

## Chapter 10- HIV and solid organ transplant

### Kidney/Pancreas Transplant

Sawinski D, Locke J. Kidney Transplantation in a HIV-Positive Recipient. Clin J Am Soc Nephrol 2019; (ahead of print). Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/30885910>

- Case report of 56 year-old male with HIV-associated nephropathy on ritonavir-boosted darunavir with abavavir and lamivudine, CD4 count of 344, undetectable HIV viral load, and HCV-coinfection.

Malat GE, Boyle SM, Jindal RM, et al. Kidney Transplantation in HIV-Positive Patients: A Single-Center, 16-Year Experience. Am J Kidney Dis. 2018. Retrieved from: <https://www.ncbi.nlm.nih.gov/pubmed/29705074>

- Hahnemann University Hospital's experience with 120 HIV+ kidney transplant recipients
- Includes immunosuppression approach to reduce rejection, including cases of belatacept use, management of cART and donor selection criteria

Drage M, Elias R, Gathogo E, Harber M, Hilton R, Khoo S, and Post F. Kidney and Pancreas Transplantation in Patients with HIV. British Transplantation Society Guidelines. Published in 2015, last revised in 2018. Retrieved from: [https://bts.org.uk/wp-content/uploads/2017/04/02\\_BTS\\_Kidney\\_Pancreas\\_HIV.pdf](https://bts.org.uk/wp-content/uploads/2017/04/02_BTS_Kidney_Pancreas_HIV.pdf)

- Updated British Transplant Society Guidelines

Avettand-fenoël V, Rouzioux C, Legendre C, Canaud G. HIV Infection in the Native and Allograft Kidney: Implications for Management, Diagnosis, and Transplantation. Transplantation. 2017;101(9):2003-2008. Retrieved from: <https://www.ncbi.nlm.nih.gov/pubmed/28196049>

- Summary of renal disease caused by HIV that can occur after transplantation

Sawinski D, Shelton BA, Mehta S, Reed RD, MacLennan PA, Gustafson S, Segev DL, Locke JE. Impact of Protease Inhibitor-Based Anti-Retroviral Therapy on Outcomes for HIV+ Kidney Transplant Recipients. Am J Transplant 2017; 17: 3114-3122. Retrieved from: <https://www.ncbi.nlm.nih.gov/pubmed/28696079>

- Retrospective analysis using SRTR data and pharmacy prescription records to evaluate outcomes between HIV+ KTR on PI-regimens vs non-PI regimens

Husson J, Stafford K, Bromberg J, et al. Association between Duration of Human Immunodeficiency Virus (HIV)-1 Viral Suppression Prior to Renal Transplantation and Acute Cellular Rejection. Am J Transplant. 2017;17:551-56. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/27458893>

- Compared duration of viral suppression prior to kidney transplant and incidence of acute cellular rejection. Patients with < 2 years of viral suppression are 2.48 times more likely to experience rejection compared to those with viral suppression for 2 years of longer. Note: Reported p value in abstract is different from the results section.

Shelton BA, Mehta S, Sawinski D, et al. Increased mortality and graft loss with kidney retransplantation among human immunodeficiency virus (HIV)- infected recipients. Am J Transplant 2017; 17: 173-179. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/27305590>

- Examined SRTR of kidney retransplant recipients from 2004-2013.
- Compared to HIV- kidney re-transplant recipients:
- HIV+ kidney retransplant recipients were more commonly African American, infected with HCV and had longer median times on dialysis.

- HIV+ re-transplant recipients experienced a 3.11 fold increased risk of death and 1.96 fold increased risk of graft loss

Cohen EA, Mulligan D, Kulkarni S, et al. De Novo Belatacept in a Human Immunodeficiency Virus-Positive Kidney Transplant Recipient. *Am J Transplant*. 2016; 16(9):2753-57. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/27137752>

- Case report of the use of belatacept as part of CNI-sparing immunosuppression regimen in kidney transplant patient. Patient was free of rejection at 18 months.

Ebcioğlu Z, Liu C, Shapiro R et al. Belatacept Conversion in an HIV-Positive Kidney Transplant Recipient with Prolonged Delayed Graft Function. *Am J Transplant* 2016; 16:3278-3281. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/27328903>

- Case report with 1-year follow-up of kidney transplant recipient with DGF converted to belatacept at 14 weeks post-transplant.

Gathogo E, Harber M, Bhagani S, et al. Impact of Tacrolimus Compared With Cyclosporin on the Incidence of Acute Allograft Rejection in Human Immunodeficiency Virus-Positive Kidney Transplant Recipients. *Transplantation*. 2016;100(4):871-8. Retrieved from: <https://www.ncbi.nlm.nih.gov/pubmed/26413990>

- Analyzed 78 HIV+ patients, 31 on CsA and 47 on TAC
- Acute rejection at 1 year occurred in 58% and 21% among patients on CsA and Tac, respectively (P =0.003)
- Choice of CNI was the only factor significantly associated with acute rejection (HR for TAC vs CsA 0.25 [95% confidence interval, 0.11-0.57], P = 0.001)
- Authors concluded that TAC may be preferred CNI for HIV+ kidney transplant recipients

Kucirka LM, Durand CM, Bae S, et al. Induction immunosuppression and clinical outcomes in kidney transplant recipients infected with human immunodeficiency virus. *Am J Transplant* 2016; 16:2368-2376. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/27111897>

