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Successful Hepatectomy, Anhepatic State, and Liver Transplant on ECMO

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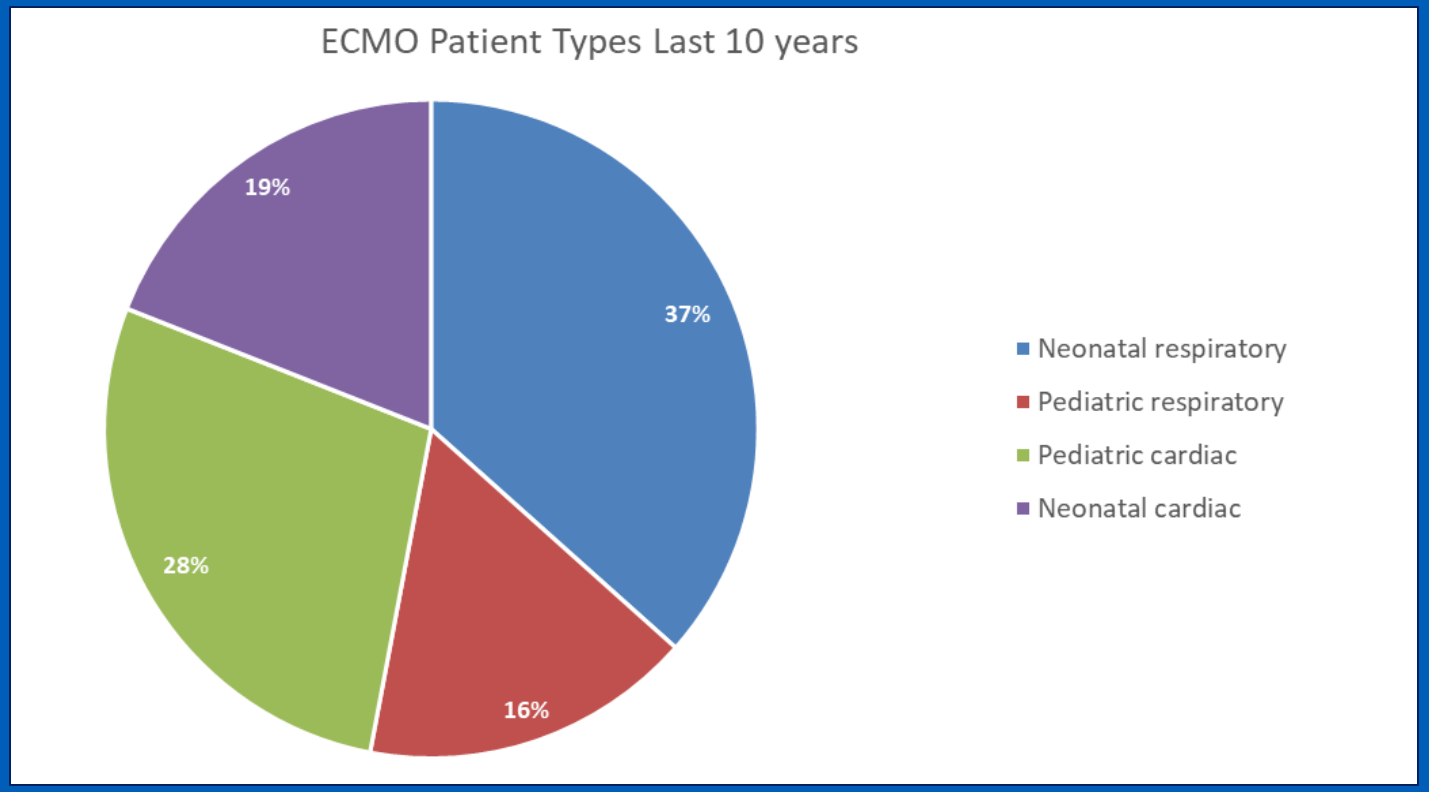
Children's Mercy ECMO Program

Kansas City, MO

Children's Mercy ECMO Program

- 1987 – began in NICU
- 2007 – expanded to PICU/CICU
- ~40 – 50 runs/year
- Total patients ~ 1120
- 500 – 600 patient days



Background

Liver Failure and ECMO

REVIEWS

The Utility of ECMO After Liver Transplantation: Experience at a High-volume Transplant Center and Review of the Literature

Braun, Hillary J. MD[1]; Pulcrano, Marisa E. MD[1]; Weber, Daniel J. MD[1]; Padilla, Benjamin E. MD[1]; Ascher, Nancy L. MD, PhD[1]

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Review article

The applications of ECMO in liver transplant recipients

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Extracorporeal Membrane Oxygenation in Pediatric Liver Transplantation: A Multicenter Linked Database Analysis and Systematic Review of the Literature

Ziogas, Ioannis A. MD[1]; Johnson, Wali R. MD[1]; Matsuoka, Lea K. MD, FACS[1]; Rauf, Muhammad A. MD[1]; Thurm, Cary PhD[2]; Hall, Matt PhD[2]; Bacchetta, Matthew MD, MBA[3,4]; Godown, Justin MD[5]; Alexopoulos, Sophoclis P. MD, FACS[1]

