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An Institution Wide Interdisciplinary Protocol for Improving the Recognition and Treatment of Sepsis in Patients Presenting to the Emergency Department

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Rationale for Development of the Severe Sepsis Protocol

- TJUH observed to expected mortality in sepsis was found to be higher in comparison to UHC
  - University Health Consortium expected mortality from sepsis 21%
  - TJUH observed mortality from sepsis 34%
  - Observed/expected ratio 1.59
  - More patients died from sepsis than stroke and CHF combined
- Implementation of a severe sepsis protocol reduces mortality*

*The Surviving Sepsis Campaign. *Crit Care Med* 2010(38):367.

Objectives of the Severe Sepsis Initiative

1. Creation of a permanent interdisciplinary committee
2. Create a protocol to streamline the recognition and treatment of sepsis
3. Develop and conduct education for all clinical staff
4. Monitor effectiveness
5. Continuous quality improvement

Creation of a permanent interdisciplinary committee

- Meets monthly
- Physicians, Nurses, Pharmacists, Administrators, Support Staff
- ED, MICU, ID, IS

- Concerns to anticipate based on our experience
  - Turnover of members
  - Waning interest
  - Delegation of work

- Utilization of residents (Pharmacy, Medicine)

Create a protocol to streamline the recognition and treatment of sepsis

- Consensus difficult to obtain at first
- Objectivity vs Subjectivity
- Scope of practice
  - Nursing FLO (first line orders)

Steps to Early Recognition and Management of Sepsis in ED

- First step: SIRS alert and clinical evaluation
- Second step: Sepsis Workup first line order set
- Third step: Initiate Severe Sepsis Order Set/Pathway and rapid triage to ICU

Severe Sepsis Order Set/Pathway

- Assess airway
- Insert/maintain 2 peripheral IV lines (18 gauge or larger) or place TLC for central IV access.
- Obtain LACTATE, blood cultures x 2, baseline CBC with diff, Chem 7, Accucheck, VBG, U/A with culture, PT/PTT, and CXR (if not done).
  - Obtain further labs as indicated e.g. other cultures, cortisol level, LFTs, urine pregnancy.

Develop and conduct education for all clinical staff

- Power Point Presentation
  - Delivered to all staff with any potential role caring for ED patients (attendings, residents, NPs, nurses, pharmacists)
  - Comprehensive
    - No assumptions made on what they already know about the sepsis continuum
- Pre- and post test to measure education success
- Pocket Cards
  - Side one: Sepsis work-up, diagnosis
  - Side two: Treatment, special circumstances
- Additional resources: Compatibility chart for sepsis meds

Monitor effectiveness

- Adherence to components of Sepsis Protocol
  - Case identification via ED charting diagnosis of sepsis
  - Review and chart abstracting by ONE clinical nurse specialist
  - Assessed for quality measures and documentation
- Brought to Sepsis committee for further review and final consensus decision
- Meets Severe Sepsis Criteria:? Yes/No
- Adherent to Severe Sepsis Management Protocol? Yes/No
- Reduction of in-hospital mortality due to sepsis
  - Measured over time

Continuous quality improvement

- Fall-outs/cases NOT adherent to management protocol
  - Referred to ED Performance Improvement Committee for more in-depth peer review
  - Follow-up with
    - Clinical staff (ED, Pulm/Crit Care, Pharmacy)
    - Sepsis Committee
- Changes in protocol
  - Guideline updates
  - Practical changes

Outcomes

- Inpatient mortality: All patients with diagnosis related group (DRG) of sepsis
  - 6 month time period (Mar-Sep), 2011 vs. 2012
  - 24.9% (n=170) vs. 16.23% (n-289) (p=0.049)
- Inpatient mortality index from Sepsis: Observed deaths TJUH/Expected deaths UHC
  - 1.31 vs. 0.94 (p=0.318)

Subgroup Analysis: Process Measures

Measures associated with optimal Sepsis care pre- vs. post-protocol implementation (studied over 2 months)

1. Blood cultures drawn before antibiotic administration:
   - 57.9% vs. 96.9% (p=0.001)
2. Rate of early antibiotic administration (within 3 hours)
   - 57.9% vs. 84.4% (p=0.005)
3. Adequate fluid resuscitation in hypotensive patients
   - 62.5% vs. 93.8% (p=0.012)
4. Initiation of vasopressors for persistent hypotension
   - 23.1% vs. 77.8% (p=0.004)

Results

- Early recognition and aggressive goal directed treatment of sepsis has been shown to improve clinical outcomes
- Implementation of a targeted educational program and a protocolized system has increased adherence to key interventions and reduced mortality in the study group

Key Elements to Our Success

1. Interdisciplinary and interdepartmental involvement of all the stakeholders in sepsis care
    - Key to identification of specific barriers to optimal care
2. Targeted educational programs emphasizing the importance of early recognition of sepsis and the value of protocolized care
3. Collaboration with IS to find innovative uses for our current EMRs, including the development of automated sepsis alerts to facilitate early recognition of patients at risk as well as bundled order sets
4. A process of continuous review of performance with regular feedback to practitioners

Thank You!