- Large cohort comparing clinical outcomes among induction agents: ATG, IL-2 receptor blocker or no induction.
- Patients receiving induction therapy were less likely to have DGF and less death-censored graft failure one year post transplant compared to patients not receiving induction therapy. Patients receiving ATG had lower rates of acute rejection.
- Infection rates were similar among induction agents and slightly lower with no induction

Lee DH, Malat GE, Bias TE, Harhay MN, Ranganna K, Doyle AM. Serum creatinine elevation after switch to dolutegravir in a human immunodeficiency virus-positive kidney transplant recipient. *Transpl Infect Dis*. 2016;18(4):625-7. Retrieved from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5525135/>

- Case report of HIV+ patient with increase in serum creatinine after initiation of dolutegravir

Nashar K, Sureshkumar KK. Update on kidney transplantation in human immunodeficiency virus infected recipients. *World J Nephrol*. 2016;5(4):300-7. Retrieved from: <https://www.ncbi.nlm.nih.gov/pubmed/27458559>

- Good general overview of HIV in kidney transplant with special attention to HIV+ to HIV+ transplants

Sawinski D. Kidney transplantation for HIV-positive patients. *Transplant Rev (Orlando)*. 2016 Oct 11. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/27776929>

- Review of the controversy and obstacles of kidney transplantation in HIV positive patients including HIV-associated nephropathy (HIVAN), HIV patients on the waitlist, the improvement of outcomes in the modern era of HAART, drug-drug interactions with immunosuppression, and the use of HIV+ donors.

Locke JE, Shelton BA, Reed RD et al. Identification of Optimal Donor-Recipient Combinations Among Human Immunodeficiency Virus (HIV)-Positive Kidney Transplant Recipients. *Am J Transplant* 2016; 16: 2377-83. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/27140837>

- Retrospective review of SRTR data attempting to identify factors predicting a higher graft loss in HIV + kidney transplant recipients compared to HIV – recipients

Sawinski D, Forde KA, Eddinger K, et al. Superior outcomes in HIV-positive kidney transplant patients compared to HCV-infected or HIV/HCV co-infected recipients. *Kidney Int.* 2015 Aug; 88(2): 341-349. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/25807035>

- Retrospective study of kidney transplants comparing patient and allograft survival outcomes between HIV mono-infection, HCV mono-infection, and HIV/HCV co-infection. This study observed (a) similar survival outcomes between HIV mono-infection recipients and uninfected recipients, (b) superior survival outcomes HIV-monoinfected recipients compared to HCV-monoinfected recipients and (c) survival outcomes are worse in HIV/HCV-coinfected recipients compared to those with mono-infections (either HCV or HIV); this highlights the importance of further studies to evaluate the use of direct acting HCV antivirals in end stage renal disease as well as to assess pre-transplant or preemptive post-transplant HCV treatment strategies.

Locke JE, Reed RD, Mehta SG et al. Center Level Experience and Kidney Transplant Outcomes in HIV-Infected Recipients. *Am J Transplant* 2015; 15:2096-2104. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/25773499>

- Retrospective review of SRTR data determining that no difference in outcomes existed in centers early in their HIV + transplant experience compared to those in the NIH-study group

Malat G, Jindal RM, Mehta K, Gracely E, Ranganna K, Doyle A. Kidney donor risk index (KDRI) fails to predict kidney allograft survival in HIV (+) recipients. *Transplantation* 2014 Mar 11. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/24621536>

- Study evaluating predictive power of KDRI as compared to DGF in predicting outcomes in HIV (+) kidney transplant recipients

Grossi PA, Righi E, Gasperina DD, et al. Report of four simultaneous pancreas-kidney transplants in HIV-positive recipients with favorable outcomes. *Am J Transplant* 2012; 12(4):1039-45. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/22221659>

- Report of 4 successful SPK transplants in HIV+ recipients

Malat G, Ranganna KM, Sikalas N, Liu L, Jindal RM, Doyle A. High frequency of rejections in HIV-positive recipients of kidney transplantation: a single center prospective trial. *Transplantation* 2012; 94(10):1020-4. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/23169224>

- Case series of mixed antibody-mediated rejection + acute cellular rejection in cohort of HIV-positive kidney transplant recipients

Muller E, Barday Z, Mendelson M, Kahn D. Renal transplantation between HIV-positive donors and recipients justified. *S Afr Med J* 2012; 102(6):497-8. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/22668948>

- Follow up publication out of South Africa highlighting the outcomes of the now 14 HIV+ to HIV+ transplants performed in that country.

Mazuecos A, Fernandez A, Andres A et al. HIV infection and renal transplantation. *Nephrol Dial Transplant* 2011; 26(4):1401-7. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/20858765>

- Multicenter, retrospective, observational study of HIV positive vs. HIV negative renal transplant recipients in Spain

Muller E, Kahn D, Mendelson M. Renal transplantation between HIV-positive donors and recipients. *N Engl J Med* 2010; 362(24):2336-7. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/20554994>

- First reported kidney transplants (4) from HIV+ donors to HIV+ recipients out of South Africa.

Landin L, Rodriguez-Perez JC, Garcia-Bello MA et al. Kidney transplants in HIV-positive recipients under HAART. A comprehensive review and meta-analysis of 12 series. *Nephrol Dial Transplant* 2010;25(9):3106-15. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/20228071>

- Meta-analysis with helpful summary tables of efficacy and safety from previous studies as well as random effects Forrest plots for outcomes and safety data.

