Sepsis

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Grand Rounds 2/5/13
Why?

- It is common, lethal and expensive.
- Of the 750,000+ severe sepsis cases each year in the US, an estimated 215,000 (28.6%) pts die.
- Mortality associated with severe sepsis has been reported as high as 30-50%
- The incidence is likely to increase even more
  - Aging population
  - Medical and technological advances
  - Widespread use of antibiotics
- It is costly
  - Accounts for ~ 40% of all ICU expenditures, totaling $16.7B in the US
  - Average LOS/cost per case: 19.6 days and $22,100
- With early recognition and aggressive treatment = better pt outcomes
• **SIRS Criteria:**
  – Temp > 38 C or < 36 C
  – Heart Rate > 90
  – Respiratory Rate > 20 or PaCO2 < 32
  – WBC > 12K, < 4K or > 10% Bands

• **Sepsis** = 2/4 SIRS + infection

• **Severe sepsis** = sepsis-induced tissue hypoperfusion (inc lactate) / organ dysfunction (AMS, lungs, kidney, etc)

• **Septic shock** = sepsis-induced hypotension (SBP < 90, MAP < 70, SBP dec > 40 from baseline) persisting despite adequate fluid resuscitation
What is Early Goal Directed Therapy?

• **EGDT is a comprehensive strategy for identifying and treating septic pts that include:**
  
  **Identification of high risk pts**
  
  – Mobilization of resources for intervention
  
  – Performance of a consensus-derived protocol to reverse early hemodynamic disturbances

• **The core objectives of EGDT in sepsis are to:**

  **Detect and treat occult global tissue hypoxia early** before organ damage becomes irreversible
  
  – Achieve a systemic oxygen delivery and demand balance
Landmark Literature (NEJM 2001)

The New England Journal of Medicine

EARLY GOAL-DIRECTED THERAPY IN THE TREATMENT OF SEVERE SEPSIS AND SEPTIC SHOCK

EMANUEL RIVERS, M.D., M.P.H., BRYANT NOLVEN, M.D., SUZANNE HAVSTAD, M.A., JULIE RESSLER, B.S., ALEXANDRIA MUZZIN, B.S., BERNARD KNOBRICH, M.D., EDWARD PETERSON, PH.D., AND MICHAEL TOMLANOVICH, M.D., FOR THE EARLY GOAL-DIRECTED THERAPY COLLABORATIVE GROUP
Results

• In hospital Mortality
  – Standard therapy 46.5 % → EGDT 30.5 %

• Mean LOS in days (for pts who survived to hospital discharge)
  – Standard therapy 18.4 days → EGDT 14.6 days
The Society of Critical Care Medicine, the European Society of Intensive Care Medicine and the International Sepsis Forum joined forces to develop a three-phase Surviving Sepsis Campaign.

- **First phase**: six-point action plan to reduce global mortality from severe sepsis by 25% by 2009.

- **Second phase**: focused on creating guidelines for sepsis management.
  - Crit Care Med 2004; 32:858-873
  - Update → Crit Care Med 2008; 36(1):296-327
  - Update → February 2013 issues of Critical Care Medicine and Intensive Care Medicine

- **Phase three**: translating the guidelines into clinical practice.
**Initial resuscitation (first 6 hours)**

- Begin resuscitation immediately in patients with hypotension or elevated serum lactate \( \geq 4 \text{ mmol/L} \); do not delay pending ICU admission. (1C)

- **Resuscitation goals:** (2C)
  - Central venous pressure (CVP) 8–12 mm Hg*
  - Mean arterial pressure \( \geq 65 \) mm Hg
  - Urine output \( \geq 0.5 \) mL.kg\(^{-1}\).hr\(^{-1}\)
  - Central venous (superior vena cava) oxygen saturation \( \geq 70\% \), or mixed venous \( \geq 65\% \)

- If venous \( \text{O}_2 \) saturation target not achieved: (2C)
  - consider further fluid
  - transfuse packed red blood cells if required to hematocrit of \( \geq 30\% \) and/or
  - dobutamine infusion max 20 \( \mu \)g.kg\(^{-1}\).min\(^{-1}\)

* A higher target CVP of 12–15 mmHg is recommended in the presence of mechanical ventilation or pre-existing decreased ventricular compliance.
Controversy?