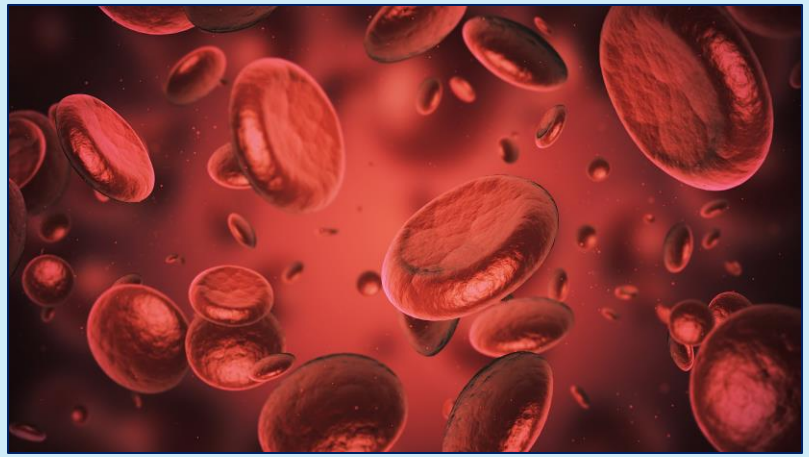
Case Background

- 13-month-old male infant, known motor delays
  - PICU admission for acute liver failure unknown etiology
  - Fulminant cardiopulmonary failure, persistent lactate >20
  - Cannulated to VA ECMO
  - Institutional Hybrid Extracorporeal Liver Support in tandem
    - Continuous renal replacement therapy (CRRT)
    - Single pass albumin dialysis (SPAD)
    - Plasma exchange (PLEX)

Clinical Case Progression

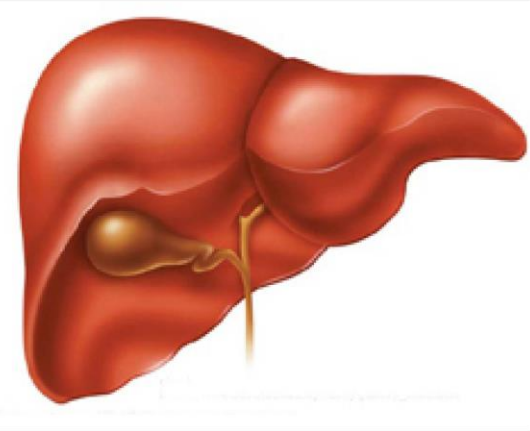
- Persistent inotrope need and lactate>20 despite full VA support
- Developed concern for pneumatosis intestinalis
- With ongoing failure to support patient
  - Listed for transplant 1a
  - Plan ex-lap of bowel to ensure salvageable, if so, proceed with hepatectomy
  - Monitor for clinical improvement anhepatic utilizing SPAD and PLEX

Planning-Hepatectomy



- Communication
  - Repeat multidisciplinary conversations necessary
    - PICU, surgery, nephrology, hepatology, anesthesiology, ECMO
    - ECMO director reviewed expected high-risk points during operation
    - PICU/Hepatology attending present in OR
- Bleeding
  - Followed institution's Congenital Diaphragmatic Hernia on ECMO guideline
    - Increase platelet/fibrinogen goals pre op
    - Stop Bivalirudin, bolus TXA and start TXA drip when OR team arrives
- CRRT Management
  - Continued intraoperatively

Intraoperative Course-Hepatectomy



- Liver necrotic/Bowel intact → Hepatectomy & portocaval shunt
- Behind the (roller, spectrum) pump
  - 2 experienced ECMO team members
  - Aortic & caval clamping:
    - Arterial line pressures increased 5-10 mmHg →No intervention
    - Venous return pressures more negative, like CDH repair
      - "Max inlet" alarms made ~5 mmHg more negative (prevent servo regulation)
      - Pump still servoregulated → flow decreased to 60-80/kg
      - Assessment venous line chatter, surgical field bleeding
      - Blood products (3 U PRBC, 1 each of FFP/platelet/cryo)
- Tolerated hepatectomy and returned to ICU