Touzot M, Pillebout E, Matignon M et al. Renal transplantation in HIV-infected patients: the Paris experience. *Am J Transplant* 2010; 10(10):2263-9. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/20840478>

- Well documented report of European experience with transplantation of HIV+ recipients, including information on immunosuppressive regimens, efficacy outcomes, and safety outcomes.

Stock PG, Barin B, Murphy B et al. Outcomes of kidney transplantation in HIV-infected recipients. *N Engl J Med* 2010; 363(21):2004-14. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/21083386>

- One of the only, larger-scale prospective studies of HIV+ transplant, conducted in kidney recipients; highlights very important data regarding risk of rejection, infectious complications, and data on the use of induction therapy.

Locke JE, Montgomery RA, Warren DS, Subramanian A, Segev DL. Renal transplant in HIV-positive patients: long-term outcomes and risk factors for graft loss. *Arch Surg* 2009; 144(1):83-6. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/19153330>

- UNOS data review describing predictors of patient and graft survival in HIV-positive population undergoing transplant

Carter JT, Melcher ML, Carlson LL, Roland ME, Stock PG. Thymoglobulin-associated Cd4+ T-cell depletion and infection risk in HIV-infected renal transplant recipients. *Am J Transplant* 2006; 6(4):753-60. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/16539632>

- Prospective, observational study of thymoglobulin in HIV+ renal transplant recipients for the treatment of rejection with commentary on safety and efficacy

Qiu J, Terasaki PI, Waki K, Cai J, Gjertson DW. HIV-positive renal recipients can achieve survival rates similar to those of HIV-negative patients. *Transplantation* 2006; 81(12):1658-61. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/16794531>

- Incredibly unique study in which outcomes of HIV+ kidney recipients and the HIV negative recipient of the contra-lateral kidney from the same donor were compared.

## Liver/Intestine Transplant

Corma-gomez A, Morano Amado L, Tellez F, et al. HIV infection does not impact on the risk of liver complications in HCV-infected patients with advanced fibrosis, after sustained virological response with DAA. *AIDS* 2019; (ahead of print). Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/30845068>

- Prospective, multi-center of 700 HCV+ patients (507 coinfecting with HIV) assessing incidence of hepatic complications at one and two years post transplantation.

Botha J, Conradie F, Etheredge H, Fabian J, Duncan M et al. Living donor liver transplant from an HIV-positive mother to her HIV-negative child: opening up new therapeutic options. *AIDS*. 2018 Oct; 32 (16): F13-F19. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/30281558>

- Unique case report of a living liver transplant from HIV positive mother to HIV negative child in Africa that includes data from one year post transplant

Nagaraju S, Mangus R, Fridell J. Multivisceral transplant in an HIV positive recipient – one year survival. *American Journal of Transplant*. 2017; 17: suppl 3 abstract number: C306.

- ATC abstract of a HIV positive recipient underwent multivisceral transplant
- Developed bowel perforation and an EBV-positive liver mass 8 months post-transplant
- Received rituximab, cyclophosphamide, doxorubicin, vincristine, and prednisolone
- Developed bone marrow suppression, pancytopenia, and sepsis dying on POD 425

Aguero F, Forner A, Valdivieso A, Blanes M, Barcena R et al. Human immunodeficiency virus-infected liver transplant recipients with incidental hepatocellular carcinoma: a prospective multicenter nationwide cohort study. *Liver Transpl*. 2017 May; 23 (5): 645-651. Retrieved from

<https://www.ncbi.nlm.nih.gov/pubmed/28188668>

- Multi-centered prospective case cohort evaluating the frequency, histopathological characteristics, and outcomes of HIV-infected OLT recipients with incidental hepatocellular carcinoma (iHCC) comparing to non HIV infected OLT recipients with iHCC
- No patients developed HCC recurrence post transplant
- HIV-infected patients have lower survival and higher frequency of HCV recurrence as a cause of death

Aguero F, Rimola A, Stock P et al. Liver Retransplantation in Patients with HIV-1 Infection: An International Multicenter Cohort Study. *Am J Transplant* 2016; 16:679-87. Retrieved from

<https://www.ncbi.nlm.nih.gov/pubmed/26415077>

- Retrospective cohort evaluating retransplantation incidence, survival, and prognostic factors in 600 HIV + liver transplant recipients.

Calmy A, van Delden C, Giostra E, et al. HIV-Positive-to-HIV-Positive Liver Transplantation. *Am J Transplant*. 2016 Aug; 16(8):2473-8. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/27109874>

- Case report of first successful liver transplantation from HIV-positive donor to HIV-positive recipient in October 2015 in Switzerland
- Both patients had been exposed to many years of antiretroviral agents and were infected with multidrug resistant viruses.

Hathorn E, Smit E, Elsharkawy A, Bramhall SR, Bufton SA et al. HIV-positive-to-HIV-positive liver transplantation. *New England Journal of Medicine*. 2016 Nov; 375: 1807-1809.