- Which part makes a difference?
- Does everyone need an invasive approach?
Which part makes a difference?

- **Early recognition of sepsis** → more aggressive txt / EGDT / better outcomes
  - The research supports it

- **Aggressive IVFs**
  - In Rivers original study, average total IVFs within first 6 hours:
  - Standard therapy: 3.5L → EGDT: 5L

- **Early antibiotics**
  - *Duration of hypotension before initiation of effective antimicrobial therapy is the critical determinant of survival in human septic shock.*
  - Each hour of delay in antimicrobial administration over the first 6 hrs was associated with an average decrease in survival of 7.6%

- RBC transfusion, steroids, glycemic control, xigris ??
Is it necessarily Rivers/SSC guidelines that make a difference?

- **The effect of a quantitative resuscitation strategy on mortality in patients with sepsis: a meta-analysis**

- Applying an early quantitative resuscitation strategy (EGDT) to patients with sepsis imparts a significant reduction in mortality.
- They observed distinct variations in the goals / end points targeted among the studies.

- = pts did better with just using **goals** (not necessarily Rivers/SSC guidelines/goals) and **early treatment**
Does everyone need an invasive approach?

**Hemodynamic / Perfusion Goals**

- Fluid resuscitation
  - CVP
  - IVC US

- MAP > 65

- Tissue oxygenation
  - ScvO2
  - Lactate
Fluid resuscitation: CVP vs IVC US

• **CVP**
  - Invasive → can lead to complications, more time consuming & is typically started later (BP not responding to IVFs, increasing lactate).
  - Not reliable as 1 measurement → better to follow trends.
  - Made up numbers (based on EGDT recs)
    - How well does a CVP 8-12 translate to evidence that the tank is full? … the evidence is WEAK at best.

• **Bottom line:**
  - Even reaching CVP thresholds does not guarantee adequate fluid loading.
  - While a very low CVP indicates an under-resuscitated pt, the opposite is not true.

• **IVC US**
  - Non-invasive
  - Can be used during initial evaluation / earlier in the course of resuscitation.
  - Can also assess global heart function and r/o pericardial effusion.
Emergency Department Bedside Ultrasonographic Measurement of the Caval Index for Noninvasive Determination of Low Central Venous Pressure


- Bedside ultrasonographic measurement of caval index (IVC collapsibility) > 50% is strongly associated with a low CVP (< 8 mm Hg).

- It could be a useful noninvasive tool in determining a patient's volume status/need for aggressive fluid replacement well before invasive monitoring can be established.

- **Dr Scott Weingart - EMCrit Blog**
  - Greater New York Hospital Association - STOP Sepsis Collaborative

- “50% has been validated more often, but requires caliper measurement. 30% is essentially what you can eyeball. I would prefer people err on the side of too much fluid early in the resus”
Tissue oxygenation

• Lactate
• Why use this?
• When to use it?
  • Suspect sepsis
  • If you are drawing/sending blood cultures (Dec 2012 - added to panel)
  • If you are admitting a pt who you think might be infected
    • Dx: UTI, PNA, fever, cellulitis, etc.
    • Currently working adding sepsis screening question to admit orders
Clinical manifestations of disordered microcirculatory perfusion in severe sepsis.

Stephen Trzeciak and Emanuel P Rivers; Critical Care Aug 2005
Lactate

• Nonspecific for anaerobic metabolism
• Impaired microcirculatory flow is one of the many possible mechanisms for elevated lactate in severe sepsis
• Consensus recommendations advocate using lactate measurements to help identify normotensive pts who are in “cryptic shock” and in need of aggressive resuscitation.