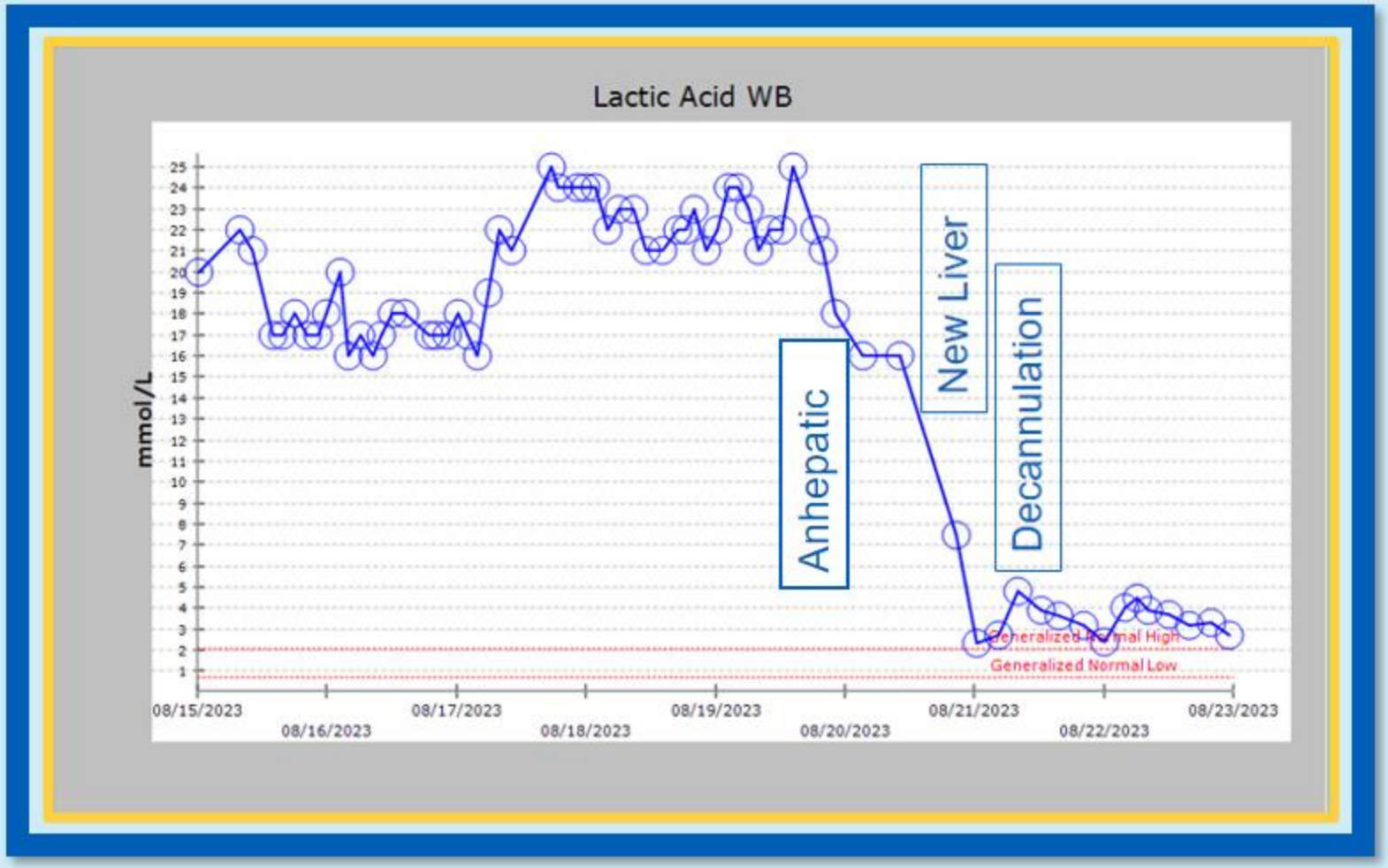
24 Hours Post-Operative

- Acidosis resolved; inotrope need minimized
- Supported with ECMO, CRRT/SPAD and PLEX x2
- Organ accepted
- Plan to proceed to OR for liver transplant
- Planning
  - Communication
  - Utilized CDH bleeding plan except held TXA infusion
  - Ensure infusions to patient patent during caval/aorta clamping

Intraoperative Course-Liver Transplant

- 500 ml EBL
  - Consistent with our institution's avg EBL
- Behind the pump
  - Similar alarm management
  - 4 U PRBC, 3 U Cryo, 2 U FFP, 1 U platelets
  - Blood product administration was higher than avg
- Successful transplant and returned to the ICU

Lactate Trends from Cannulation to Decannulation



8/18: Listed for transplant

8/19: Liver removed

8/20: Liver transplant

8/21: Decannulated from ECMO

Children's Mercy KANSAS CITY

Post-Operative Course

- Weaned quickly from inotropes
- Decannulated 24 hours later with good graft function, 6-day total run
- He was extubated POD#12
- Developed cardiac tamponade on POD#14
  - Cardiac arrest with ECPR
  - Pericardial drain
- Genetic testing returned Pearson Syndrome (mitochondrial)
- With genetic disorder and neurologic injury from ECPR
  - Care re-directed to comfort care

Lessons Learned

- While ultimate outcome undesirable, institution has successful collaboration experience for future patients
- Preoperative planning vital
  - Future complex operative procedures while on ECMO may need specific checklists
- Multidisciplinary awareness required
  - Blood bank, apheresis, CRRT support
- Ongoing institutional discussion surrounding ECPR candidacy

Thank You and Questions

- Miller, Jenna MD, FAAP (X: @JennaMillerKC)
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