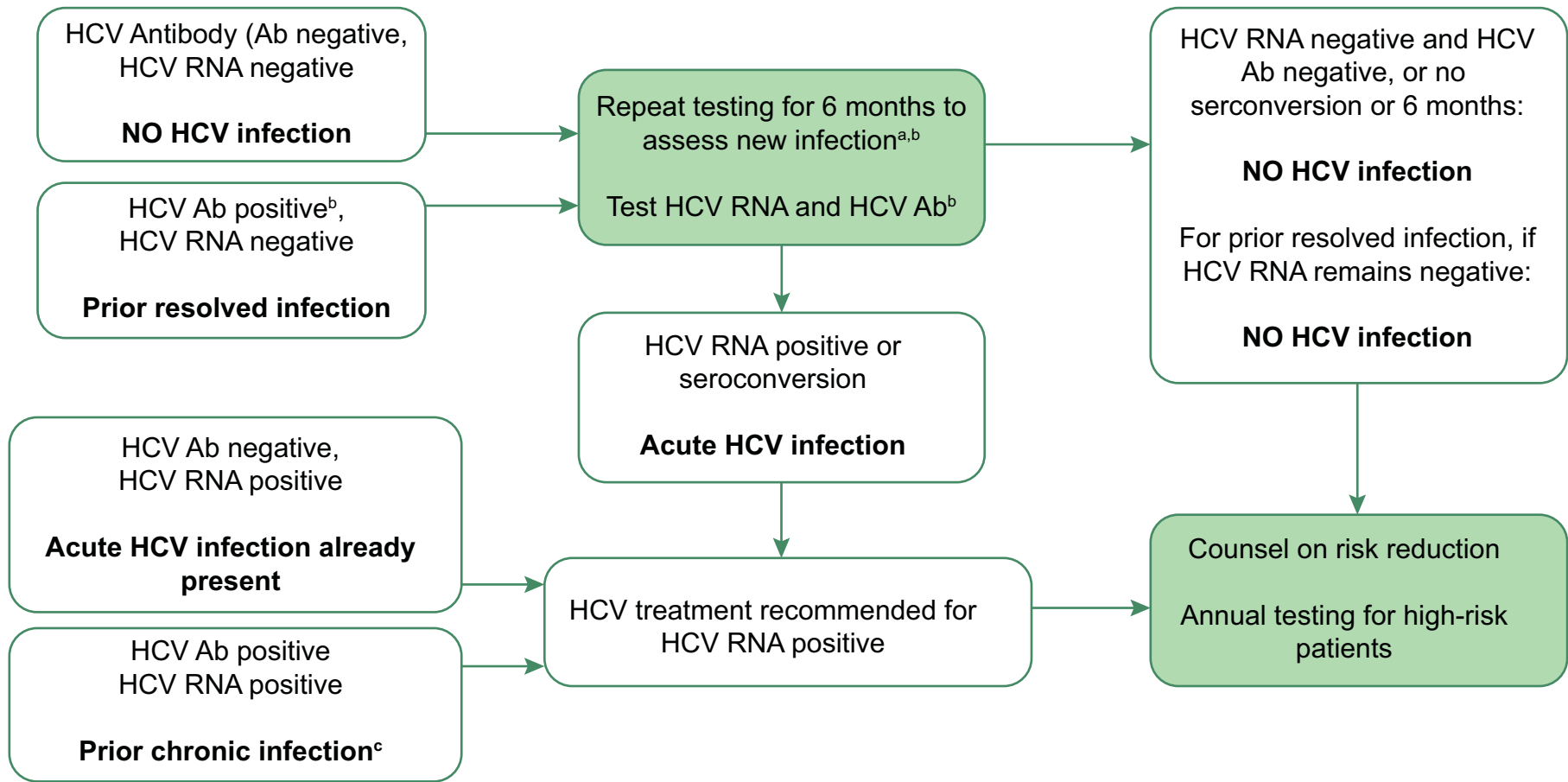
POST-TREATMENT ASSESSMENT OF CURE (SVR)

- Assessment of quantitative HCV RNA and a hepatic function panel are recommended 12 weeks or later following completion of therapy to confirm HCV RNA is undetectable (virologic cure) and transaminase normalization.
- Assessment for other causes of liver disease is recommended for patients with elevated transaminase levels after achieving SVR.

FOLLOW-UP AFTER ACHIEVING VIROLOGIC CURE (SVR)

- Ultrasound surveillance for HCC (with or without alpha-fetoprotein testing) every 6 months is recommended for patients with cirrhosis in accordance with AASLD guidance.
- Upper endoscopic surveillance for esophageal varices is recommended in accordance with AASLD guidance on portal hypertensive bleeding in cirrhosis
- Patients with ongoing risk for HCV infection (eg, IV drug use or MSM engaging in unprotected sex) should be counseled about risk reduction, and tested for HCV RNA annually and whenever they develop elevated ALT, AST, or bilirubin.
- Patients should abstain from alcohol to avoid progression of liver disease.

FOLLOW-UP FOR PATIENTS WHO DO *NOT* ACHIEVE A VIROLOGIC CURE

- Patients in whom initial HCV treatment fails to achieve cure (SVR) should be evaluated for retreatment by a specialist, in accordance with AASLD/IDSA guidance.
- Ultrasound surveillance for hepatocellular carcinoma (with or without alpha-fetoprotein testing) every 6 months is recommended for patients with cirrhosis, in accordance with AASLD guidance.
- Assessment for disease progression every 6 to 12 months with a hepatic function panel, CBC, and INR is recommended.
- Patients should abstain from alcohol to avoid progression of liver disease.

HCV Antibody (Ab negative, HCV RNA negative

NO HCV infection

HCV Ab positive[b], HCV RNA negative

Prior resolved infection

HCV Ab negative, HCV RNA positive

Acute HCV infection already present

HCV Ab positive HCV RNA positive

Prior chronic infection[c]

Repeat testing for 6 months to assess new infection[a,b]

Test HCV RNA and HCV Ab[b]

HCV RNA positive or seroconversion

Acute HCV infection

HCV treatment recommended for HCV RNA positive

HCV RNA negative and HCV Ab negative, or no serconversion or 6 months:

NO HCV infection

For prior resolved infection, if HCV RNA remains negative:

NO HCV infection

Counsel on risk reduction

Annual testing for high-risk patients

Exposure   48 hours   24 weeks

Baseline testing within 48 hourse of exposure[d]