• **Cryptic Septic Shock: A Sub-analysis of Early, Goal-Directed Therapy**
  – Chest 2003

• Subgroup analysis of Rivers original study:
  • MAP > 100 + lactate > 4 had mortality rate 60.9%
  • MAP < 70 had mortality rate 42%
The Surviving Sepsis Campaign: results of an international guideline-based performance improvement program targeting severe sepsis

- Hypotension and lactate > 4: 46.1%
- Hypotension alone: 36.7%
- Lactate > 4 alone: 30%

Prognostic value of incremental lactate elevations in emergency department patients with suspected infection.


- Mortality rose continuously across a continuum of incremental lactate elevations
- 6% in pts with lactate levels <1.0 mmol/L
- 39% in pts with levels of 19 to 20 mmol/L.
ScvO2 -or- SmvO2

- Normal ScvO2 > 70%
- Normal SmvO2 > 65%

If low = tissue not seeing enough hgb (so it is taking more O2)
1. Not enough hgb to come around (relative anemia)
2. Hgb not coming around fast enough (cardiac output inadequate)
Lactate Clearance vs Central Venous Oxygen Saturation as Goals of Early Sepsis Therapy

- *JAMA.* Feb 2010; 303(8):739-746

To test the hypothesis of noninferiority between lactate clearance and central venous oxygen saturation (ScvO2) as goals of early sepsis resuscitation

- **ScvO2 group:** resuscitated to normalize CVP, MAP & ScvO2 ≥ 70%
- **Lactate clearance group:** resuscitated to normalize CVP, MAP & lactate clearance of at least 10%.

Lactate clearance was not inferior to ScvO2 and did not result in significantly different in-hospital mortality.

Lactate clearance: 17% vs ScvO2: 23%
Metabolic goals

• **Adrenal replacement txt**: Hydrocortisone 100 mg IV q8
  – Vasopressor-refractory hypotension, suspect adrenal insufficiency (if pts endocrine / steroid history warrants it, got etomidate ?)
  – ACTH stim test, cortisol levels no longer recommended

• **Glycemic control**
  – Controversial history but most recent studies / recommendations (tight control → no change in mortality, increased incidence of mod-severe hypoglycemia)
  – Insulin therapy when 2 consecutive glucose levels > 180 with a goal ≤ 180
    • NICE-SUGAR study

• **Activated Protein C (xigris)**
  – On October 25, 2011, Eli Lilly announced a voluntary-recall of Xigris following the results of the PROWESS-SHOCK trial, which demonstrated no survival benefit when using the drug when compared to placebo.
Blood controversy

• Original Rivers study and SSC recs were to transfuse pRBCs to hgb ≥ 10
  – Increase the O2 carrying capacity
• Multiple studies: has not shown a mortality benefit
• + potential transfusion risks/reactions
• Now more conservative approach
  – If Hgb < 7: transfuse 1 unit pRBC
  – If Hgb 7-10: consider transfusion especially in elderly pts or with CAD
Airway/O2

• Maximize O2 delivery with supplemental O2 to keep O2 sats > 90%

• Indications for Intubation
  – Airway protection
  – Oxygenation / Ventilation
  – Expected clinical course

• 75% of pts with sepsis (severe/shock) require mechanical ventilation
  – Increased work of breathing d/t hypoxia + compensation for metabolic/lactic acidosis

• ARDSNET
  – Compared TV: 12 cc/kg/IBW vs 6 cc/kg/IBW
    with goal plateau pressure < 30 cm H2O
  – 22% dec mortality, inc in ventilator-free / organ failure-free days

• Maintain HOB 30-45 … decrease risk of aspiration PNA
Special circumstance

Pt with severe metabolic acidosis and needing mechanical ventilation

- Compensation occurs via hyperventilation
- When these patients require intubation and mechanical ventilation, be sure to provide the same level of respiratory compensation when setting the ventilator.
- Failing to provide a rate sufficient to compensate for the pre-intubation acidosis leads to a rapid drop in pH, bradycardia and eventually asystole.

