


Treatment of HCV-Uninfected Transplant Recipients Receiving Organs From HCV-Viremic Donors

With the large disparity between persons in need of organ transplantation and available donor organs, many transplant programs are turning to the use of organs from HCV-viremic donors (Akabane, 2024). In the past, organs from HCV-viremic donors were primarily used in recipients with chronic hepatitis C or discarded. With the advent of safe and effective HCV DAA regimens, however, organs from HCV-viremic donors may be considered for use in recipients without HCV infection. Use of these organs increases the pool of available organs, access to transplantation ([Sageshima, 2018](#)), and potentially reduces waitlist time ([Bhamidimarri, 2017](#)); ([Scalea, 2015](#)) and related mortality ([Altshuler, 2022](#)); ([Sawinski, 2019](#)); ([Shelton, 2018](#)); ([Kucirka, 2012](#)).

All organ donors undergo HCV-antibody and HCV nucleic acid testing (NAT). Nonhepatic donors who are HCV antibody positive but HCV RNA negative likely pose a negligible risk of HCV transmission to the recipient, although more data are needed to confirm this. However, among increased-risk donors (as defined by the US Public Health Service [PHS] guidelines) who had a recent HCV exposure, HCV RNA may not yet be detectable and transplant recipients from these donors should be monitored for HCV infection in addition to HBV and HIV per the increased-risk donor testing protocols ([Levitsky, 2017](#)); ([Seem, 2013b](#)). Transplant recipients who receive a liver from an HCV-antibody–positive/HCV-RNA–negative donor should be monitored more closely after transplantation given the potential risk for HCV transmission ([Bari, 2018](#)); ([Sobotka, 2021](#)). Donors who are HCV RNA positive (with or without anti-HCV) pose the highest risk for HCV transmission to transplant recipients. Because of the significant risk for HCV infection when transplanting an organ from an HCV-viremic donor into an HCV-uninfected recipient, rigorous informed consent, including discussion of potential secondary risks to caregivers from needlestick exposures ([Kim, 2022](#)), and post transplantation HCV-related follow-up processes are recommended.

Recommendations When Considering Use of HCV-Viremic Donor Organs in HCV-Uninfected Recipients

RECOMMENDED	RATING 
<p>Informed consent should include the following elements:</p> <ul style="list-style-type: none"> • Risk of transmission from an HCV-viremic donor • Risk of liver disease if HCV treatment is not available or treatment is unsuccessful • Risk of graft failure • Risk of extrahepatic complications, such as HCV-associated renal disease • Risk of HCV transmission to partner • Benefits, specifically reduced waiting time and possibly lower waiting list mortality 	<p>I, C</p>

Recommendations When Considering Use of HCV-Viremic Donor Organs in HCV-Uninfected Recipients

<ul style="list-style-type: none"> Other unknown long-term consequences (hepatic and extrahepatic) of HCV exposure, even if cure is attained 	
<p>Transplant programs should have a programmatic strategy to:</p> <ul style="list-style-type: none"> Document informed consent Assure access to HCV treatment and retreatment(s), as necessary Ensure long-term follow-up of recipients (beyond SVR12) 	I, C

Available data indicate increasing acceptance of organs from HCV-viremic donors among HCV-uninfected recipients ([Cotter, 2019](#)); ([Potluri, 2019](#)); ([Bowring, 2018](#)). Although no published data are available regarding the long-term (beyond 1 to 2 years) consequences to HCV-negative recipients transplanted with organs from HCV-viremic donors who are treated post transplant with DAAs, limited short-term data from liver, kidney, heart, and lung transplant programs are encouraging.

Liver Transplantation


Among 10 HCV-negative liver transplant recipients of organs from an HCV-viremic donor, 100% attained SVR12 with 12 weeks to 24 weeks of various DAA regimens ([Kwong, 2019](#)). The median time from transplantation to treatment initiation was 43 days (interquartile range 20–59 days). Noteworthy was the high rate of acute cellular or antibody-mediated rejection (30%) during or after DAA therapy in this study. In another study of 14 HCV-negative liver transplant recipients from an HCV-viremic donor treated with glecaprevir/pibrentasvir for 12 weeks starting within 5 days of transplant, SVR rates were 100% and only 1 recipient experienced acute rejection ([Bethea, 2020](#)). In another single-center experience, 61 HCV-negative recipients of a liver allograft from an HCV-viremic donor were compared to 231 HCV-negative recipients of a liver allograft from an HCV-negative donor ([Bohorquez, 2021a](#)). Of the 61 participants in the study group, 56 received antiviral therapy; treatment was initiated a median of 66.9 days following transplantation. Four study group participants died within 1 year following liver transplantation. One was persistently aviremic and another experienced a complex postoperative course. Of the 51 study participants with complete treatment data, 64% were treated with glecaprevir/pibrentasvir and 36% received sofosbuvir/velpatasvir. All achieved SVR12. One participant required retreatment with sofosbuvir/velpatasvir/voxilaprevir after relapse. There were no significant differences between recipients of allografts from HCV-viremic versus HCV-negative donors in terms of other clinical outcomes such as acute cellular rejection, kidney dysfunction, or survival.

