Severe Sepsis and Septic Shock in Children

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Women and Children’s Hospital of Buffalo
Pediatric Grand Rounds

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Conflicts of Interest

None

Except:
If we stop all septic shock, we may not have jobs...
Objectives

What Do We Think?
What Do We Know?
Why Are Kids Still Dying?
AND
What Can We Do About It?
What Do We Think?

*It is Everywhere*

*It is Easy to Miss*

*It Is Devastating*
What Do We Think?

*It is everywhere. It is easy to miss. It is devastating.*

- Severe sepsis, shock cost US hospitals billions annually\(^1,2\)
- 1991 ACCP-SCCM Conference\(^3\)
  - Common language, framework to describe, investigate
  - Definitions of ‘SIRS,’ ‘sepsis,’ ‘septic shock’
- Pediatric definitions, framework took another decade, several conferences\(^4\)

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\(^3\) Bone et al, *Chest*, 1992
What Do We Think?
It is everywhere. It is easy to miss. It is devastating.

• Severe sepsis in US PICUs, 2004-2012\textsuperscript{5}:
  – Prevalence on the rise, 6.2% to 7.7%
  – Median 17 days in hospital, 7 days in ICU, $77,000
  – Mortality rate down-trending, still over 10%

• International point prevalence study\textsuperscript{6}:
  – Severe sepsis in 8% of PICU patients
  – 2/3 with MODS at diagnosis
  – Nearly 1 of 5 survivors with moderate/severe disability
  – Mortality rate 25%

\textsuperscript{5}Ruth et al, \textit{PCCM}, 2014
\textsuperscript{6}Weiss et al, \textit{Am J Respir Crit Care Med}, 2015
What Do We Think?

*It is everywhere. It is easy to miss. It is devastating.*

- “Surviving Sepsis” Campaign\(^7\)\(^-\)\(^10\)
  - Established 2002
    - Public and provider awareness
  - Evidence-based guidelines, bundles
    - Lower mortality, down-trending LOS in more compliant centers

- Remain persistent challenges to appreciation, recognition, and management
  - Across disciplines, provider roles

\(^7\) Dellinger et al, *CCM*, 2004
\(^10\) Levy et al, *CCM*, 2015
What Do We Think?

*It is everywhere. It is easy to miss. It is devastating.*

- 1000 physicians from US, Europe interviewed\(^{11}\)
  - 90% agreed sepsis symptoms ‘easily’ misattributed
  - Fewer than 25% of intensivists could define “sepsis”
  - 9 in 10 agreed patients ‘often’ treated too late
- 250 nurses from 500-bed US children’s hospital’s hospital\(^{12}\)
  - Knowledge of, attitudes towards SIRS, sepsis
  - Clinical scenarios
    - SIRS/Sepsis or not?
    - Average score of 61%, more difficulty with earlier stages
  - 20% uncomfortable recognizing SIRS, 10% septic shock

\(^{11}\)Poeze et al, *Critical Care*, 2004
\(^{12}\)Jeffrey, *Pediatric Nursing*, 2014
What Do We Think?

*It is everywhere. It is easy to miss. It is devastating.*

- Studies highlight a major challenge
  - SSC bundles positively impact care
    - Rely on recognition
- Recognition delays impact care, outcomes\(^6\)
  - 67% had multi-organ dysfunction the day “severe sepsis” diagnosed
    - 1/3 with *new/progressive* organ dysfunction within week
- A challenge, not *the* challenge...
  - Giving antibiotics after diagnosis made\(^{13}\)
    - 60 minutes longer on wards than in ER
    - Independently associated with mortality

\(^{13}\) Weiss et al, *CCM*, 2014
What Do We Think?