- Observe their MV (minute ventilation) just prior to paralysis/intub = this should be your vent setting RR.
- In general, rates can be increased to about 30 breaths per minute, after which auto-PEEP becomes problematic.
- If you anticipate a difficult intub/delay, consider giving IV Bicarb to maintain pH during RSI
**Etomidate controversy**
- known to cause transient adrenal suppression
- the clinical significance of this drug effect continues to be debated
  - No compelling evidence to eliminate RSI etomidate in sepsis
    - 0.3 mg/kg IV
  - Consider **Ketamine** 1-1.5 mg/kg IV
    - Stimulates SNS → augments HR/BP
    - Bronchodilator

**Analgesia + Sedation**
- A protocol of no sedation for critically ill patients receiving mechanical ventilation: a randomised trial
  - The Lancet, Vol 375, Pages 475 - 480, February 2010
  - Morphine prn vs Propofol/Versed + Morphine prn →
  - Analgesia only group less days on vent & shorter ICU stays, but increased agitated delirium
- Refer to LUMC protocols
  - Fentanyl (1 mcg/kg/hr) + Versed (1 mg/hr) drips – titrated to effect
Cultural change

- We have Stroke / STEMI / Trauma protocols/teams and Sepsis should be viewed just as important

- To be successful we need a multidisciplinary team approach + acceptance within
Loyola University Medical Center

Early Recognition of Sepsis

Two or more SIRS Criteria:
1. Temp > 38°C or < 36°C
2. Heart Rate > 90
3. Respiratory Rate > 20 or PaCO2 < 32
4. WBC > 12K, <4K or >10% Bands

Suspected Infection?

YES ➔

Check Lactate

Obtain Appropriate Cultures

MAP < 65 after IVF bolus?
(20-30 cc/kg over 30 min)

NO ➔

Lactate ≥ 4 mmol/L or
≥ 1 Organ Dysfunction

NO ➔

Severe Sepsis

YES ➔

Antibiotics and Re-Assess

Sepsis

NO ➔

Septic Shock

If goals of care are curative, proceed to
EARLY GOAL DIRECTED THERAPY (EGDT)
SEPSIS GUIDELINES (Non-Invasive / Invasive)
and consider notification of the ICU

Exclusion: Age <18 yrs, STEMI, Acute Pulmonary Edema, Trauma.
Two or more SIRS Criteria:
1. Temp > 38°C or < 36°C
2. Heart Rate > 90
3. Respiratory Rate > 20 or PaCO2 < 32
4. WBC > 12K, < 4K or > 10% Bands

Suspected Infection?

Re-Assess

Check Lactate

Obtain Appropriate Cultures

Re-Assess
MAP < 65 after IVF bolus? (20-30 cc/kg over 30 min)

- **NO**: Lactate ≥ 4 mmol/L or ≥1 Organ Dysfunction
  - **NO**: Sepsis
  - **YES**: Antibiotics and Re-Assess
- **YES**: Septic Shock
  - If goals of care are curative, proceed to
    **EARLY GOAL DIRECTED THERAPY (EGDT)**
    **SEPSIS GUIDELINES** (Non-Invasive / Invasive)
    and consider notification of the ICU

- **YES**: Severe Sepsis
LUMC Non-Invasive Sepsis Guidelines

- Initiate Sepsis Order Set
  - Think of Source Control and send cultures
  - Initiate Broad Spectrum Antibiotics within 1 hour
  - Supplemental O₂: If hypoxemia despite NRIs, Intubation and switch to Invasive Guidelines
  - Establish 2 large bore IVs and give IVF Bolus: Isotonic crystalloid 20-30 ml/kg bolus over 30 minutes