A retrospective study of deceased donor liver transplantations in the US from January 2008 through January 2018 demonstrated that 2-year graft survival was similar, regardless of HCV status concordance or discordance between the allograft donor and recipient ([Cotter, 2019](#)). In a single-center retrospective study of 21 HCV-seronegative recipients who received a liver transplant from an HCV-viremic donor, 95% (20/21) of recipients had confirmed HCV viremia. One hundred percent of the 15 participants with available data achieved SVR12 after DAA treatment. There were equivalent rates of posttransplant complications between the 21 recipients who received a liver from an HCV-viremic donor when compared to 21 recipients who received a liver from an HCV-antibody-positive, NAT-negative donor ([Sobotka, 2021](#)).

In a prospective, multicenter (n=6), single-arm, open-label clinical trial, 13 HCV-negative liver transplant recipients received an allograft from an HCV-viremic donor. Participants were treated with 12 weeks of sofosbuvir/velpatasvir; the median time from transplantation to DAA therapy was 7 days ([Terrault, 2020](#)). All liver transplant recipients achieved SVR12. Serious adverse events possibly related to study participation among the liver recipients included antibody-mediated rejection, biliary sclerosis, cardiomyopathy, and graft-versus-host disease (which eventually led to the individual’s death). In a prospective multicenter (n=3) observational study, 20 HCV-negative recipients of a liver transplant from an HCV-viremic donor, all recipients had HCV viremia confirmed within 3 days posttransplant and 100% attained SVR12 after receiving DAA treatment (median 27.5 days posttransplant) ([Aqel, 2021](#)). One transplant recipient who was started on DAA treatment on postop day 24 developed end-stage renal disease secondary to HCV-related acute membranous nephropathy; the individual died 14 months posttransplant due to septic shock from a presumed infection.

Unlike with other organs, shorter durations of HCV therapy should not be used in recipients of livers from HCV-viremic donors because of the large reservoir of HCV in the transplanted organ. Additionally, although prophylactic or pre-emptive therapy has not been as strongly stressed for recipients of liver grafts from HCV-viremic donors, a case report noted the development of acute kidney injury (with proteinuria) in the first month post transplant due to HCV-associated focal proliferative glomerulonephritis. This case report highlights the potential for HCV-related, extrahepatic manifestations in the early posttransplant setting ([Bohorquez, 2021b](#)). The prospective multicenter study noted above ([Aqel, 2021](#)) also highlights the importance of considering the initiation of DAA treatment earlier post transplant given that one liver transplant recipient had biopsy-proven acute HCV-related glomerulonephritis on postop day 18, which was 6 days prior to the initiation of DAA therapy. The individual went on to develop end-stage renal disease despite having attained SVR12. The person died due to presumed infectious complications. The possible elevated risk for immunologic complications (eg, rejection) in liver recipients from HCV-viremic donors treated with DAA therapy requires further study but vigilance is appropriate.


Recommendation Regarding Timing of DAA Therapy for HCV-Negative Recipients of a Liver Transplant From an HCV-Viremic Donor

RECOMMENDED	RATING 
Early ^a treatment with a pangenotypic direct-acting antiviral regimen is recommended when the person is clinically stable.	II, B

^a Early treatment refers to starting within the first 2 weeks after liver transplantation but preferably within the first week when the person is clinically stable.

Recommended regimens listed by evidence level and alphabetically for:

Treatment of HCV-Uninfected Recipients of a Liver Graft From an HCV-Viremic Donor

RECOMMENDED	DURATION	RATING 
Daily fixed-dose combination of glecaprevir (300 mg)/pibrentasvir (120 mg) ^b	12 weeks	I, C
Daily fixed-dose combination of sofosbuvir (400 mg)/velpatasvir (100 mg)	12 weeks	I, C

^a Other considerations in selection of the DAA regimen:

- Presence of liver dysfunction (eg, elevated bilirubin) as protease inhibitors should be avoided
- Specific drugs that are contraindicated or not recommended with specific DAA agents, including but not limited to:
 - High-dose antacid therapy (eg, twice daily proton pump inhibitor)
 - Amiodarone (contraindicated with sofosbuvir-inclusive regimens; see prescribing information)
 - Specific statins (eg, atorvastatin)
- Consideration of immunosuppressive drugs and DAA interactions (see below)

^b Dosing is 3 coformulated tablets (glecaprevir [100 mg]/pibrentasvir [40 mg]) taken once daily. Please refer to the prescribing information.

