Utilizing Hep-C Donor Hearts: What are the True Financial and Clinical Costs?

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Medical Director, Adult Heart Transplant Program
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Utilizing Hep-C Donor Hearts: What are the Potential Financial and Clinical Gains?

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Disclosures: I am not a hepatologist
Learning Objectives

• Summarize the current state of knowledge about utilization of Hep-C donors in the DAA era

• Describe the potential GAINS, both clinical and financial, derived from utilization of Hep-C donors

• Identify knowledge gaps that warrant further research and discovery
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How We Got Here...
How We Got Here...

Direct-acting Antivirals
The Opioid Epidemic

National Drug Overdose Deaths Involving Any Opioid

Centers for Disease Control and Prevention
Increasing Number of Deceased Donors

Overdose deaths

Overdose death donors

Increasing Rates of Hepatitis C

% drug treatment admissions for IV opioids

Rate of acute hepatitis C

Centers for Disease Control and Prevention
Evolution of Hep C Therapies

- Interferon and Ribavirin
- 2014: FDA approves ledipasvir/sofosbuvir combination tablet
- Direct-acting Antiviral (DAA) Era
- ...and multiple other IFN-free regimens
Heart Transplants from HCV NAT+ Donors

Wang et al. OPTN/SRTR 2018 Annual Data Report: Hepatitis C
Utilization Rates of Hep C Donors

Madan et al. JHLT 2019;38:907-917
Promising Early Outcomes

Early outcomes using hepatitis C–positive donors for cardiac transplantation in the era of effective direct-acting anti-viral therapies

Kelly H. Schldorf, MD, Sandip Zalawadiya, MD, Ashish S. Shah, MD, Mark Wigger, MD, Chan Y. Chung, MD, Sarah Smith, MSN, APRN, Matthew Danter, MD, Chun W. Choi, MD, Mary E. Keesler, MD, D. Marshall Brinkley, MD, Suzanne Brown Sacks, MD, Henry Ooi, MD, Roman Perri, MD, Joseph A. Awad, MD, Samuel Lewis, RN, BSN, Rachel Hayes, MSN, APRN, Heather O'Dell, MSN, APRN, Callie Darragh, MSN, APRN, Alicia Carver, PharmD, Cori Edmonds, PharmD, Shelley Ruzevich-Scholl, RN, and JoAnn Lindenfeld, MD

Active waitlist time BEFORE and AFTER HCV consent

JHLT 2018:37:763-769
Promising Early Outcomes

Transplanting hepatitis C virus–infected hearts into uninfected recipients: A single-arm trial

Rhondalyn C. McLean¹ | Peter P. Reese²,³ | Michael Acker⁴ | Patricia Ardura⁵ | Christian Bermudez⁶ | Lee R. Goldberg¹ | Peter L. Abt⁷ | Emily Adair⁸
Viviana M. Van Deerlin⁹ | K. Rajender Reddy⁰ | Roy D. Bloom¹¹ | Lawrence Supplee¹² | Anna Sicilia¹³ | Ashley Woodards¹⁴ | Muhannad Hamdan¹⁵
Katharine J. Bar¹⁶ | Paige Porrett⁴ | Matthew H. Levine⁴ | Nicole T. Wernimont¹⁷ | Caren Gentile¹¹ | Jennifer Smith¹¹ | David S. Goldberg²,⁷

Outcomes of heart transplantation from hepatitis C virus–positive donors

Saima Aslam, MD, MS,² Ily Yumul,¹ Mark Mariski,³ Victor Pretorius,⁴ and Eric Adler,⁵

Heart and Lung Transplants from HCV-Infected Donors to Uninfected Recipients

Ann E. Woolley, M.D., Steve K. Singh, M.D., Hilary J. Goldberg, M.D., David Kartesz, M.D., Mandeep R. Mehra, M.D., Kenneth Kusiz, B.S., Megan E. Johnson, B.A., Tsu Y. Tung, M.D., John Fanikos, R.Ph., Samuel C. Bollard, M.D., and Lindsey R. Baden, M.D., for the HCV Trial Team*

Rational Heart Transplant From a Hepatitis C Donor: New Antiviral Weapons Conquer the Trojan Horse

ROBERT L. GOTTLIEB, MD, PhD,¹ Robert L. Gottlieb, MD, PhD,¹,²,³ TEENA SAM, PharmD,¹,²,³ SUZANNE Y. WADA, MD,¹,²,³ JAMES F. TROTTER, MD,¹,²,³ SUMIT K. ASRANI, MD,¹,²,³ BRIAN LIMA, MD,¹,²,³ SUSAN M. JOSEPH, MD,¹,²,³ GONZALO V. GONZALEZ-STAWINSKI, MD,¹,²,³,⁷ AND SHELLEY A. HALL, MD¹,²,³
Promising Outcomes at 1-Year: Vanderbilt

30-day survival: 92.5%

1-year survival: 90.4%
Promising Outcomes at 1-Year: UNOS

Survival, propensity score matched

HCV-viremic vs. HCV-naive

HCV-positive vs. HCV-negative

Madan et al. JHLT 2019;38:907-917

Kilic et al. J Am Heart Assoc 2020
Hep C Hearts: What We Know

• No cases of HCV transmission from non-viremic donors

• DAAs
  • Well tolerated
  • Highly effective

• Comparable survival to 1-year

• Expand donor pool → Impact wait list time
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Potential to Expand the Donor Pool...