**Fluid Resuscitation**

- Fluid loaded

**MAP**

- MAP ≥ 65

**Repeat Lactate**

- ≥ 10% Lactate Clearance

- Lactate Increasing or < 10% Clearance

- Dynamic IVC Ultrasound (best):
  - Keep giving 500-1000 ml boluses of isotonic crystalloid q30 minutes until there is <30% change in IVC size with inspiration

- Empiric Fluid Loading (OK):
  - Most pts will require ~6 liters of fluid during initial resuscitation (first 6 hours)

- Start Vasopressors and switch to Invasive guidelines

**Consider Transfusion**

- If Hgb < 7: transfuse 1 unit pRBC
- If Hgb 7-10: consider transfusion especially in elderly pts or with CAD

**Colloids (especially if heart appears hypodynamic on echo)**

- If Ca low, replete that first (500-1000 mg)
- If Ca normal, then administer Dobutamine (2.5-20 mcg/kg/min)

**Additional fluids:** If had empiric IVF loading, give an additional liter of crystalloid

**Disposition**

- Admit to monitored bed
- Periodically recheck for MAP=65, good mental status, good UOP
- Trend lactate q2-4 hours (if rises again, restart guidelines)

**Goals Achieved**

- Yes

- No

- Continue with above or Switch to Invasive Guidelines
- Initiate Sepsis Order Set
- Think of Source Control and send cultures
- Initiate Broad Spectrum Antibiotics within 1 hour
- Supplemental O2. If hypoxemia despite NRB, Intubation and switch to Invasive Guidelines
- Establish 2 large bore IVs and give IVF Bolus: Isotonic crystalloid 20-30 ml/kg bolus over 30 minutes

Fluid Resuscitation

Dynamic IVC Ultrasound (best):
Keep giving 500-1000 ml boluses of isotonic crystalloid q30 minutes until there is <30% change in IVC size with inspiration

or

Empiric Fluid Loading (OK):
Most pts will require ~ 6 liters of fluid during initial resuscitation (first 6 hours)
Fluid loaded

MAP

MAP ≥ 65

MAP < 65

Lactate increasing or < 10% Clearance

MAP ≥ 65

Lactate increasing or < 10% Clearance

Consider Transfusion
If Hgb < 7: transfuse 1 unit pRBC
If Hgb 7-10: consider transfusion especially in elderly pts or with CAD

Inotropes (especially if heart appears hypodynamic on echo)
If Ca low, replete that first (500-1000 mg)
If Ca normal, then administer Dobutamine (2.5-20 mcg/kg/min)

Additional fluids: If had empiric IVF loading, give an additional liter of crystalloid

(First 6 hours)
≥ 10% Lactate Clearance

Continue with above or Switch to Invasive Guidelines

Goals Achieved

No

Yes

Disposition
- Admit to monitored bed
- Periodically recheck for MAP > 65, good mental status, good UOP
- Trend lactate q2-4 hours (if rises again, restart guidelines)
LUMC Invasive Sepsis Guidelines

- Initiate Sepsis Order Set
- Think of Source Control and send cultures
- Initiate Broad Spectrum Antibiotics within 1 hour
- Supplemental O2. If hypoxemia despite NRB, intubation (see bottom right)
- IVF Bolus: Isotonic crystalloid 20-30 ml/kg bolus over 30 minutes
- Place full-sterile central line (U or subclavian)

**Fluid Resuscitation**

- Fluid loaded
- MAP

**Dynamic IVC Ultrasound (best):**
Administer 500-1000 ml boluses of isotonic crystalloid q30 minutes until there is <30% change in IVC size with inspiration

**CVP (OK):**
Administer 500-1000 ml boluses of isotonic crystalloid q30 minutes until CVP > 10 mmHg in non-intubated pts and > 14 mmHg in intubated pts