Transplantation of Other Organs

In the THINKER trial, 10 HCV-uninfected kidney transplant recipients received an allograft from a genotype 1 infected HCV-viremic donor and were treated with 12 weeks of elbasvir/grazoprevir; 100% achieved SVR ([Goldberg, 2017](#)). In a 1-year follow-up study that included 10 additional participants (n=20) who received 12 weeks to 16 weeks of elbasvir/grazoprevir (± ribavirin), all attained SVR12. Kidney function in those who received a kidney from an HCV-infected donor was comparable to matched controls who received an allograft from an HCV-uninfected donor ([Reese, 2018](#)). A separate open-label trial similarly demonstrated a 100% SVR12 rate with 12 weeks of elbasvir/grazoprevir (± sofosbuvir) therapy initiated immediately prior to transplantation in 10 HCV-uninfected kidney transplant recipients of an allograft from an HCV-viremic donor ([Durand, 2018](#)). Notably, organ recipients in this study received the first dose of elbasvir/grazoprevir on call to the operating room. Of the 10 persons treated, only 3 had detectable HCV viremia compared to 100% in the THINKER trial, which utilized the same regimen but initiated DAA therapy on day 3 after transplantation.

In a prospective multicenter (n=7) MYTHIC trial, 30 HCV-negative recipients received a kidney allograft from an HCV-viremic donor. Early initiation of glecaprevir/pibrentasvir (target was within 3 days post transplant) for 8

weeks resulted in a 100% SVR12 rate; there were no significant treatment-related adverse events ([Sise, 2020](#)). Three episodes of acute rejection were noted but all recipients had good graft function at 6 months follow-up. Three recipients developed transient BK viremia. Four out of 10 of the CMV seronegative recipients who received a kidney from a CMV seropositive donor developed CMV disease within the first year post transplant. One-year survival was 93%; 1-year graft function was excellent (median creatinine 1.17; interquartile range [IQR] 1.02–1.38 mg/dL) ([Sise, 2021](#)).

A prospective, multicenter, single-arm, open-label clinical trial evaluated the safety and efficacy 12 weeks of sofosbuvir/velpatasvir among 11 HCV-negative kidney transplant recipients who received a graft from an HCV-viremic donor ([Terrault, 2020](#)). The median time from transplant to initiation of DAA therapy was 16.5 days; all kidney transplant recipients in this study attained SVR12. No serious adverse events related to study participation were noted among the kidney recipients. The REHANNA trial evaluated a shortened 4-week course of glecaprevir/pibrentasvir among HCV-negative kidney transplant recipients who received a graft from an HCV-viremic donor. The first dose was administered prior to organ perfusion. All 10 recipients achieved SVR12; there were no adverse outcomes noted ([Durand, 2021](#)). Other studies evaluating HCV discordant kidney donors and transplant recipients have also demonstrated high SVR12 rates without any treatment-related toxicities (Binari, 2024); ([Franco, 2019](#)); ([Friebus-Kardash, 2019](#)). A single-center, retrospective cohort study compared 1-year outcomes among 65 transplant recipients who received a kidney from an HCV-viremic donor with 59 recipients who received a kidney from an HCV-negative donor ([Molnar, 2021](#)). Allograft biopsy findings and kidney allograft function during the first year post kidney transplantation were assessed. There were no statistically significant differences between the HCV-positive and HCV-negative cohorts with regards to delayed graft function rates, estimated glomerular filtration rates (eGFR), and the proportions of recipients with cellular rejection, antibody mediated rejection, or de novo donor-specific antibodies.


A study of HCV-uninfected recipients who received a heart transplant from an HCV-viremic donor showed that a 12-week course of elbasvir/grazoprevir initiated a few days after transplantation (once the recipient became viremic) resulted in SVR12 in 90% (9/10) of the evaluable recipients ([McLean, 2019](#)). In the DONATE HCV trial, 44 HCV-uninfected lung (n=36) and heart (n=8) transplant recipients of an allograft from an HCV-viremic donor were treated with sofosbuvir/velpatasvir administered prophylactically or preemptively, starting within a few hours after transplantation and continued for 4 weeks (compared with the standard 12-week course). Among the initial 35 recipients with at least 6 months of follow-up after transplantation, 100% achieved SVR and had excellent graft function ([Woolley, 2019](#)). There was an increase in the proportion of the HCV-viremic lung cohort who had acute cellular rejection compared with the HCV-uninfected lung cohort, although this finding was not statistically significant. Longer term follow-up is needed to assess for chronic rejection. In a study of 20 HCV-uninfected heart transplant recipients of an allograft from an HCV-viremic donor, participants were treated prophylactically or preemptively with glecaprevir/pibrentasvir beginning just prior to transplantation and continued for 8 weeks. All participants attained SVR12; patient and graft survival were 100% with a median follow-up of 10.7 months ([Bethea, 2019](#)). Another clinical trial evaluated 22 HCV-uninfected lung transplant recipients of an allograft from an HCV-viremic donor. The 20 recipients who became viremic after transplantation were treated with 12 weeks of sofosbuvir/velpatasvir beginning 2 weeks to 6 weeks after transplantation (median 21 days; IQR 16.76–24.75 days). All lungs from HCV-viremic donors were treated with ex-vivo lung perfusion ± ultraviolet C perfusate irradiation to reduce HCV RNA concentration and infectivity, likely contributing to a slower rise in HCV viral load among recipients. Although all 20 recipients treated with DAAs had undetectable HCV RNA at the end of treatment, 2 recipients experienced posttreatment relapse. One recipient experienced severe hepatitis with early signs of fibrosing cholestatic hepatitis on liver biopsy. Both recipients who experienced a relapse exhibited complex NS3A and NS5A resistance-associated substitutions (RASs) at the time of relapse. The relapsed recipients were successfully retreated with 24 weeks of sofosbuvir/velpatasvir/voxilaprevir plus ribavirin and achieved SVR12 ([Cypel, 2020](#)). A retrospective analysis supported utilization of HCV-viremic lung transplantation, demonstrating a 100% SVR rate with no increased rate of rejection among the 17 lung transplant recipients (Afshar, 2024).

