ECMO Bridge to Lung Transplant

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Update in Advanced Lung Disease
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CL

48y M Peruvian immigrant aquarium cleaner with acute hypoxic respiratory failure

– Recently hospitalized for mycobacterial facial cellulitis and left lower lobe pneumonia
  • 6 months earlier had facial cellulitis
    – Soft tissue only by MRI, despite antibiotics
  • 4 months earlier noted cough and SOB
    – CXR w/ LLL pneumonia, Moxifloxacin
      – Only facial improvement, added minocycline
  • 2 months earlier daily fevers, pulmonary process worsens
  • 1 month earlier hospitalized, VATS biopsy
    – Organizing pneumonia w/ acute lung injury and fibrosis
      – Steroids, Antibiotics

Next Steps?

A. d/c home, no further follow up needed
B. d/c home, f/u with PCP
C. d/c home, f/u with General Pulmonologist
D. d/c home, refer for Transplant evaluation

CL continued

48y M Peruvian immigrant aquarium cleaner with acute hypoxic respiratory failure

– F/u pulmonologist: hypoxic, SOB, significant weight loss
  • 2 week hospitalization
    – 2L NC -> NRB
    – Failed high dose steroids, cellcept
      – Intubation
    – Oscillator
      – Oxygen saturations only in 80s
Now what?

A. Comfort care  
B. Lung transplant  
C. ECMO (Extracorporeal membrane oxygenation)  
D. Call a friend

Organ Bank

Basic ECMO Circuit

CIRCUIT CONFIGURATION FOR VA AND VV ECMO
Avalon Double Lumen Cannula For VV Support

By simultaneously removing blood from both the SVC and IVC and returning blood to the Right Atrium this instrument is able to match the body's natural flow ratios.
ECMO Bridge to transplant

ECMO: PERMITS AMBULATION PRE-TRANSPLANTATION!!

Things to Think About

- Retrograde flow

Principles of ECLS
Veno-Arterial Mode of Support

- Blood drained from venous circulation and returned to the arterial circulation
- Cardiac and pulmonary support
- Partial or total VA support
- Access can be either peripheral (via groins or neck vessels) or central (directly into great vessels)
Distal Extremity Perfusion

VA ECMO - Peripheral

Femoral vein to femoral artery  Internal jugular V. to axillary artery

Illustration Source: Medscape
VA ECMO - Central

Admission CXR

CL

• 48y M w/ DAD/AIP transferred from local hospital on VA ECMO
  – Concern: drug-induced DAD in setting of 3 drug therapy for mycobacterial skin infection vs cryptogenic organizing PNA.

• Peripheral VA ECMO; tracheostomy
  – Agitation w/ neuro checks -> flow disturbances
• 10 days later: Central VV ECMO
• 1 week later: weight bearing; listed for lung transplant
• 2 weeks later: BOLT on CPB
• POD 46 d/c home
ECLS as a Bridge to Transplant appears to be on the Rise

Number of articles on ECLS and ECLS as a bridge to LTx published on PubMed for each year from 2000-2011

Am. J. Respir. Crit. Care Med. April 1, 2012 vol. 185 no. 7 699-701

Retrospective, 2 institutions
- ECMO bridge vs institutional and UNOS
- 31 patients
  - UCSF, 25, U Kentucky, 6
  - ECMO 1/03-6/2012
    - 18 ambulatory
  - UNOS 5/05-6/2011

Canada’s Longest Experience With Extracorporeal Membrane Oxygenation as a Bridge to Lung Transplantation: A Case Report

Extracorporeal membrane oxygenation as a bridge to lung transplantation: a systematic review

Retrospective Life Support in Awake Patients as a Bridge to Lung Transplant

Extracorporeal membrane oxygenation as a bridge to lung transplantation in the United States: An evolving strategy in the management of rapidly advancing pulmonary disease

Ambulatory Extracorporeal Membrane Oxygénation as a Bridge to Lung Transplantation
Walking While Waiting