**Vasopressors:**
1. Titrate Norepinephrine (0.01 mcg/kg/minute)
2. Place sterile A-line
3. If MAP < 65 after Norepi between 0.5 - 1 mcg/kg/minute: add Hydrocortisone 100 mg IV q4 h & Vasopressin 0.04 units/min

**MAP ≥ 65**

- Repeat Lactate + SvO2

**Goals Achieved**

- ≥ 10% Lactate Clearance AND SvO2 < 65%

- Continue with above lactates & SvO2 q1 hr until these 2 goals are met

**Yes**

- Disposition
  - Admission (ICU vs monitored bed)
  - Periodically check for MAP > 65, good mental status, good UOP
  - Trend lactate q2-4 hours (if rises again, restart guidelines)

- Intubate to decrease pulmonary metabolic load (see below)

**No**

- Consider Transfusion
  - If Hgb < 7: transfuse 1 unit RBC
  - If Hgb 7-10: consider transfusion especially in elderly pts or with CAD

- Additional fluids: If you were using CVP to determine fluid status, give an additional liter of crystalloid

- Inotropes (especially if heart appears hypodynamic on echo)
  - If Ca low, replete that first (500-1000 mg)
  - If Ca normal, then administer Dobutamine (2.5-20 mcg/kg/min)

**Lung Protective Mechanical Ventilation**
- Ketamine is the preferred induction agent (1-1.5 mg/kg IV); Etomidate is acceptable (0.3 mg/kg IV)
- Low TV (consider 6 cc/kg IBW) with a goal Plateau Pressure < 30
- Analgesia + Sedation (see LUMC protocols)
- Raise HOB to 30-45°
- Initiate Sepsis Order Set
- Think of Source Control and send cultures
- Initiate Broad Spectrum Antibiotics within 1 hour
- Supplemental O2. If hypoxemia despite NRB, Intubation (see bottom right)
- IVF Bolus: Isotonic crystalloid 20-30 ml/kg bolus over 30 minutes
- Place full-sterile central line (IJ or subclavian)

Fluid Resuscitation

Fluid loaded

Dynamic IVC Ultrasound (best):
Administer 500-1000 ml boluses of isotonic crystalloid q30 minutes until there is <30% change in IVC size with inspiration

or

CVP (OK):
Administer 500-1000 ml boluses of isotonic crystalloid q30 minutes until CVP > 10 mmHg in non-intubated pts and > 14 mmHg in intubated pts
**MAP**

- **MAP ≥ 65**
  - **Repeat Lactate**
  - **Lactate < 10% Clearance OR SmvO2 < 65%**
    - **≥ 10% Lactate Clearance AND SmvO2 ≥ 65%**
      - **Vasopressors:**
        1. Titrate **Norepinephrine** (0.01 mcg/kg/minute)
        2. Place sterile A-line
        3. If MAP < 65 after Norepi between 0.5 - 1 mcg/kg/minute:
           add **Hydrocortisone** 100 mg IV q8 & **Vasopressin** 0.04 units/min

- **MAP < 65**

**Consider Transfusion**
- If Hgb < 7: transfuse 1 unit pRBC
- If Hgb 7-10: consider transfusion especially in elderly pts or with CAD

**Inotropes** (especially if heart appears hypodynamic on echo)
- If Ca low, replete that first (500-1000 mg)
- If Ca normal, then administer **Dobutamine** (2.5-20 mcg/kg/min)

**Additional fluids:** If you were using CVP to determine fluid status, give an additional liter of crystalloid

**Intubate** to decrease pulmonary metabolic load (see below)
≥ 10% Lactate Clearance
AND
Svo2 ≥65%

Goals Achieved

Continue with above trending lactates & Svo2 q1 hr until these 2 goals are met

Yes

Disposition
- Admission (ICU vs monitored bed)
- Periodically recheck for MAP>65, good mental status, good UOP
- Trend lactate q2-4 hours (if rises again, restart guidelines)