A study of 22 heart transplants from HCV-viremic donors to HCV-uninfected recipients evaluated an 8-week course of glecaprevir/pibrentasvir initiated 6 days to 11 days after transplantation once the viremia developed. Two recipients had DAA interruptions. No differences were noted between the HCV-viremic versus HCV-aviremic donor cohorts in terms of survival or rejection ([Reventovich, 2020](#)). Another study evaluated 38 thoracic organ transplants (22 heart, 16 lung) from HCV-viremic donors. Treatment with glecaprevir/pibrentasvir was initiated at the time of detectable viremia (mean 7 days) among the heart recipients and within 3 days after transplantation for the lung recipients. All participants achieved SVR12 ([Smith, 2021](#)). DAA treatment interruption occurred in 2 recipients due to hyperbilirubinemia. One recipient resumed treatment within a few days; the other recipient’s treatment course was shortened to 10 days. Both recipients still attained SVR12. In the heart transplant recipients, all recipients became viremic within the first week after transplantation. In contrast, only 11 of the 16 lung transplant recipients developed viremia. Overall, investigators noted reduced HCV transmission, lower viral loads, and more rapid clearance in the lung transplant recipients who received earlier treatment ([Smith, 2021](#)). In both of these studies, DAA treatment initiation within a few days after transplantation was associated with an occasional need for treatment interruption, although all recipients still achieved SVR12 ([Reventovich, 2020](#)); ([Smith, 2021](#)).

A separate study conducted among 50 heart transplant recipients (22 received a heart from an HCV-viremic donor), an 8-week course of glecaprevir/pibrentasvir was initiated once viremia developed (mean 7.2 days) ([Gidea, 2020](#)). Investigators noted a higher proportion of acute cellular rejection in the HCV-viremic versus HCV-aviremic donor study groups (14/22 versus 5/28, respectively) in the first 2 months and at 180 days (17/22 versus 12/28, respectively). These findings raise concern about a potential association between HCV-viremic donors and transplant rejection.

While these early results are encouraging, the overall number of published cases remains small and treatment approaches notably variable. Known reported risks include DAA treatment failure with emergence of complex RASs and possible severe or rapidly progressive liver disease (fibrosing cholestatic hepatitis) ([Cypel, 2020](#)); ([Kapila, 2019](#)); ([Molnar, 2019](#)). Additionally, ethical and scientific issues remain, including avoidance of selection bias, optimal timing of DAA therapy, and long-term graft and patient outcomes. Due to the limited and heterogeneous experience and lack of longer-term safety data, strong consideration should be given to performing these transplantations with a rigorous informed consent process as recommended by the American Society of Transplantation consensus panel ([Levitsky, 2017](#)).

In addition, there have been an increasing number of dual organ transplants performed from HCV-viremic donors for heart-kidney recipients nationally between August 2015 and August 2020. Analyses from the United Network for Organ Sharing registry demonstrated similar 1-year survival between 90 HCV donor seropositive and 896 HCV donor seronegative heart-kidney recipients using unadjusted and adjusted Cox-proportional hazards-regression models including in propensity score matched cohorts ([Madan, 2021](#)); ([Diaz-Castrillon, 2022](#)).

Recommendation Regarding Timing of DAA Therapy for HCV-Negative Recipients of a Non-Liver Solid Organ Transplant From an HCV-Viremic Donor	
RECOMMENDED	RATING 
Prophylactic ^a or preemptive ^b treatment with a pangenotypic DAA regimen is recommended.	II, B


Recommendation Regarding Timing of DAA Therapy for HCV-Negative Recipients of a Non-Liver Solid Organ Transplant From an HCV-Viremic Donor

^a Initiate DAA therapy immediately pretransplant or on day 0 post transplant. No HCV RNA testing of the transplant recipient is required.