- Letter to the editor describing a liver transplant from a HIV/HCV positive donor to a HIV positive recipient
- Rebound elevation in HIV RNA occurred within POD2, antiretroviral therapy was resumed on the evening of POD1
- HIV VL was undetectable by 7 weeks post-transplant

Cattaneo D, Puoti M, Sollima S, et al. Reduced raltegravir clearance in HIV-infected liver transplant recipients: an unexpected interaction with immunosuppressive therapy? *J Antimicrob Chemother.* 2016 May; 71(5):1341-5. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/26755497>

- Retrospective, multicenter study of raltegravir pharmacokinetics in HIV-infected liver transplant recipients. A higher raltegravir exposure was observed in these patients; some patients required dose reductions to tolerate raltegravir. The increased exposure was theorized to be due to inhibition of UDP-glucuronosyltransferase (UGT) activity and P-glycoprotein.

Locke JE, Durand C, Reed RD, et al. Long-term outcomes after liver transplantation among human immunodeficiency virus-infected recipients. *Transplantation* 2016; 100: 141-146. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/26177090>

- Compared 5- and 10- year outcomes of HIV patients with matched HIV negative patients.

Joshi D and Agarwal K. Role of liver transplantation in human immunodeficiency virus positive patients. *World Journal of Gastroenterology.* 2015 Nov; 21 (43): 12311-12321. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4649115/>

- Key challenges faced by HIV/HCV coinfection liver transplant patients in the pre- and post operative period including epidemiology, selection criteria, and short/long term outcomes

Congly SE, Doucette KE, Coffin CS. Outcomes and management of viral hepatitis and human immunodeficiency virus co-infection in liver transplantation. *World J Gastroenterol.* 2014;20(2):414-24. Retrieved from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3923016/>

- Review article of management of patients co-infected with HBV or HCV and HIV
- Includes outcomes data and post-transplant medication management

Fox AN, Vagefi PA, Stock PG. Liver transplantation in HIV patients. *Semin Liver Dis* 2012; 32(2):177-85. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/22760657>

- Review of liver transplantation in HIV+ recipients

Gastaca M, Agüero F, Rimola A et al. Liver Retransplantation in HIV-Infected Patients: A Prospective Cohort Study. *Am J Transplant* 2012; 12:2465-76. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/22703615>

- Compares retransplant incidence and 3-year survival rates in 14 HIV + liver transplant recipients compared to 157 HIV – recipients

Di Benedetto F, Di Sandro S, De Ruvo N, et al. First report on a series of HIV patients undergoing rapamycin monotherapy after liver transplantation. *Transplantation* 2010; 89(6):733-8. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/20048692>

- Case series evaluating rapamycin monotherapy in liver transplantation, also describes mTORi specific activity in HIV

Mindikoglu AL, Regev A, Magder LS. Impact of human immunodeficiency virus on survival after liver transplantation: analysis of the United Network for Organ Sharing database. *Transplantation* 2008; 85(3):359-68. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/18301332>

- Large, retrospective database review of impact of HIV on outcomes after liver transplant.

### **Heart/Lung Transplant**

Ong, S., Levy, R. D., Yee, J., Partovi, N., Churg, A., Roméo, P., ... & Ryerson, C. J. (2018). Successful lung transplantation in an HIV seropositive patient with desquamative interstitial pneumonia: a case

report. *BMC pulmonary medicine*, 18(1), 162. Retrieved from <https://bmcpulmed.biomedcentral.com/articles/10.1186/s12890-018-0727-0>

- Case report on an HIV positive patient who received lung transplant that details long term outcomes (up to 2 years)

Mehdiani, Arash, et al. "Heart transplantation bridged by mechanical circulatory support in a HIV-positive patient." *Journal of cardiac surgery* 31.8 (2016): 559-561. Retrieved from: <https://www.ncbi.nlm.nih.gov/pubmed/27349495>

- Case report of 44 year old HIV+ male successfully bridged by MCS to heart transplant

Agüero, F., et al. "An Update on Heart Transplantation in Human Immunodeficiency Virus–Infected Patients." *American Journal of Transplantation* 16.1 (2016): 21-28. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/26523614>

- Overview of epidemiological data and case series/cohorts of HT patients with concomitant HIV infection

Hernandez Conte A, Kittleson MM, Dilibero D, et al. Successful Orthotopic Heart Transplantation and Immunosuppressive Management. *Tex Heart Inst J*. 2016;43(1):69-74. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4810590/>

- 2 case reports of successful HIV+ to HIV+ OHT

Bansal, S., Hayanga, J., Odell, J., Odell, D., Jeong, K., Fabio, A., ... & D'Cunha, J. (2015). Risky business: taking the stigma out of high-risk donation in lung transplantation. *The Annals of Thoracic Surgery*, 100(5), 1787-1794. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/26294346>

- Retrospective review of UNOS registry data evaluating outcomes associated with using high risk donors vs non-high risk donors in lung transplantation
- Does not focus on lung transplant with HIV+ recipients/donors, just on use of high risk donors

Kern RM, Seethamraju H, Blanc PD, et al. The Feasibility of Lung Transplantation in HIV- Seropositive Patients. *Ann Am Thorac Soc*. 2014;11(6):882-89. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/24964265>

- 3 case reports of lung transplant in HIV+ patients. Of note, all 3 patients experienced acute cellular rejection.