Questions?

SIRS/Sepsis: ACCP/SCCM Definitions

- Infection: inflammatory response to microorganisms, or invasion of normally sterile body tissues
- Systemic Inflammatory Response Syndrome (SIRS): systemic response to a variety of insults (burns, trauma, pancreatitis, infection)
- Sepsis is SIRS in the setting of suspected or proven infection

SIRS/Sepsis: Definitions

SIRS: presence of 2 or more of the following criteria

- Fever (core temperature > 38.3 C or 101.0 F) or hypothermia (core temperature < 36 C or 96.8 F)
- Heart rate > 90 beats/min
- Respiratory rate > 20 breaths/min or $PaCO_2$ < 32 or need for mechanical ventilation for an acute respiratory process
- WBC > 12,000/mm^3, < 4,000/mm^3, or bands > 10%

Sepsis: patient has SIRS and a suspected or confirmed infection.

Potential Clinical Clues for Suspected Infection

History/symptoms

- Fever, chills, lethargy, or malaise
- Productive cough
- Headache
- Sore throat
- Diarrhea, abdominal pain
- Dysuria, cloudy urine
- Sick contacts
- Recent surgery/instrumentation
- Recent chemotherapy

Signs

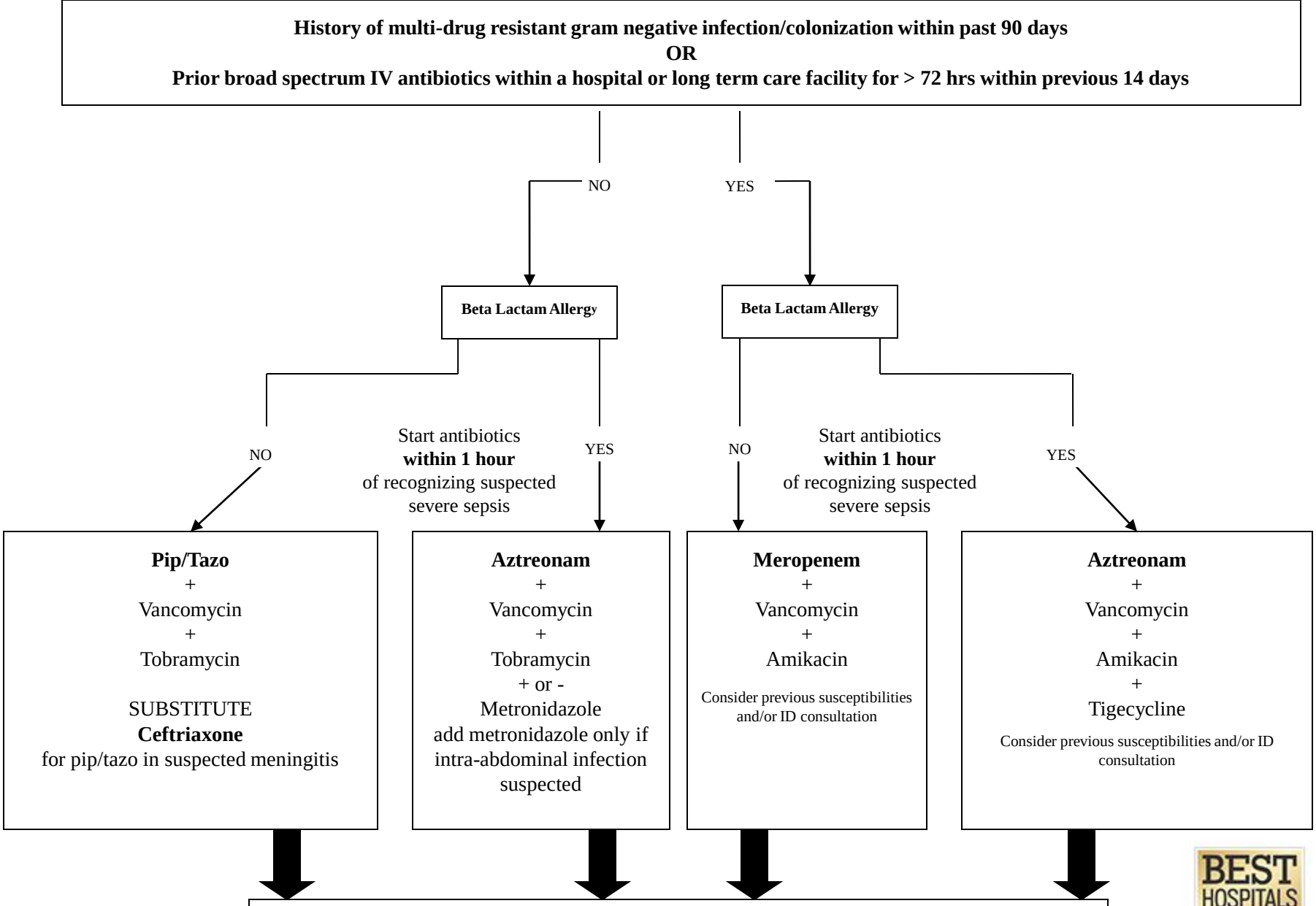
- Disorientation
- Tachypnea
- Tachycardia
- Hypoxia
- Hyper/hypo-thermia
- Decreased urine output
- Hypotension