Between 2014 and 2017:
- 1306 HCV+ Donors Recovered
- 64 Hearts Transplanted
- >800 Hearts Discarded d/t HCV+

Moayedi et al. Circ Heart Fail 2018;11:e005276
...and Reduce: Death on the Wait List

Hsich E et al. JACC HF 2016;4:689-97
...and Reduce: Clinical Deterioration → Wait List Removal

Cumulative incidence (%) of patients removed from the list, by indication

VanderPluym et al. JHLT 2014;33:261-269
...and Reduce: Bridge-to-Transplant LVAD

Mechanical Bridge

Medically Managed

Freedom from heart transplantation

Wait List Days

Truby et al. Circ: HF 2018;11:e005586
Quantifying the Clinical Benefit

Accepting HCV-positive vs not

HCV-negative vs HCV-positive

Heart Transplant Listing

Heart Transplant

Survival

1-y Survival

Survival Proportion, %

0.75

0.50

0.25

at risk

0

90

180

270

365

Follow-up, d

Log-rank P value: .76

HCV negative donor

HCV positive donor
Impact on Wait List Times

Median active wait list time 4 days (IQR 1,18)

Heart Transplant

Donor profile: 68 Ab+/NAT+ 10 Ab+/NAT- 2 Ab-/NAT+

Schlendorf et al. JAMA Cardiol. Dec 2019
Financial Impact of Hep C Donors
Financial Impact of Hep C Donors

Renal Transplant

Cost-effectiveness of hepatitis C-positive donor kidney transplantation for hepatitis C-negative recipients with concomitant direct-acting antiviral therapy

Gaurav Gupta¹,² | Yiran Zhang³ | Norman V. Carroll³ | Richard K. Sterling²,⁴

Accept HCV+ kidney → Treat HCV
$154,000

Wait for HCV- kidney
$257,000

Gupta et al. Am J Transplant 2018;18:2496-2505
If MELD >22, accepting HCV+ liver is cost effective (ICER $56K-$92K)

# Financial Impact of Hep C Donors

## Heart Transplant

### Costs
- HCV Surveillance
- HCV Treatment
- Treatment of HCV-related complications

### Potential Savings
- Fewer hospital/ICU days among waitlisted pts
- Less reliance on bridge-to-transplant MCS
# Estimated DAA Wholesale Acquisition Costs

<table>
<thead>
<tr>
<th>Recommended Regimens for GT1a HCV, without Cirrhosis</th>
<th>Cost of Regimen</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Elbasvir-Grazoprevir x 12 weeks</td>
<td>$54,600</td>
</tr>
<tr>
<td>Glecaprevir-Pibrentasvir x 8 weeks</td>
<td>$26,400</td>
</tr>
<tr>
<td>^Ledipasvir-Sofosbuvir x 8 weeks</td>
<td>$63,000</td>
</tr>
<tr>
<td>Ledipasvir-Sofosbuvir x 12 weeks</td>
<td>$94,500</td>
</tr>
<tr>
<td>Sofosbuvir-Velpatasvir x 12 weeks</td>
<td>$74,760</td>
</tr>
</tbody>
</table>

[https://www.hepatitis.uw.edu/go/evaluation-treatment/cost](https://www.hepatitis.uw.edu/go/evaluation-treatment/cost)
# Financial Impact of Hep C Donors

## Heart Transplant

### Costs
- HCV Surveillance
- HCV Treatment
  - ~ $20,000-$40,000
- Treatment of HCV-related complications

### Potential Savings
- Fewer hospital/ICU days among waitlisted pts
  - $5,000-$7,000 per day
- Less reliance on bridge-to-transplant MCS
  - $84,000 per CF-LVAD
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Hep C Hearts: What We Don’t Know

- Ideal timing and duration of treatment?
- Effects on CAV development and progression?
- Non-cardiac ramifications of HCV viremia?
- Potential for HCV eradication prior to transplant?
Hep C Hearts: What We Don’t Know

• Ideal timing and duration of treatment?
• Effects on CAV development and progression?
• Non-cardiac ramifications of HCV viremia?
• Potential for HCV eradication prior to transplant?
Hep C Donors and Risk of CAV in the pre-DAA Era

Haji et al. JHLT 2004;23:277-283
Hep C Hearts: What We Don’t Know

• Ideal timing and duration of treatment?
• Effects on CAV development and progression?
• Non-cardiac ramifications of HCV viremia?
• Potential for HCV eradication prior to transplant?
HCV: Systemic Manifestations

**Strongly associated**
- Mixed cryoglobulinemia
- Sjögren (sicca) syndrome
- Lymphoproliferative disorders
- Porphyria cutanea tarda
- Neuropathy
- Membranoproliferative glomerulonephritis
- Cryoglobulinemic vasculitis

**Possibly associated**
- Corneal ulcers (Mooren ulcers)
- Thyroid disease
- Lichen planus
- Pulmonary fibrosis
- Type 2 diabetes
- Systemic vasculitis (polyarteritis nodosa, microscopic polyangiitis)
- Arthralgias, myalgias, inflammatory polyarthritis
- Autoimmune thrombocytopenia

Hep C Hearts: What We Don’t Know

• Ideal timing and duration of treatment?
• Effects on CAV development and progression?
• Non-cardiac ramifications of HCV viremia?
• Potential for HCV eradication prior to transplant?
Summary

• The combined impact of the opioid crisis and emergence of DAAs offer a viable strategy to expand the donor pool

• Potential clinical and financial gains include:
  • Increased transplant volumes
  • Reduced time to transplant
  • Reduced wait list morbidity and mortality
  • Profits and savings associated with above

• Ongoing research is needed to further elucidate other clinical and financial gains and costs