Krishan K, Pinney S, Anyanwu AC. Successful left ventricular assist device bridge to transplantation in a patient with end-stage heart failure and human immunodeficiency virus. *Artif Organs* 2012;36(8):759. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/22748011>

- Brief case report of a successful LVAD bridge to ECD heart transplant in a HIV+ recipient with non-ischemic cardiomyopathy

Bertani A, Grossi P, Vitulo P et al. Successful lung transplantation in an HIV- and HBV-positive patient with cystic fibrosis. *Am J Transplant* 2009; 9(9):2190-6. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/19656132>

- Detailed case report of BLT in recipient with CF and HIV/HBV coinfection in Italy

Bisleri G, Morgan JA, Deng MC, Mancini DM, Oz MC. Should HIV-positive recipients undergo heart transplantation? *J Thorac Cardiovasc Surg*. 2003; 126(5):1639-40. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/14666047>

- Brief, fairly superficial case report of a successful heart transplant in HIV+ recipient

Calabrese LH, Albrecht M, Young J et al. Successful cardiac transplantation in an HIV-1-infected patient with advanced disease. *N Engl J Med* 2003; 348(23):2323-8. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/12788996>

- Case report of a heart transplant for dilated cardiomyopathy s/p chemotherapy in a HIV+ patient with history of AIDS, multiple OIs, and Kaposi's sarcoma

### **Concurrent HBV/HCV**

Camargo J, Anjan S, Chin-Beckford N, et al. Clinical outcomes in HIV+/HCV+ coinfecting kidney transplant recipients in the pre- and post- direct acting antiviral (DAA) therapy eras: 10-year single center experience. *Clin Transplant* 2019; (ahead of print). Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/30866102>

- Single center retrospective study of HIV+/HCV+ coinfecting KT recipients (2007-2017). Outcomes were assessed for the pre-DAA and post-DAA (i.e., after December 2013).
- Outcomes of HIV+/HCV+ KT recipients, including HIV-/HCV+ to HIV+/HCV+ transplants, in the DAA era were excellent in this small cohort (13 patients)
  - Less infection and rejection compared to pre-DAA group

Berenguer J, Gil-Martin A, Jarrin I, Moreno A, Dominguez L et al. All-oral direct-acting antiviral therapy against hepatitis C virus (HCV) in human immunodeficiency virus/HCV-coinfecting subjects in real-world practice: Madrid coinfection registry findings. *Hepatology*. 2018 July; 68 (1): 32-47. Retrieved from: <https://www.ncbi.nlm.nih.gov/pubmed?term=29377274>

- Evaluated treatment outcomes in a prospective registry of HIV/HCV co-infected patients treated with IF-free DAAT in hospitals from region of Madrid between November 2014-August 2016
- DAAT was safe and highly effective in coinfecting patients
- Predictors of failure included gender, HIV-related immunosuppression, HCV RNA load, severity of liver disease, and use of suboptimal DAAT regimens

Rai R, Ezeoke OM, McQuade JL, Zimmer L, Koo C et al. 1148PD Immunotherapy in patients with concurrent solid organ transplant, HIV, and Hepatitis B and C. *Annals of Oncology*. 2017 Sep; 28 (S5), doi: 10.1093. Retrieved from: [https://academic.oup.com/annonc/article/28/suppl\\_5/mdx376.013/4109227](https://academic.oup.com/annonc/article/28/suppl_5/mdx376.013/4109227)

- Majority of trials on anti PD-1/L1 (PD1) agents for tumor treatment excluded patients with solid organ transplant, HIV, HBV, or HCV so the safety and efficacy in this patient population is unknown
- 5 patients with solid organ transplant had melanoma and received pembrolizumab
- Immunotherapy can be given to renal transplant patients without rejection, however this is not universal
- PD1 does not appear to adversely affect the viral control in HIV and HBV and HCV patients

Araiz J. J., Serrano M. T., García-Gil F. A., Lacruz E. M., Lorente S. , Sánchez J. I. and Suarez M. A. Intention-to-treat survival analysis of hepatitis C virus/human immunodeficiency virus coinfecting liver transplant: Is it the waiting list? *Liver Transpl*; 2016 Sep; 22 (9): 1186-1196. Retrieved from: <https://www.ncbi.nlm.nih.gov/pubmed/27114030>

- Several complications related to HIV/HCV while patients are on the waitlist may impact the potential for liver transplant as well as outcomes
- Compared survival of patients on the liver transplant waitlist with HCV with and without HIV infection
- Patients with HCV/HIV coinfection had higher mortality on the waiting list than those with HCV mono-infection
- Donor age > 70, UNOS status 1, MELD, and HIV coinfection had independent negative predictive value for survival

Bonacci M, Lens S, Marino Z, et al. Challenges in Special Populations: HIV/HCV Coinfection, Liver Transplantation and Patients with End-Stage Renal Disease. *Dig Dis*. 2016; 34(4):317-26. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/27170384>

- Review of hepatitis C virus (HCV) antiviral combinations in unique patient populations including HIV/HCV coinfection, liver transplant patients, and patients with end-stage renal disease (ESRD). Implications of drug-drug interactions are also discussed in this review

Sawinski D, Lee DH, Doyle AM, et al. Successful posttransplant treatment of hepatitis C with ledipasvir-sofosbuvir in HIV+ kidney transplant recipients. *Transpl* 2016; advanced online publication. doi:[10.1097/TP.0000000000001336](https://doi.org/10.1097/TP.0000000000001336). Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/27467534>

- 6 HIV/HCV genotype 1 coinfecting recipients were treated with ledipasvir-sofosbuvir post kidney transplantation. All patients tolerated the regimen well and achieved SVR12. All patients were alive with functioning allografts at last follow up, mean of 265 days after the end of therapy. Tac required dose adjustment, but ART regimen required no dose adjustments.