• *It is everywhere*
  – Prevalence

• *It is easy to miss*
  – Doctors, nurses, early, late

• *It is devastating*
  – Morbidity, mortality, cost

• Progress in understanding, awareness
  – Challenges remain
    • Knowledge gaps, attitudes
    • Providers who see sepsis every day

• A flawed *culture of sepsis*?
What Do We Know?
Women and Children’s Hospital Needs to Get Better

- VPS collects data from PICUs all over the country
  - Morbidity, mortality, even how “sick” patients are
  - Calculate **SMR (Standardized Mortality Ratio)**
- Compare actual mortality rate with “expected”

<table>
<thead>
<tr>
<th>Sepsis with/without Shock</th>
<th>WCHOB</th>
<th>VPS Ref Grp</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30</td>
<td>194</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>

Our mortality rate from sepsis is almost **6 times higher** than what it “should be”
**More than 6 times** that of other children’s hospitals **
New York State Severe Sepsis-Septic Shock Pediatric Data Report
Discharge Dates 4/1/2014-6/30/2015

YTD:
NYS 15.7%, WCHOB 3.9%
Sepsis Protocol/Order Set Use

YTD: NYS 80%, WCHOB 11%
Why are Kids Still Dying?
Why are Kids Still Dying?
Maybe We Should Start At the Beginning...

• “Sepsis syndrome” first described in adults as systemic response to infection
  – Abnormal temperatures, heart and respiratory rates
  – Signs of organ dysfunction
• Not until 2002 that pediatric “syndrome” described
  – Defined “Infection,” “SIRS,” “Sepsis,” “Septic Shock”
  – Described multi-organ dysfunction

SIRS

The “Systemic Inflammatory Response Syndrome”

• Non-specific whole-body inflammation
  – A response to infection, trauma, burns, surgery, etc.

• Diagnosing children requires at least 2 of 4 criteria:
  
  One must be abnormal temperature or white blood count

1. Core temperature over 38.5°C or under 36°C

2. White blood count abnormally high or low; or 10% immature neutrophils

3. Abnormal heart rate
  – 2 standard deviations above normal
  – Bradycardia in infants also qualifies

4. Abnormal respiratory rate
  – 2 standard deviations above normal
  – Need for invasive mechanical ventilation also qualifies

Goldstein, Pediatr Crit Care Med, 2005
Sepsis

• **Infection**
  – *Suspected or proven* illness
    • “Suspected” based on physical exam, labs, imaging
    • Viral, bacterial, fungal, rickettsial
    • “Proven” by a positive culture, tissue stain, PCR

• **Sepsis**
  – The body’s systemic response to an infection

  AKA

  “SIRS” + an infection

Severe Sepsis

• Sepsis with...
  – Cardiovascular dysfunction
    OR
  – Acute respiratory distress syndrome
    OR
  – Dysfunction/failure in 2 or more other organs
    • Liver
      – Tbili > 4, ALT greater than 2x normal
    • Kidneys
      – Creatinine 2x higher than normal or above baseline
    • Hematology
      – Platelets <80 or drop by 50% of their highest value; INR>2
    • Brain
      – Glasgow Coma Scale <11, or decreased mental status

Goldstein, Pediatr Crit Care Med, 2005
Septic Shock
*Sepsis with cardiovascular dysfunction*

After 40ml/kg of IV fluids, a septic patient with:

1. Hypotension (SBP < 5th %ile for age)
   
   OR

2. A need for vasoactive drugs to achieve a normal blood pressure
   
   OR

3. Any 2 or more of the following:
   
   A. Unexplained metabolic acidosis
   
   B. Prolonged capillary refill
   
   C. Minimal urine output (less than 0.5 mL/kg/hr x 4 hours)
   
   D. Lactate more than twice normal
   
   E. Core-to-peripheral temperature discrepancy of more than 3° C

- Can be difficult to detect in children
  
  - Hypotension, unlike in adults, is usually a *late* finding

  **Kids can have clear signs of shock *well before* their blood pressure drops**

Why are Kids Still Dying?

YOU KEEP USING THAT MEME.