Prolonged VV ECMO (265 Days) for ARDS Without Technical Complications

Extracorporeal membrane oxygenation as a bridge to pulmonary transplantation

Canadian Experience in Extracorporeal Membrane Oxygenation as a Bridge to Lung Transplantation: Failure Due to Acute Anaphylactic Reaction

- ECMO bridge vs institutional and UNOS
- 31 patients
  - UCSF, 25, U Kentucky, 6
  - ECMO 1/03-6/2012
    - 18 ambulatory
  - UNOS 5/05-6/2011
• Single center (Hannover), retrospective, 32 months intention-to-treat (bridge to LTx)
    • ECMO
    • Mechanical ventilation
Extracorporeal Life Support in “Awake” Patients as a Bridge to Lung Transplant

Prashant N. Mohite¹ | Anton Sabashnikov ¹ | Anna Reed ³ | Diana C. Sacz ³ | Nikhil P. Patel ¹
Anton-Frieder Pape ³ | Fabio Dailobertos ³ | Toufan Bahrami ³ | Mohammed Arfan ³ | Martin Cartl ³
Sundip Kee ³ | Andre R. Simon ³

• Single center (London), retrospective
  – All (249) lung transplants 1/2007-3/2013
    • 226 (90.8%) double LTx
  – ECMO bridge to LTx (7) vs Elective LTx (242)
    • Eat, drink, interact w/ family, intense PT
    • 89/106 “awake” days

Thorac Cardiovasc Surg. 2015 Mar 5

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<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
<th>p-Value</th>
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<tbody>
<tr>
<td>Use of CPB</td>
<td>7 (100%)</td>
<td>187 (77.7%)</td>
<td>0.335</td>
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<tr>
<td>SITx</td>
<td>0</td>
<td>23 (9.7%)</td>
<td>1.000</td>
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<tr>
<td>pH2/PO2 ratio on arrival</td>
<td>287.5 ± 117.3</td>
<td>342.4 ± 108.8</td>
<td>0.193</td>
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<tr>
<td>pH2/PO2 ratio at 24 h</td>
<td>287.5 ± 117.3</td>
<td>342.4 ± 108.8</td>
<td>0.193</td>
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<tr>
<td>pH2/PO2 ratio at 48 h</td>
<td>287.5 ± 117.3</td>
<td>342.4 ± 108.8</td>
<td>0.193</td>
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<tr>
<td>pH2/PO2 ratio at 72 h</td>
<td>287.5 ± 117.3</td>
<td>342.4 ± 108.8</td>
<td>0.193</td>
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<tr>
<td>Ventilation (h)</td>
<td>18 (11.2)</td>
<td>6 (3.2)</td>
<td>0.054</td>
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<tr>
<td>ICU stay (d)</td>
<td>41 (34.5)</td>
<td>34 (25.1)</td>
<td>0.181</td>
</tr>
<tr>
<td>Hospital stay (d)</td>
<td>34 (25.1)</td>
<td>34 (25.1)</td>
<td>0.181</td>
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Rejection grade

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<tr>
<td>A0</td>
<td>5 (83.3%)</td>
<td>170 (74.9%)</td>
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<tr>
<td>A1</td>
<td>1 (16.7%)</td>
<td>22 (9.7%)</td>
<td>0.468</td>
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<tr>
<td>A2</td>
<td>0</td>
<td>28 (12.3%)</td>
<td>1.000</td>
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<tr>
<td>A3</td>
<td>0</td>
<td>7 (3.13%)</td>
<td>1.000</td>
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<tr>
<td>BOS</td>
<td>0</td>
<td>42 (19.9%)</td>
<td>0.599</td>
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Abbreviations: BOS, bronchiolitis obliterans syndrome; CPB, cardiopulmonary bypass; ICU, intensive care unit; SITx, single lung transplant.
Conclusion

• ECMO bridge to lung transplant
  – Comparable to less acute, potentially superior
  • “Salvage transplantation” is possible
  – Requires
    • Early referral to experienced center
    • Multidisciplinary evaluation
    • Good patient selection

Thank you