Sollima S, Milazzo L, Torre A, Calvi E, Regalia E, Antinori S. Paritaprevir/ritonavir, ombitasvir, and dasabuvir for treatment of recurrent hepatitis C virus infection in the human immunodeficiency virus coinfecting liver transplant recipient. *Liver Transpl*. 2016;22(2):252-3. Retrieved from: <https://aasldpubs.onlinelibrary.wiley.com/doi/full/10.1002/lt.24353>

- Case report of successful treatment of HCV recurrence in HIV co-infected liver transplant recipient

Stock PG, Terrault NA. Human immunodeficiency virus and liver transplantation: Hepatitis C is the last hurdle. *Hepatology*. 2015 May; 61 (5): 1747-1754. Retrieved from: <https://www.ncbi.nlm.nih.gov/pubmed/25292153>

- Review article of experience with liver transplants with HIV/HCV co-infection focusing on donor/recipient selection criteria, minimizing rejection risk, and HCV therapy

Sawinski D, Goldberg DS, Blumberg E, et al. Beyond the NIH multicenter HIV transplant trial experience: outcomes of HIV+ liver transplant recipients compared to HCV+ or HIV+/HCV+ coinfecting recipients in the United States. *Clin Infect Dis* 2015; 61(7):1054-62. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4560908/>

- Retrospective US cohort study investigating the effect of HIV on liver transplant patients and graft outcomes when compared to HCV and uninfected patients
- HIV/HCV coinfection was associated with a 2.5 fold increased risk of mortality and an almost 3-fold increase in allograft loss
- HIV monoinfected patients had comparable outcomes to uninfected recipients

Xia Y, Friedmann P, Yaffe H et al. Effect of HCV, HIV and Coinfection in Kidney Transplant Recipients: Mate Kidney Analyses. *Am J Transplant* 2014; 14: 2037-47. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/25098499>

- Compared rejection and survival outcomes in 1700 HCV and 243 HIV + kidney transplant recipients compared to the HCV – and HIV – mate kidney recipients

Vivanco M, Friedmann P, Xia Y, et al. Campath induction in HCV and HCV/HIV-seropositive kidney transplant recipients. *Transpl Intl* 2013; 26 :1016-1026. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/23947744>

- Compared overall mortality by induction therapy (alemtuzumab, T cell-depleting agents, IL-2 blocking agents and no induction therapy) using SRTR data from 2003-2010. Compared to no induction, patients receiving any induction had similar overall patient and graft survival at 1 year and 3 years.

Durante-Mangoni E, Maiello C, Limongelli G, Sbriglia C, Pinto D, Amaarelli C et al. Management of immunosuppression and antiviral treatment before and after heart transplant for HIV-associated dilated

cardiomyopathy. International journal of immunopathology and pharmacology. 2014 Jan-Mar; 27 (1): 113-120. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/24674686>

- Summary of major challenges faced taking care of a HIV infection and long term outcomes that resulted

Miro JM, Montejo M, Castells et al. Outcome of HCV/HIV-Coinfected Liver Transplant Recipients: A Prospective and Multicenter Cohort Study. Am J Transplant 2012; 12: 1866-76. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/22471341>

- Prospective multicenter study evaluating post-liver transplant outcomes of HIV/HCV infected patients compared to HCV monoinfected patients

Terrault NA, Roland ME, Schiano T, Dove L, Wong MT, Poordad F, et al. Outcomes of liver transplantation in HCV-HIV coinfecting recipients. Liver Transplantation. 2012 Jun; 18 (6): 716-726. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/22328294>

- Concern that patients with HCV/HIV will have poor outcomes post-liver transplant
- Patient and graft survival in liver transplant patients are lower in HCV-HIV compared to HCV alone
- Rates of treated acute rejection but not HCV disease severity are significantly higher in HCV/HIV compared to HCV recipients

Ison MG, Llata E, Conover CS et al. for the HIV-HCV Transplantation Transmission Investigation Team. Transmission of human immunodeficiency virus and hepatitis C virus from an organ donor to four transplant recipients. Am J Transplant 2011; 11(6):1218-25. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/21645254>

- Unique report of HIV transmission via organ donation highlighting process for screening of HIV in pre-transplant setting.

Coffin CS, Stock PG, Dove LM et al. Virologic and Clinical Outcomes of Hepatitis B Virus Infection in HIV-HBV Coinfected Transplant Recipients. Am J Transplant 2010; 10:1268-75. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3155863/>

- Prospective cohort evaluating patient and graft survival in 22 HIV-HBV coinfecting liver transplant recipients compared to 20 HBV monoinfected recipients

Teicher E, Vincent I, Bonhomme-Faivre L et al. Effect of highly active antiretroviral therapy on tacrolimus pharmacokinetics in hepatitis C virus and HIV co-infected liver transplant recipients in the ANRH HC-08 study. Clin Pharmacokinet 2007; 46(11):941-52. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/17922559>

- Helpful kinetic data on immunosuppressant use in the post-transplant setting.

### General/Other

Blumberg E, Rogers C. Solid Organ Transplantation in the HIV-Infected Patient: Guidelines from the American Society of Transplantation Infectious Diseases Community of Practice. Clinical transplantation (2019): e13499. Retrieved from: <https://onlinelibrary.wiley.com/doi/abs/10.1111/ctr.13499>

- Updated SOT in HIV-infected patient guidelines from the American Society of Transplantation Infectious Diseases Community of Practice

Miro J., Paolo A., Durand C. Challenges in solid organ transplantation in people living with HIV. Intensive Care Medicine (2019): 1-3. Retrieved from: <https://link.springer.com/article/10.1007%2Fs00134-019-05524-1>

- Review article of challenges faced in SOT patients with HIV and comparison of survival between HIV-infected vs HIV-non infected patients.