I DO NOT THINK IT MEMES WHAT YOU THINK IT MEMES.
Why are Kids Still Dying?
Even When You Know What You’re Looking For...
It’s Not Always Easy to See

• Especially in patients who have:
  – Developmental delay
    • *May not be able to tell you that something is wrong*
  – Complex medical histories
    • *Their ‘abnormal’ may be different than expected*
  – Technology-dependence
    • *Is it an equipment problem or a patient problem?*
  – Many hospital admissions on their record
    • *“It’s just So-and-So being So-and-So...”*
  – Positive viral testing
    • *“They have RSV, they can’t be septic...”*
An Unfortunate Case in Point

19 year-old with global developmental delay, numerous admissions for pneumonia...

– Presents to the ER with respiratory distress
  • *Influenza A positive*

– Admitted to the General Pediatrics floors for dehydration
  • High fevers, escalating heart rate, signs of shock for over 22 hours
  • No fluid resuscitation, no blood gases, no lactates, no LFTs, no antibiotics

  *Unrecognized sepsis from the time of ED triage until PICU consultation*

– On ICU admission:
  • Blood pressure of 50/20
  • Liver, kidney, brain, bone marrow dysfunction

    *Fulminant septic shock*

He never left the ICU
What Can We Do About It?

Try to Understand the Problem

YEP

THAT'S THE ENGINE
What Can We Do About It?
Try to Understand the Problem

The PRESS Study
Pediatric Provider Experience with Sepsis and Septic Shock

Full-court PRESS: From the ER to the ICU

Baseline of *institutional* knowledge of sepsis, septic shock
- Survey physicians, nurses, therapists from ED, wards, ICU
- Provide understanding of educational challenges
  - Specific problem areas for certain provider groups
  - Tailor interventions
  - *Cross-sectional assessment for pediatric hospital not been done*
What Can We Do About It?

Try to Understand the Problem

• PRESS Hypotheses:
  – Majority:
    • Comfortable with recognizing severe sepsis, shock
      – Uncomfortable with recognition of SIRS, sepsis
    • Fail to identify septic patients without fever, bacterial infection
    • Identify shock with hypotension, vasoactive drugs
      – Fail to identify septic shock in normotensive patients
  – Many opportunities for education
    • Didactic sessions, online modules, and simulation
What Can We Do About It?

Try to Understand the Problem

Response Rate: 82%
Completion Rate: 49.5%

Number of Providers

Responded
Completed
What Can We Do About It?

Try to Understand the Problem

Percentage of Respondents

Resident
Fellow
Faculty
RN
RT
NP

PICU
STAT
Floor
ER
PICU

ER
Floor
PICU
STAT

What Can We Do About It?

Gather the Data

Ranking every U.S. children's hospital, how would you predict we rate in ability to recognize and manage sepsis and septic shock?
Please indicate *level of agreement* with the following statements...
What Can We Do About It?

Gather the Data

Our institution excels at SIRS and sepsis recognition

33% of ED RNs
27% of All Residents
What Can We Do About It?

Gather the Data

Our institution excels at SIRS and sepsis treatment

20% of ED RNs

Strongly Disagree | Somewhat Disagree | Neutral | Somewhat Agree | Strongly Agree
What Can We Do About It?

Gather the Data

I feel comfortable **alerting other providers** that a patient may have **SIRS or sepsis**

![Bar chart showing survey results](chart.png)

- **11% of ICU RNs**
- **24% of RTs**

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Somewhat Disagree</th>
<th>Neutral</th>
<th>Somewhat Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>0%</td>
<td>10%</td>
<td></td>
<td>20%</td>
<td>50%</td>
</tr>
<tr>
<td>No EM Residents</td>
<td>11% of ICU RNs</td>
<td></td>
<td>24% of RTs</td>
<td></td>
</tr>
</tbody>
</table>
What Do We Do About It?

*Gather the Data*

I feel comfortable **alerting other providers** that a patient may have **severe sepsis/shock**

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<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Somewhat Disagree</th>
<th>Neutral</th>
<th>Somewhat Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>No ED RNs</td>
<td>6%</td>
<td>5%</td>
<td>4%</td>
<td>19%</td>
<td></td>
</tr>
<tr>
<td>No EM Residents</td>
<td>6%</td>
<td>5%</td>
<td>4%</td>
<td>19%</td>
<td></td>
</tr>
<tr>
<td>6% Floor RNs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5% ICU RNs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4% Peds Residents</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>19% RTs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
I feel comfortable diagnosing a patient with **septic shock** if they have a normal blood pressure.