^b Initiate DAA therapy on day 0 to day 7 post transplant, as soon as the person is clinically stable. Demonstration of HCV viremia in the transplant recipient is not required

Recommended regimens^a listed by evidence level and alphabetically for:

Treatment of HCV-Uninfected Recipients of Non-Liver Organs From HCV-Viremic Donors

RECOMMENDED	DURATION	RATING 
Daily fixed-dose combination of glecaprevir (300 mg)/pibrentasvir (120 mg) ^b	8 weeks	I, C
Daily fixed-dose combination of sofosbuvir (400 mg)/velpatasvir (100 mg)	12 weeks	I, C

^a Other considerations in selection of the DAA regimen:

- Presence of liver dysfunction (eg, elevated bilirubin) as protease inhibitors should be avoided.
- Specific drugs that are contraindicated or not recommended with specific DAA agents, including but not limited to:
 - High-dose antacid therapy (eg, twice daily proton pump inhibitor)
 - Amiodarone (contraindicated with sofosbuvir-inclusive regimens; see prescribing information)
 - Specific statins (eg, atorvastatin)
- Consideration of immunosuppressive drugs and DAA interactions (see below)

^b 8 weeks is recommended for prophylactic/preemptive treatment approaches. However, if treatment initiation is delayed beyond the first week after transplant, treatment should be continued for 12 weeks. Dosing is 3 coformulated tablets (glecaprevir [100 mg]/pibrentasvir [40 mg]) taken once daily. Please refer to the prescribing information.

Initiation of DAA therapy for HCV-negative recipients of a non-liver allograft from an HCV-viremic donor can occur prophylactically/preemptively (ie, perioperatively without confirmation of viremia in the recipient) or reactively after documentation of HCV viremia. The goal is to undertake DAA therapy as early as clinically possible to minimize the duration of HCV viremia in the recipient and avoid the development of acute hepatitis and other nonhepatic complications of HCV infection. Initiating prophylactic/preemptive DAA therapy before viremia occurs may reduce the likelihood of complications, such as fibrosing cholestatic hepatitis, acute HCV-related glomerulonephritis, acute pancreatitis, acute cellular rejection, and allograft vasculopathy (Lopez-Soler, 2023); ([Gidea, 2020](#)); ([Schlendorf, 2020](#)); ([Betha, 2019](#)); ([Cypel, 2020](#)); ([Kapila, 2019](#)); ([Woolley, 2019](#)); ([Molnar, 2019](#)); ([Durand, 2018](#)). A prophylactic/preemptive treatment approach may also allow for a shorter duration of DAA therapy in non-liver transplant recipients of organs from HCV-viremic donors ([Woolley, 2019](#)). A clinical trial evaluated the use glecaprevir/pibrentasvir combined with ezetimibe 10 mg (as an inhibitor of HCV entry) in 30 recipients of nonhepatic organs (lung, heart, kidney) from HCV-viremic donors. The drugs were administered with 1 dose before and for 7 days after transplantation. With this short therapy, none of the 30 individuals developed chronic HCV infection. It is unknown if infection occurred and was rapidly cleared or if it was prevented entirely ([Feld, 2020](#)). Although intriguing, short duration approaches are not currently recommended outside of a clinical trial setting and have only been studied in the context of non-liver transplantation.

While initiating HCV treatment as early as possible post transplant may be clinically beneficial, barriers to initiating DAA treatment prophylactically/preemptively include the cost of DAA treatment and protracted insurance authorizations. One study compared the clinical and fiscal impact between an institution-subsidized course of initial DAA treatment with an insurance approval process for DAA coverage once HCV viremia was documented in the recipient. The timing of DAA initiation, duration of recipient viremia, and associated costs incurred by the recipient and the institution were assessed in 89 abdominal organ transplant recipients who did not have their DAA treatment subsidized compared to 62 thoracic organ transplant recipients who received DAA treatment that was initially subsidized by the institution. Their analysis showed that by not waiting to initiate DAA treatment for insurance authorization after HCV viremia was documented in the recipient enabled earlier treatment initiation (median 4 days [IQR 2–7 days] versus 10 days [IQR 8–13 days]) and shorter duration of viremia (median 16 days [IQR 12–29 days] versus 36 days [IQR 30–47 days]) ([Stewart, 2021](#)).