Rollins B, Farouk S, DeBoccardo G, et al. Higher Rates of Rejection in HIV-infected Kidney Transplant Recipients on Ritonavir-Boosted Protease Inhibitors: Three-Year Follow Up Study. Clin Transplant 2019; (ahead of print). Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/30864166>

- Single-center study of 42 patients demonstrating higher rates of acute rejection in PI HAART regimens when compared to other HAART regimens at 1, 2, and 3 years.

Sparkes T, Lemonovich T. Interactions between Anti-infective Agents and Immunosuppressants- Guidelines from the American Society of Transplantation Infectious Diseases Community of Practice. Clin Transplant 2019; (ahead of print). Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/30817021>

- Summary of drug-drug interactions between immunosuppressants and anti-infective agents

Wolfe C, Ison M. Donor-Derived Infections: Guidelines from the American Society of Transplantation Infectious Diseases Community of Practice. Clin Transplant 2019; (ahead of print) Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/30903670>

- Guidelines on use of HIV-positive donors and HIV-positive recipients, HCV viremic donors, and approaches to patients with donor-derived infections

Van Pilsum Rasmussen S, Bowring MG, Shaffer AA, Henderson ML, Massie A, et al. Knowledge, attitudes, and planned practice of HIV-positive to HIV-positive transplantation in US transplant centers. Clin Transplant. 2018 Oct; 32(10):e13365. Retrieved from: <https://www.ncbi.nlm.nih.gov/pubmed/30074638>

- Survey describing scope of planning among US transplant centers for HIV+ donors to HIV+ recipients
- Assessed knowledge/attitudes about HIV+ to HIV+ transplantation to identify transplant center barriers to implementation of this practice

Durand C. M., Segev D., Sugarman J. Realizing HOPE: the ethics of organ transplantation from HIV-positive donors. Annals of internal medicine. 2016 Jul; 165 (2): 138-142. Retrieved from <http://annals.org/aim/fullarticle/2512234>

- Review over factors to consider in transplanting a HIV positive organ such as access, risks, and consent

Roland M. E., Barin B., Huprikar S., Murphy B., Hanto D. W. Blumberg E., Stock, P. G. Survival in HIV-positive transplant recipients compared with transplant candidates and with HIV-negative controls. AIDS. 2016 Jan; 30 (3): 435-444. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/26765937>

- Evaluation of the impact of liver and kidney transplantation on survival in HIV-positive transplant candidates and compare outcomes between HIV-positive and negative recipients

Boyarsky BJ, Durand CM, Palella FJ, Segev DL. Challenges and Clinical Decision-Making in HIV-to-HIV Transplantation: Insights from HIV Literature. AM J Transplant 2015; 15:2023-2030. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/26080612>

- Review of clinical considerations of HIV-to-HIV transplantation

Richterman A, Sawinski D, Reese PP et al. An Assessment of HIV-Infected Patients Dying in Care for Deceased Organ Donation in a United States Urban Center. Am J Transplant 2015; 15:2105-2116. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/25976241>

- Extrapolated data from 6 HIV clinics in Philadelphia to estimate the increase in potential donors as a response to the HOPE Act

Koval C. E., Khanna A., Pallotta A., Spinner M., Taege A. J, et al. En bloc multivisceral and kidney transplantation in an HIV patient: First case report. *American Journal of Transplantation*. 2015 Oct; 16 (1): 358-363. Retrieved from <https://onlinelibrary.wiley.com/doi/full/10.1111/ajt.13455>

- First case report detailing a multivisceral and kidney transplantation in an HIV positive patient.

Miro JM, Aguero F, Duclos-Vallee JC et al. Infections in solid organ transplant HIV-infected patients. *Clin Microbiol Infect* 2014; 20:119-130. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/25040016>

- Review article with recommendations for listing criteria, HAART regimens, and infection prevention in the pre- and post-transplant periods

Frassetto LA, Tan-Tam CC, Barin B, et al. Best single time point correlations with AUC for cyclosporine and tacrolimus in HIV-infected kidney and liver transplant recipients. *Transplantation* 2014; 97(6):702-7. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/24389906>

- Prospective evaluation of CNI level sampling in HIV+ individuals to find the best time point correlation with AUC in abdominal transplant recipients

Mgbako O, Glazier A, Blumberg E, Reese PP. Allowing HIV-positive organ donation: ethical, legal, and operational considerations. *Am J Transplant* 2013; 13(7):1636-42. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/23758835>

- Very relevant article highlighting important considerations in an era where HIV+ organ donation is now permissible.

Seem DL, Lee I, Umscheid CA, Kuehnert MJ. Excerpt from PHS guideline for reducing HIV, HBV, and HCV transmission through organ transplantation. *Am J Transplant* 2013; 13(8):1953-62. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/23890284>

- Guidelines endorsed by ASTS with helpful information regarding general considerations and coordination to reduce inadvertent risks of acquiring blood borne pathogen via transplantation.