No
**Lung Protective Mechanical Ventilation**

- Ketamine is the preferred induction agent (1-1.5 mg/kg IV); Etomidate is acceptable (0.3 mg/kg IV)
- low TV (consider 6 cc/kg/IBW) with a goal Plateau Pressure < 30
- Analgesia + Sedation (see LUMC protocols)
- Raise HOB to 30-45°
Order set: “Sepsis Adult”
### STEROIDS
- **hydrocortisone sodium succinate 100 mg inj**
  100 mg, intravenous, NOW

### VASOPRESSORS / INOTROPES
#### VASOPRESSORS AND INOTROPES
- **norepinephrine 4 mg in dextrose 5% 250 ml infusion**
  intravenous, CONTINUOUS, Titrate by 0.01 mcg/kg/min increments every 2 minutes (or as clinically indicated) to HR and BP goals as instructed by physician or clinical scenario. Titrate to ***
- **vasopressin 100 units in dextrose 5% 100 ml infusion**
  0.04 Units/min, intravenous, CONTINUOUS
- **DOBUTamine 250 mg in dextrose 5% 250 ml infusion**
  2.5 mcg/kg/min, intravenous, CONTINUOUS, Titrate by 2.5 mcg/kg/min increments every 30 minutes (or as clinically indicated) to HR and BP goals as instructed by physician. Max dose of 20 mcg/kg/min.
- **calcium gluconate (10%) 1g injection**
  1 g, intravenous, NOW, Give IV push over 10 minutes.
- **calcium chloride 10 % injection**
  1 g, intravenous, NOW, Give IV push for over 10 minutes. Preferred central line administration.

### STRESS ULCER PROPHYLAXIS
#### STRESS ULCER PROPHYLAXIS
- **famotidine 20 mg in NaCl 0.9% 50 ml IVPB**
  20 mg, intravenous, EVERY 12 HR for 5 days

### ANTIBIOTIC ORDERING
ONLY INITIAL DOSE OF ANTIBIOTICS ARE ALLOWED WITHOUT ID APPROVAL IN PATIENTS WITH SEVERE SEPSIS / SHOCK
- **ABDOMEN SOURCE - COMMUNITY ACQUIRED**
- **ABDOMEN SOURCE - HOSPITAL ACQUIRED**
- **CENTRAL NERVOUS SYSTEM - COMMUNITY ACQUIRED**
- **CENTRAL NERVOUS SYSTEM - HOSPITAL ACQUIRED**
- **DIABETIC FOOT INFECTION OR ULCER**
- **GENITOURINARY - COMMUNITY ACQUIRED**
- **GENITOURINARY - HOSPITAL ACQUIRED**
- **LINE OR DEVICE RELATED INFECTION (I.E. CENTRAL LINE, PACEMAKER, ORTHOPEDIC IMPLANTS**
- **NEUTROPENIC FEVER - ANC < 500/MM3 AND TEMP > 101F**
## Antibiotic Ordering

### Only Initial Dose of Antibiotics are allowed without ID approval in patients with severe sepsis / shock

## Abdomen Source - Community Acquired

- **Abdomen Source: Community Acquired - Not Penicillin Allergic**
  - Piperacillin with tazobactam in dextrose 5% 50 ml IVPB
    - 3.375 g, intravenous, NOW

- **Abdomen Source: Community Acquired - Mild Penicillin Allergy (e.g. rash) - Choose All**
  - CeFePime 2 g in dextrose 5% 100 ml IVPB
    - 2 g, intravenous, NOW
  - MetroNIDAZOLE 500 mg IVPB
    - 500 mg, intravenous, NOW

- **Abdomen Source: Community Acquired - Major or Severe Penicillin Allergy (e.g. hives, anaphylaxis) - Choose All**
  - Ciprofloxacin IVPB
    - 400 mg, intravenous, NOW
  - MetroNIDAZOLE 500 mg IVPB
    - 500 mg, intravenous, NOW