Selection of the DAA therapy for HCV-negative recipients of a non-liver allograft(s) from an HCV-viremic donor should follow the same principles as for those who develop recurrent HCV infection post liver transplantation (see [Persons Who Develop Recurrent HCV Infection Post Liver Transplantation](#)). Importantly, since genotyping of HCV-viremic donors is not routinely performed, only pangenotypic regimens should be utilized if a prophylactic/preemptive treatment approach is used. If treatment is delayed until the recipient has quantifiable HCV RNA, the recipient's genotype can be used to guide DAA treatment selection if a pangenotypic regimen is not used. Selection of regimens that avoid the use of ribavirin (to reduce ribavirin-associated side effects) and that do not require baseline RAS testing are preferred.

Notably, organs from HCV-viremic donors may be used in transplant candidates with current or prior HCV infection (see [Persons Who Develop Recurrent HCV Infection Post Liver Transplantation](#)).

Drug-Drug Interactions Between DAAs and Calcineurin Inhibitors

The drug-drug interactions of DAA agents and calcineurin inhibitors are complex and unpredictable without formal studies. A summary of interactions between calcineurin inhibitors and DAAs with recommended dosing is provided in the [DAA Interactions With Calcineurin Inhibitors](#) table.

Based on the metabolism of grazoprevir and elbasvir, a 15-fold increase in grazoprevir AUC and a 2-fold increase in elbasvir AUC can be expected with cyclosporine coadministration. Therefore, this combination should be avoided. Since a 40% to 50% increase in tacrolimus level is predicted with coadministration of

grazoprevir, no dosing adjustments are anticipated but tacrolimus levels should be monitored. No clinically significant drug-drug interactions have been observed between sofosbuvir-inclusive regimens and tacrolimus.

Related References

- Afshar K, Schonhoft E, Kozuch J, et al. Using HCV-viremic organs for lung transplantation does not confer higher rejection rates compared to HCV-negative organs. *Clin Transplant*. 2024;38(2):e15260. doi: 10.1111/ctr.15260.
- Akabane M, Imaoka Y, Esquivel CO, Kim WR, Sasaki K. The spread pattern of new practice in liver transplantation in the United States. *Clin Transplant*. 2024;38(7):e15379. doi: 10.1111/ctr.15379.
- Altshuler PJ, Helmers MR, Schiazza AR, et al. [HCV-positive allograft use in heart transplantation is associated with increased access to overdose donors and reduced waitlist mortality without compromising outcomes](#). *J Card Fail*. 2022;28(1):32-41. doi:10.1016/j.cardfail.2021.07.007.
- Aqel B, Wijarnpreecha K, Pungpapong S, et al. [Outcomes following liver transplantation from HCV-seropositive donors to HCV-seronegative recipients](#). *J Hepatol*. 2021;74(4):873-880.
- Bari K, Luckett K, Kaiser T, et al. [Hepatitis C transmission from seropositive, nonviremic donors to non-hepatitis C liver transplant recipients](#). *Hepatology*. 2018;67(5):1673-1682. doi:10.1002/hep.29704.
- Bethea ED, Gaj K, Gustafson JL, et al. [Pre-emptive pangenotypic direct acting antiviral therapy in donor HCV-positive to recipient HCV-negative heart transplantation: an open-label study](#). *Lancet Gastroenterol Hepatol*. 2019;4:771-780.
- Bethea E, Arvind A, Gustafson J, et al. [Immediate administration of antiviral therapy after transplantation of hepatitis C-infected livers into uninfected recipients: implications for therapeutic planning](#). *Am J Transplant*. 2020;20(6):1619-1628.
- Bhamidimarri KR, Ladino M, Pedraza F, et al. [Transplantation of kidneys from hepatitis C-positive donors into hepatitis C virus-infected recipients followed by early initiation of direct acting antiviral therapy: a single-center retrospective study](#). *Transpl Int*. 2017;30:865-873.
- Binari LA, Thorne P, Rega SA, et al. Twelve-month kidney and liver outcomes of kidney transplantation from hepatitis C viremic deceased donors to aviremic recipients. *Transpl Infect Dis*. 2024;26(1):e14213. doi: 10.1111/tid.14213.
- Bohorquez H, Bugeaud E, Bzowej N, et al. [Liver transplantation using hepatitis C virus-viremic donors into hepatitis C virus-aviremic recipients as standard of care](#). *Liver Transpl*. 2021;27(4):548-557.
- Bohorquez H, Velez JCQ, Lusco M, Scheuermann J, Cohen AJ. Hepatitis C-associated focal proliferative glomerulonephritis in an aviremic recipient of a hepatitis C-positive antibody donor liver. *Am J Transplant*. 2021;21(8):2895-2899. doi: 10.1111/ajt.16565.
- Bowring MG, Kucirka LM, Massie AB, et al. [Changes in utilization and discard of HCV antibody-positive deceased donor kidneys in the era of direct-acting antiviral therapy](#). *Transplantation*. 2018;102:2088-2095.
- Cotter TG, Paul S, Sandikci B, et al. [Increasing utilization and excellent initial outcomes following liver transplant of hepatitis C virus \(HCV\)-viremic donors into HCV-negative recipients: outcomes following liver transplant of HCV-viremic donors](#). *Hepatology*. 2019;69:2381-2395.