Harbell J, Terrault NA, Stock P. Solid organ transplants in HIV-infected patients. *Curr HIV/AIDS Rep* 2013; 10(3):217-25. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/23893004>

- Review on SOT in HIV+ recipients that includes eligibility criteria, outcomes and medical management of abdominal transplant patients (including drug interactions and immunosuppressants, antiretroviral therapy, viral co-infection and microbial prophylaxis)

Blumberg EA, Rogers CC for the AST Infectious Diseases Community of Practice. Human immunodeficiency virus in solid organ transplantation. *Am J Transplant* 2013; 13(Suppl 4):169-78. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/23465009>

- Comprehensive review of transplantation into a HIV+ recipient endorsed by AST/Canadian Society of Transplantation; includes criteria for transplantation, drug interactions for antiretrovirals and immunosuppression, prophylaxis and vaccinations

Chin-Hong P, Beatty G, Stock P. Perspectives on liver and kidney transplantation in the human immunodeficiency virus-infected patient. *Infect Dis Clin North Am* 2013; 27(2):459-71. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/23714349>

- Review of abdominal transplantation in HIV+ recipients with commentary on HBV and HCV coinfection

Primeggia J, Trimpone JG Jr, Kumar PN. Pharmacologic issues of antiretroviral agents and immunosuppressive regimens in HIV-infected solid organ transplant recipients. *Infect Dis Clin North Am* 2013;27(2):473-86. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/23714350>

Very useful review of drug interactions with immunosuppressants and HIV medications; informative summary tables.

Frassetto L, Floren L, Barin B, et al. Changes in clearance, volume and bioavailability of immunosuppressants when given with HAART in HIV-1 infected liver and kidney transplant recipients. *Biopharm Drug Dispos.* 2013;34:442-51. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4018225/>

- PK study of CSA and FK with NNRTI and/or PI. PI increases CSA and FK AUC and bioavailability, efavirenz increases CSA exposure and bioavailability.
- Changes with Nevirapine not observed.

Van Maarseveen EM, Rogers CC, Trofe-Clark J, van Zullen AD, Mudrikova T. Drug-drug interactions between antiretroviral and immunosuppressive agents in HIV-infected patients after solid organ transplantation: a review. *AIDS Patient Care STDS* 2012;26(10):568-81. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/23025916>

- Very thorough class-by-class review of drug interactions between antiretrovirals and immunosuppressants including comprehensive table of data presented in various other publications to date.

Harbell J, Fung J, Nissen N et al. Surgical complications in 275 HIV-infected liver and/or kidney transplantation recipients. *Surgery* 2012; 152(3):376-81. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/22938898>

- Multicenter, nonrandomized, prospective study comparing incidence and severity of surgical complications in HIV+ versus HIV- transplant recipients

Boyarsky BJ, Hall EC, Singer AL, Montgomery RA, Gebo KA, Segev DL. Estimating the potential pool of HIV-infected deceased organ donors in the United States. *Am J Transplant* 2011; 11(6):1209-17. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/21443677>

- Report that estimates the number of potential deceased HIV+ organ donors and the characterization of the donor pool

Health Quality Ontario. Kidney and liver organ transplantation in persons with human immunodeficiency virus: an evidence-based analysis. *Ont Health Technol Assess Ser* 2010; 10(4):1-56. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/23074407>

- Large-scale meta-analysis of trials evaluating outcomes in HIV+ abdominal transplant recipients

Moreno A, Perez-Elias MJ, Casado JL et al. Raltegravir-based highly active antiretroviral therapy has beneficial effects on the renal function of human immunodeficiency virus-infected patients after solid organ transplantation. *Liver Transpl* 2010; 16(4):530-2. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/20213666>

- Unique article focusing on the potential benefit of utilizing raltegravir-based HIV therapy after transplantation presented as case series of patients.

Tricot L, Teicher E, Peytavin G, et al. Safety and efficacy of raltegravir in HIV-infected transplant patients co-treated with immunosuppressive drugs. *Am J Transplant* 2009; 9(8):1946-52. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/19519819>

- Additional safety data for the use of raltegravir in this patient population

Johnston B, Conly J. Solid organ transplantation and HIV: A changing paradigm. *Can J Infect Dis Med Microbiol* 2008; 19(6):425-9. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/19436573>

- Review of the development/improvement of outcomes and care in HIV+ transplant recipients

Ciuffreda D, Pantaleo G, Pascual M. Effects of immunosuppressive drugs on HIV infection: implications for solid-organ transplantation. *Transpl Int* 2007;20(8):649-58. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/17425723>

- Review of immunologic pathogenesis of HIV and rationale for immunosuppressant use; includes review of safety data when used in transplant recipients

Frassetto LA, Browne M, Cheng A et al. Immunosuppressant pharmacokinetics and dosing modifications in HIV-1 infected liver and kidney transplant recipients. *Am J Transplant* 2007; 7(12):2816-20. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/17949460>

- Details effect of antiretroviral agents (HAART) on immunosuppression pharmacokinetics

Roland ME, Lo B, Braff J, Stock PG. Key clinical, ethical, and policy issues in the evaluation of the safety and effectiveness of solid organ transplantation in HIV-infected patients. *Arch Intern Med* 2003;163(15):1773-8. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/12912709>

- Older article highlighting social issues surrounding the transplantation of organs into an HIV+ patient.

Roland ME, Stock PG. Review of solid-organ transplantation in HIV-infected patients. *Transplantation* 2003; 75(4):425-9. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/12605104>

- Older general review article on HIV+ transplantation.