---

**What Can We Do About It?**

*Gather the Data*

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Somewhat Disagree</th>
<th>Neutral</th>
<th>Somewhat Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>40% ED RNs</td>
<td>14% ICU RNs</td>
<td>26% Peds Residents</td>
<td>43% RTs</td>
<td></td>
</tr>
</tbody>
</table>

---
I *Have Hesitated* to Notify Others About a Patient with Sepsis or Shock...
What Can We Do About It?

Gather the Data

“Concerns about pushback or negative response”

- Never: 47% ICU RNs, 41% RTs
- Rarely: 42% Peds Residents
- Sometimes: 41% RTs
- Frequently: 20%
- Very Frequently: 0%
What Can We Do About It?

Gather the Data

“Making a ‘big deal’ if I was actually mistaken”

- 42% ICU RNs
- 76% Peds Residents
- 34% RTs
- No ED or Floor RNs

Never
- Rarely
- Sometimes
- Frequently
- Very Frequently
What Can We Do About It?

Gather the Data

“Prior discouragement from a colleague, supervisor”

No ED or Floor RNs
No EM Residents

38% ICU RNs
31% Peds Residents
24% RTs

Never
Rarely
Sometimes
Frequently
Very Frequently
QUESTION:
QUESTION:
SEPTIC OR NOT?
14 year old with influenza diagnosed on viral screen
All bacterial cultures negative, no antibiotics, admitted to floors for ‘dehydration’
- T: 39.0°C orally
- HR: 165
- RR: 18
- BP: 110/65  CR: 2 seconds   Pulses: 2+
- WBC: 7.4, with 70% lymphocytes, 20% neutrophils

\[ \text{Sepsis} = \text{SIRS} + \text{Infection} \]

**Septic or Not?**

- Yes
- No

Correct:
- 54% Residents
- 25% RNs
- 21% RTs
What Can We Do About It?

Gather the Data

Percentage of Correct Responses

Question

1 2 3 4 5 6 7

0% 25% 50% 75% 100%
What Can We Do About It?

Gather the Data

Formal education should be available, mandatory for WCHOB providers
NUMBERS!
What Does the Data Tell Us?

• Our Culture of Sepsis:
  Most feel we are about average, better at treating than recognizing
  ≈1 of every 10 still not comfortable with sepsis, shock
  ≈1 of every 5 hesitate, at least some of the time, to call a child ‘septic’

• The Good News...
  – We need and want to get better
Our Culture of Sepsis

we are what we believe we are.

- C. S. Lewis
What Can We Do About It?

DON'T KEEP CALM
AND
STAND UP
AND FIGHT!
What Can We Do About It?
Plan, Do, Study, Act

WCHOB Sepsis Initiative

**Phase I:**
- Sepsis QA Committee
- Streamline protocol, order set
- Data collection [*PRESS*]

**Phase II:**
- Education, education, education
- Sepsis Drills
- Protocol dispersion, website

**Phase III:**
- Evaluation
- Modification
- Community outreach
What Can We Do About It?
See something, say something. Activate the sepsis protocol!

The First 15 minutes...

Women and Children’s Hospital of Buffalo
Pediatric Severe Sepsis Protocol

<table>
<thead>
<tr>
<th>Minutes</th>
<th>Goals for time 0-15 min (check off the box as completed):</th>
<th>Performed by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-15</td>
<td>Cardiac monitor attached</td>
<td>ALL</td>
</tr>
<tr>
<td></td>
<td>Supplemental oxygen started via facemask at 100%</td>
<td>ALL</td>
</tr>
<tr>
<td></td>
<td>Start sepsis order set</td>
<td>RN, RRT</td>
</tr>
<tr>
<td></td>
<td>Peripheral intravenous (PIV) line started and draw labs</td>
<td>RRT, MD, RN</td>
</tr>
<tr>
<td></td>
<td>Place Intraosseous (IO) line if no PIV after 3 attempts or 10 minutes</td>
<td>MD</td>
</tr>
<tr>
<td></td>
<td>STAT labs: blood culture, CBC with differential, VBG, glucose, electrolytes, lactate, iStat</td>
<td>RN, RRT</td>
</tr>
<tr>
<td></td>
<td>Administer 1st 20cc/kg NS or LR IV/IO bolus via push/pull over 10 min</td>
<td>RN</td>
</tr>
</tbody>
</table>