Cypel M, Feld JJ, Galasso M, et al. Prevention of viral transmission during lung transplantation with hepatitis C-viraemic donors: an open-label, single-centre, pilot trial. *Lancet Respir Med*. 2020 Feb;8(2):192-201. doi: 10.1016/S2213-2600(19)30268-1.

Diaz-Castrillon CE, Huckaby LV, Witer L, et al. [National trends and outcomes of heart-kidney transplantation using hepatitis C positive donors](#). *Clin Transplant*. 2022;36(4).

doi:10.1111/ctr.14581. Durand CM, Bowring MG, Brown DM, et al. [Direct-acting antiviral prophylaxis in kidney transplantation from hepatitis C virus-infected donors to noninfected recipients: an open-label nonrandomized trial](#). *Ann Intern Med*. 2018;168(8):533-540.

Durand CM, Barnaba B, Yu S, et al. [Four-week direct-acting antiviral prophylaxis for kidney transplantation from hepatitis C-viremic donors to hepatitis C-negative recipients: an open-label nonrandomized study](#). *Ann Intern Med*. 2021;174(1):137-138.

Feld JJ, Cypel M, Kumar D, et al. [Short-course, direct-acting antivirals and ezetimibe to prevent HCV infection in recipients of organs from HCV-infected donors: a phase 3, single-centre, open-label study](#). *Lancet Gastroenterol Hepatol*. 2020;5(7):649-657.

Franco A, Moreso F, Merino E, et al. [Renal transplantation from seropositive hepatitis C virus donors to seronegative recipients in Spain: a prospective study](#). *Transpl Int*. 2019;32(7):710-716. doi:10.1111/tri.13410.

Friebus-Kardash J, Gackler A, Kribben A, et al. [Successful early sofosbuvir-based antiviral treatment after transplantation of kidneys from HCV-viremic donors into HCV-negative recipients](#). *Transpl Infect Dis*. 2019;21:e13146.

Gidea CG, Narula N, Reyentovich A, et al. [Increased early acute cellular rejection events in hepatitis C-positive heart transplantation](#). *J Heart Lung Transplant*. 2020;S1053-2498(20):31624-7.

Goldberg DS, Abt P, Reese PP, et al. [Transplanting HCV-infected kidneys into uninfected recipients](#). *N Engl J Med*. 2017;377(11):1105. doi:10.1056/NEJMc1709315.

Kapila N, Al-Khallowfi K, Bejarano PA, Vanatta JM, Zervos XB. Fibrosing cholestatic hepatitis after kidney transplantation from HCV-viremic donors to HCV-negative recipients: a unique complication in the DAA era. *Am J Transplant*. 2020 Feb;20(2):600-605. doi: 10.1111/ajt.15583.

Kim M, Stern J, Robalino R, et al. [Caregiver exposure to hepatitis C virus following transplantation with hepatitis C viremic donor organs: a case series](#). *Transpl Infect Dis*. 2022;24(2). doi:10.1111/tid.13775.

Kucirka LM, Peters TG, Segev DL. [Impact of donor hepatitis C virus infection status on death and need for liver transplant in hepatitis C virus-positive kidney transplant recipients](#). *Am J Kidney Dis*. 2012;60:112-120.

Kwong AJ, Wall A, Melcher M, et al. [Liver transplantation for hepatitis C virus \(HCV\) non-viremic recipients with HCV viremic donors](#). *Am J Transplant*. 2019;19(5):1380-1387. doi:10.1111/ajt.15162.

Levitsky J, Formica RN, Bloom RD, et al. [The American Society of Transplantation Consensus Conference on the use of hepatitis C viremic donors in solid organ transplantation](#). *Am J Transplant*. 2017;17(11):2790-2802. doi:10.1111/ajt.14381.

Lopez-Soler RI, Thorndyke A, Trotter C, Zingraf G, Sorenson J, Samra M. Kidney transplantation in an elderly veteran population with hepatitis C virus nucleic acid test-positive donors results in improved outcomes after prophylactic glecaprevir/pibrentasvir therapy. *Transplant Proc*. 2023;55(2):317-324. doi: 10.1016/j.transproceed.2022.12.015.

Madan S, Patel SR, Vlismas P, et al. Increasing multiorgan heart transplantation with hepatitis C virus donors in the current-era. *J Heart Lung Transplant*. 2021;40(11):1382-1386. doi: 10.1016/j.healun.2021.05.018.

McLean RC, Reese PP, Acker M, et al. [Transplanting hepatitis C virus-infected hearts into uninfected recipients: a single-arm trial](#). *Am J Transplant*. 2019;19(9):2533-2542.