## Abdomen Source - Hospital Acquired

## Central Nervous System - Community Acquired

## Central Nervous System - Hospital Acquired

## Diabetic Foot Infection or Ulcer

## Genitourinary - Community Acquired

## Genitourinary - Hospital Acquired

## Line or Device Related Infection (i.e. central line, pacemaker, orthopedic implants)

## Neutropenic Fever - ANC < 500/mm3 and Temp > 101F

## Pulmonary - Community Acquired

## Pulmonary - Healthcare Associated

### ED Orders

- Search
- Pref List

### Discharge Orders
2012 SSC guidelines

- A formal *conflict of interest policy* was developed at the onset of the process and enforced throughout.
- The entire guideline process was conducted *independent* of any industry funding.
- The recommendations in this document are intended to *provide guidance* for the clinician . . . cannot replace the clinicians decision-making capability when he or she is presented with a patients unique set of clinical variables.
- These recommendations are intended to be *best practice* and not created to represent standard of care.
- The committee believes that the greatest outcome improvement can be made through *education and process change*.
- Emphasize routine screening for earlier identification/txt
  - Sending more lactates, etc.
Fluid resuscitation?

• Recognized limitations of static measures (CVP) and that targeting dynamic measures of fluid responsiveness may have advantages.
  – However the efficacy of these techniques remains incomplete and requires further study before endorsement.

• In pts with elevated lactate, they suggest targeting resuscitation to normalize lactate.
SURVIVING SEPSIS CAMPAIGN BUNDLES

TO BE COMPLETED WITHIN 3 HOURS:
1) Measure lactate level
2) Obtain blood cultures prior to administration of antibiotics
3) Administer broad spectrum antibiotics
4) Administer 30 mL/kg crystalloid for hypotension or lactate ≥4 mmol/L

TO BE COMPLETED WITHIN 6 HOURS:
5) Apply vasopressors (for hypotension that does not respond to initial fluid resuscitation) to maintain a mean arterial pressure (MAP) > 65 mm Hg
6) In the event of persistent arterial hypotension despite volume resuscitation (septic shock) or initial lactate ≥4 mmol/L (36 mg/dL):
   - Measure central venous pressure (CVP)*
   - Measure central venous oxygen saturation (ScvO₂)*
7) Remeasure lactate if initial lactate was elevated*

*Targets for quantitative resuscitation included in the guidelines are CVP of ≥8 mm Hg, ScvO₂ of ≥70%, and normalization of lactate.
EMCrit Lessons from the STOP Sepsis Collaborative

- Dec 2012 – 10,000 patient mark
- Screening → Send lots of lactates
- Make lactate ≥ 4 a panic value (LUMC Dec 2012)
- Non-invasive protocols have evidence and seem to be working
- Early appropriate antibiotics → Simultaneous Infusions
- Check Your Work → Mandate repeat lactates
Headline news - New York State Adopts Sepsis Rules

- *NY Times Dec 2012*: One Boy’s Death Moves State to Action to Prevent Others
- *WSJ Jan 2013*: NY plans new hospital rules for treating sepsis

- In a precedent-setting statement during his State of the State Message, New York's Governor Andrew M. Cuomo announced that every hospital in the state must adopt sepsis screening procedures.

- State Health Commissioner Dr. Nirav Shah said the regulations, which are expected to take effect in May after a public comment period, could prevent 5,000 to 8,000 deaths a year.

- "New York will become the first state in the nation to require our hospitals to adopt best practices for the early identification and treatment of sepsis"
Conclusion

- Sepsis is common, lethal and expensive → EGDT can make a difference
- Have a high index of suspicion (SIRS + suspected infection)
- Send lactate early and often
- Be more aggressive with IVFs
- Early Antibiotics
- Use the ultrasound early and often if available
- Not everyone needs an Invasive strategy … use the guidelines created
- Treat it as important as a Stroke / STEMI / Trauma