Recheck vitals and perfusion

STOP

If still abnormal or patient ill appearing, continue protocol
If vitals normalized and patient well appearing, discontinue protocol.
What Can We Do About It?
See something, say something. Activate the sepsis protocol!

The Next 15 minutes...

<table>
<thead>
<tr>
<th>Time</th>
<th>Goals for time 15-30 minutes:</th>
<th>Responsible Party</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 to 30</td>
<td>Administer 2nd 20cc/kg NS or LR IV/IO bolus via push/pull over 10 min</td>
<td>RN, RRT</td>
</tr>
<tr>
<td></td>
<td>Administer antibiotics</td>
<td>RN, MD</td>
</tr>
<tr>
<td></td>
<td>Review labs ➔ Correct hypoglycemia and/or hypocalcemia</td>
<td>MD</td>
</tr>
<tr>
<td></td>
<td>Consult PICU</td>
<td>MD, RRT</td>
</tr>
<tr>
<td></td>
<td>Place second PIV: send LFT’s, DIC panel, Chem, Mg, Type and screen</td>
<td>RN, RRT</td>
</tr>
<tr>
<td></td>
<td>Designate staff member to advocate for, liaison with, and support patient’s family</td>
<td>ALL</td>
</tr>
</tbody>
</table>

Stop
Recheck vitals and perfusion

- If still abnormal or patient ill appearing, continue protocol
- If vitals normalized and patient well appearing, discontinue protocol.
<table>
<thead>
<tr>
<th>Age</th>
<th>37.8</th>
<th>38.3</th>
<th>38.9</th>
<th>39.4</th>
<th>40</th>
<th>40.6</th>
<th>41.1</th>
<th>41.7</th>
<th>SBP 5%ILE FOR AGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2 years *</td>
<td>&gt;180</td>
<td>&gt;185</td>
<td>&gt;190</td>
<td>&gt;195</td>
<td>&gt;200</td>
<td>&gt;205</td>
<td>&gt;210</td>
<td>&gt;215</td>
<td>&lt;30 days: 60</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1mo- 2y: 70</td>
</tr>
<tr>
<td>2 - 5 years</td>
<td>&gt;140</td>
<td>145</td>
<td>150</td>
<td>155</td>
<td>160</td>
<td>165</td>
<td>170</td>
<td>175</td>
<td>75</td>
</tr>
<tr>
<td>6 - 12 years</td>
<td>&gt;130</td>
<td>135</td>
<td>140</td>
<td>145</td>
<td>150</td>
<td>155</td>
<td>160</td>
<td>165</td>
<td>85</td>
</tr>
<tr>
<td>13 - 18 years</td>
<td>&gt;110</td>
<td>115</td>
<td>120</td>
<td>125</td>
<td>130</td>
<td>135</td>
<td>140</td>
<td>145</td>
<td>90</td>
</tr>
</tbody>
</table>

*Also qualify if bradycardic: < 1 month: HR <100 1 - 23 months: HR < 90
### HYPOCALCEMIA

| Calcium gluconate | IV: 100 mg/kg of Calcium gluconate (max dose 3000 mg) | may be given peripherally |

### HYPOGLYCEMIA

<table>
<thead>
<tr>
<th>Dextrose</th>
<th>D5 NS 5 mL/kg, OR</th>
<th>may be given peripherally</th>
</tr>
</thead>
<tbody>
<tr>
<td>IO: 50% Dextrose 1-2 mL/kg</td>
<td></td>
<td>give via central line or IO</td>
</tr>
</tbody>
</table>