Molnar MZ, Nair S, Cseprekal O, et al. [Transplantation of kidneys from hepatitis C-infected donors to hepatitis C-negative recipients: single center experience](#). *Am J Transplant*. 2019;19(11):3046-3057.

Molnar MZ, Azhar A, Tsujita M, et al. [Transplantation of kidneys from hepatitis C virus-infected donors to hepatitis C virus-negative recipients: one-year kidney allograft outcomes](#). *Am J Kidney Dis*. 2021;77(5):739-747. doi:10.1053/j.ajkd.2020.10.017.

Potluri VS, Goldberg DS, Mohan S, et al. [National trends in utilization and 1-year outcomes with transplantation of HCV-viremic kidneys](#). *J Am Soc Nephrol*. 2019;30:1939-1951.

Reese PP, Abt PL, Blumberg EA, et al. [Twelve-month outcomes after transplant of hepatitis C-infected kidneys into uninfected recipients: a single-group trial](#). *Ann Intern Med*. 2018;169(5):273-281. doi:10.7326/M18-0749.

Reyentovich A, Gidea CG, Smith D, et al. [Outcomes of the treatment with glecaprevir/pibrentasvir following heart transplantation utilizing hepatitis C viremic donors](#). *Clin Transplant*. 2020;34(9):e13989.

Sageshima J, Troppmann C, McVicar JP, Santhanakrishnan C, deMattos AM, Perez RV. [Impact of willingness to accept hepatitis C seropositive kidneys among hepatitis C RNA-positive waitlisted patients](#). *Transplantation*. 2018;(102):1179-1187.

Sawinski D, Forde KA, Lo Re V, et al. [Mortality and kidney transplantation outcomes among hepatitis C virus-seropositive maintenance dialysis patients: a retrospective cohort study](#). *Am J Kidney Dis*. 2019;73:815-826.

Scalea J, Barth RN, Munivenkatappa R, et al. [Shorter waitlist times and improved graft survivals are observed in patients who accept hepatitis C virus+ renal allografts](#). *Transplantation*. 2015;99:1192-1196.

Schlendorf KH, Zalawadiya S, Shah AS, et al. [Expanding heart transplant in the era of direct-acting antiviral therapy for hepatitis C](#). *JAMA Cardiol*. 2020;5(2):167-174. doi:10.1001/jamacardio.2019.4748.

Seem DL, Lee I, Umscheid CA, Kuehnert MJ. [PHS guideline for reducing human immunodeficiency virus, hepatitis B virus, and hepatitis C virus transmission through organ transplantation](#). *Public Health Rep*. 2013;128(4):247-343.

Shelton BA, Sawinski D, Mehta S, Reed RD, MacLennan PA, Locke JE. Kidney transplantation and waitlist mortality rates among candidates registered as willing to accept a hepatitis C infected kidney. *Transpl Infect Dis*. 2018;20(2):e12829. doi: 10.1111/tid.12829.

Sise ME, Goldberg DS, Kort JJ, et al. [Multicenter study to transplant hepatitis C-infected kidneys \(MYTHIC\): an open-label study of combined glecaprevir and pibrentasvir to treat recipients of transplanted kidneys from deceased donors with hepatitis C virus infection](#). *J Am Soc Nephrol*. 2020;31(11):2678-2687.

Sise ME, Goldberg DS, Schaubel DE, et al. [One-year outcomes of the multi-center study to transplant hepatitis C-infected kidneys \(MYTHIC\) trial](#). *Kidney Int Rep*. 2021;7(2):241-250. doi:10.1016/j.ekir.2021.11.022.

Smith DE, Chen S, Fagnoli A, et al. [Impact of early initiation of direct-acting antiviral therapy in thoracic organ transplantation from hepatitis C virus positive donors.](#) *Semin Thorac Cardiovasc Surg.* 2021;33(2):407-415.

Sobotka LA, Mumtaz K, Wellner MR, et al. [Outcomes of hepatitis C virus seropositive donors to hepatitis C virus seronegative liver recipients: a large single center analysis.](#) *Ann Hepatol.* 2021;24:100318. doi:10.1016/j.aohep.2021.100318.

Stewart ZA, Stern J, NM A, et al. [Clinical and financial implications of 2 treatment strategies for donor-derived hepatitis C infections.](#) *Transplant Direct.* 2021;7(10):e762. doi:10.1097/TXD.0000000000001222.

Terrault NA, Burton J, Ghobrial M, et al. [Prospective multicenter study of early antiviral therapy in liver and kidney transplant recipients of HCV-viremic donors.](#) *Hepatology.* 2020. doi:10.1002/hep.31551.

Woolley AE, Singh SK, Goldberg HJ, et al. [Heart and lung transplants from HCV-infected donors to uninfected recipients.](#) *N Engl J Med.* 2019;380(17):1606-1617. doi:10.1056/NEJMoa1812406.

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