8 week old girl with abnormal TFTs

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HPI

- Born via C-section at 38 6/7 weeks
- Had prenatal diagnosis of hypoplastic left heart syndrome
- Underwent Norwood procedure with Blalock-Taussig shunt at DOL 6
  - Unclear if iodine prep used
- Very difficult and complicated post-operative course
- Worsening clinical status with increased pressor requirement at 8 weeks
- TFTs drawn and abnormal
  - Contributing to deterioration?
Post-operative course

- Low cardiac output syndrome
  - ECMO POD #0-7
- Prolonged bleeding from surgical site requiring delayed sternal closure (POD #12)
- Episodes of SVT
  - Amiodarone gtt POD #1-9
- Fluid overload and acute kidney injury
  - Hemofiltration initially, peritoneal dialysis starting POD #10
- IVC thrombosis POD #16-> Heparin gtt
- Rising conjugated bilirubin 2/2 TPN cholestasis
- Multiple episodes of clinical instability requiring increased pressor support POD #16, POD #27, POD #40, POD #48
  - TFTs sent POD #48 and endo consulted
Medications

5% albumin 32 ml q2 prn
Bumex 20 mcg/kg/hr
Ca gluconate 0.1 g q2 prn
Diuril 15.96 mg IV
Epinephrine 0.07 mg/kg/min
Nexium 2 mg IV q24h
Fluconazole 9.6 mg IV q24
Heparin 10.5 U/kg/h
Hydrocortisone 3 mg IV q24
Dilaudid 0.07 mg/kg/hr

Ativan 0.3 mg IV q6
Metolazone 1.2 mg PO qam
Phenobarbital 9.6 mg IV q12h
Zosyn 320 mg IV q12h
TPN
KCl 3 meQ IV q2 prn
Sodium bicarbonate 3.2 meQ q1 prn
Spironolactone 3 mg po q12h
Family and Social History

- Family History
  - No known thyroid disorders

- Social History
  - In hospital since birth
  - Both parents involved
  - 2 older siblings
Physical Exam

- 36.6 °C (97.9 °F) 142 86 % 39 83/29 mmHg
- Constitutional: No acute distress. Ill appearing
- Head: Anterior fontanelle is flat. No cranial deformity or facial anomaly.
- Eyes: Periorbital edema.
- Neck: Unable to palpate thyroid due to body habitus
- Cardiovascular: Regular rhythm, continuous 2/6 murmur, diffuse edema 2+ pulses
- Pulmonary/Chest: Effort normal on ventilator. Inspiratory and expiratory rhonchi. Abdominal: Distended, firm abdominal wall
- Genitourinary: Labial edema, Prepubertal
- Skin: Skin is cool, jaundice, multiple lines and chest tube in place, wound vac over sternum
- Neuro: Sedated
TFTs

- TSH 1.13
- T4 4.4
- Free T4 1.05
- T3 46
- Reverse T3 733
Interpretation

- Euthyroid sick syndrome
- Low total T4
  - Increased clearance with phenobarbital
  - Low TBG (3+ protein in urine, albumin 2.6)
  - Decreased binding of T4 to TBG with heparin
- Low T3
  - ESS
  - Decreased T4 to T3 conversion with hydrocortisone
  - ?Amiodarone effect
Hydrocortisone use

<table>
<thead>
<tr>
<th>Dates</th>
<th>Dosing</th>
<th>Per BSA</th>
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<tbody>
<tr>
<td>12/31</td>
<td>10.4 mg IV x 1</td>
<td>52 mg/m²/d</td>
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<tr>
<td>1/1-1/6</td>
<td>3 mg IV q6</td>
<td>60 mg/m²/d</td>
</tr>
<tr>
<td>1/6-1/10</td>
<td>3 mg IV q12</td>
<td>30 mg/m²/d</td>
</tr>
<tr>
<td>1/11-1/12</td>
<td>3 mg IV q24</td>
<td>15 mg/m²/d</td>
</tr>
<tr>
<td>1/14-1/18</td>
<td>3 mg IV q6</td>
<td>60 mg/m²/d</td>
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<tr>
<td>1/18-1/20</td>
<td>3 mg IV q12</td>
<td>30 mg/m²/d</td>
</tr>
<tr>
<td>1/21-</td>
<td>3 mg IV q24</td>
<td>15 mg/m²/d</td>
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</table>
Continued course

- 1/25/13 Labs prior to hydrocortisone dose
  - Cortisol 74.5
  - ACTH 6.8
  - DHEA-S <15
- Hydrocortisone discontinued after 1/25 dose
- 1/27 cortisol 41.0
- Hydrocortisone restarted 3 mg IV q6 1/28-1/29
- No thyroid replacement recommended
- Approval for T3 drip requested
- Started on LT4 25 mcg IV per cardiology 1/25-27
- Changed to T3 1 mcg q8 1/27 per cardiology
- Patient expired 1/29 am
Ongoing effect of amiodarone?

- Decreased T4 to T3 conversion, increased RT3
  - Inhibits outer ring 5’-monodeiodination of T4
- Failure to escape from Wolff-Chaikoff effect
- Direct toxic effect
- Half life 40 days
- Prolonged hypothyroidism after discontinuation
  - 3-6 mos in one study
  - Shortened by potassium perchlorate administration
    - Lowers intrathyroidal iodide concentration
Congenital Heart Disease Surgery and Thyroid Function

- Correlation with degree of illness
  - Total T3 < 45.5 ng/dL on night of POD 0 have odds ratio 12.00 of PICU stay > 10 d
  - T3 uptake OR 20.00 hospital stay > 20 d, strongly correlated with PICU, hospital, and mechanical ventilation days
Congenital Heart Disease Surgery and T3 Treatment

- Animal studies showed improved ventricular function after bypass
- Initial clinical studies showed trend towards incr CO, decreased pressor requirement postoperatively but no significant diff in clinical outcomes
- 1999 trial of adults undergoing CABG
  - Significant reduction of myocardial ischemia, pacemaker dependence, mechanical assistance
- 2000 trial of T3 infusion starting POD #1 up to POD #12 after pediatric cardiac surgery
  - Greater change in cardiac index, especially in surgeries with longer bypass times
  - Lower mean therapeutic intervention score
- 2001 study of T3 infusion to maintain normal T3 levels after pediatric cardiac surgery
  - No difference in groups as a whole
  - Decreased therapeutic intervention and inotrope score in newborn subgroup
- 2005 trial of 72 hour T3 infusion after Norwood procedure or interrupted aortic arch repair
  - Significant difference in composite clinical score- decreased time to negative fluid balance
  - No difference in cardiac index, inotrope score, PICU length of stay, hospital length of stay
- 2010 trial of infants and children undergoing surgeries with cardiopulmonary bypass
  - No differences in group as a whole
  - Subjects <5 months shorter time to extubation, >5 months longer time to extubation
  - Lower inotrope use in subjects <5 months
Hydrocortisone clearance with hepatic and renal dysfunction

- Cortisol half-life increased from 2 to 3 hours
- Prednisone
  - Hepatic dysfxn no effect
  - Renal dysfxn slows clearance
- Dexamethasone
  - Hepatic dysfxn slows clearance
  - Renal dysfxn speeds clearance
References