### ANTIBIOTICS

<table>
<thead>
<tr>
<th>Standard Risk Patient</th>
<th>Ceftriaxone 50 mg/kg/dose IV (max dose 2000 mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ Vancomycin 15 mg/kg/dose IV (max dose 2000 mg)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Immune Compromised</th>
<th>Piperacillin/Tazobactam 100 mg/kg. Piperacillin component (max dose 4.5 grams = 4000 mg Piperacillin and 500 mg Tazobactam)</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ Vancomycin 15 mg/kg/dose IV (max dose 2000 mg)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sickle Cell</th>
<th>Ceftriaxone 50 mg/kg/dose IV (max dose 2000 mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ Vancomycin 15 mg/kg/dose IV (max dose 2000 mg)</td>
<td></td>
</tr>
<tr>
<td>+ Azithromycin 10 mg/kg/dose IV (max 500 mg) if pneumonia suspected</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intra-abdominal Source</th>
<th>Piperacillin/Tazobactam 100 mg/kg/dose Piperacillin component (max dose 4.5 grams = 4000 mg Piperacillin and 500 mg Tazobactam)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR</td>
<td>Ampicillin IV 50 mg/kg/dose IV + Gentamicin 2.5 mg/kg/dose IV</td>
</tr>
<tr>
<td>OR</td>
<td>Ampicillin IV 50 mg/kg/dose IV + Cefotaxime 50 mg/kg/dose IV</td>
</tr>
<tr>
<td>Unable to tolerate cephalosporins</td>
<td>Meropenem 20 mg/kg/dose (max dose 1gm)</td>
</tr>
<tr>
<td>History of anaphylaxis</td>
<td>Hydroracitin 10 mg/kg IV (max dose 500 mg)</td>
</tr>
</tbody>
</table>

### VASOPRESSORS / INOTROPES

<table>
<thead>
<tr>
<th>Cold Shock</th>
<th>Dopamine 5 - 20 mcg/kg/min</th>
<th>Cold Shock, central access (CVL or IO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epinephrine 0.05 - 0.3 mcg/kg/min</td>
<td>Cold Shock, no IO/CVL</td>
<td></td>
</tr>
<tr>
<td>Milrinone 0.25 - 0.75 mcg/kg/min</td>
<td>Cold shock despite on dopa +/- Epi; normal BP</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Warm Shock</th>
<th>Doephrinephrine 0.05 - 0.3 mcg/kg/min</th>
<th>Warm Shock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vasopressin 0.5 - 2 milliliters/kg/min</td>
<td>Warm Shock resistant to catecholamines</td>
<td></td>
</tr>
</tbody>
</table>

### Fluid and catecholamine resistant shock

| Hydrocortisone 2 mg/kg/dose (max dose 100 mg) | may be given peripherally |
Recognize decreased mental status and perfusion. Begin high flow O₂. Establish IV/IO access.

**Initial resuscitation:** Push boluses of 20 cc/kg isotonic saline or colloid up to & over 60 cc/kg until perfusion improves or unless rales or hepatomegaly develop. Correct hypoglycemia & hypocalcemia. Begin antibiotics.

**shock not reversed?**

- If 2nd PIV start inotrope.

- **Fluid refractory shock:** Begin inotrope IV/IO. use atropine/ketamine IV/IO/IM to obtain central access & airway if needed. **Reverse cold shock** by titrating central dopamine or, if resistant, titrate central epinephrine. **Reverse warm shock** by titrating central norepinephrine.

**shock not reversed?**

- dose range: dopamine up to 10 mcg/kg/min, epinephrine 0.05 to 0.3 mcg/kg/min.

- **Catecholamine resistant shock:** Begin hydrocortisone if at risk for absolute adrenal insufficiency
What Can We Do About It?

• We have a shared responsibility
• No one provider is perfect...but a team can be
  – Bundle, protocol compliance
  – Fluids, antibiotics
  – Recognize challenges, limitations
  – Identify areas of improvement
  – Need help, ask for help
  – Learn from our past
And Now Here’s Something We Hope You’ll Really Like....