Continuum from Sepsis to Septic Shock

- Sepsis
  - 2 SIRS criteria plus suspected or documented infection
- Severe sepsis
  - Sepsis plus at least one organ dysfunction (see next slide)
- Septic shock
  - Sepsis plus persistent hypotension despite fluid resuscitation, or
  - Perfusion abnormalities

“Golden Hours of Sepsis”

- Early recognition and intervention of patients with severe sepsis leads to improved outcomes
- Similar concept to:
  - Acute coronary syndrome
  - Stroke
  - Trauma

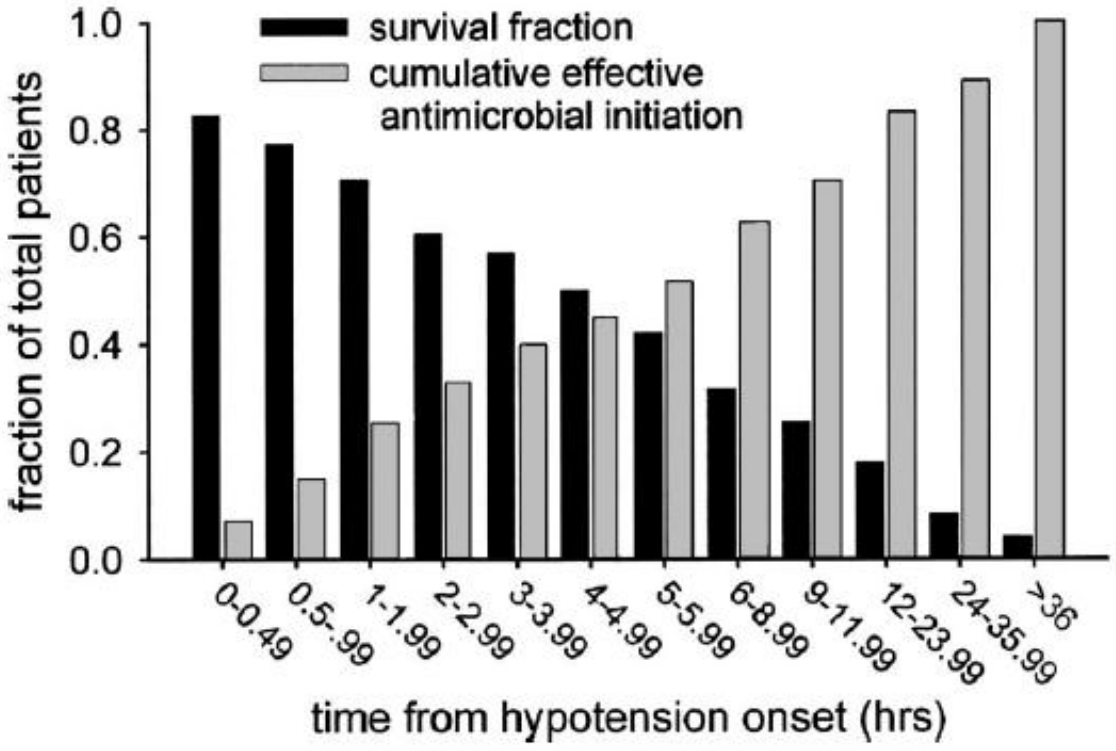

History of multi-drug resistant gram negative infection/colonization within past 90 days
OR
Prior broad spectrum IV antibiotics within a hospital or long term care facility for > 72 hrs within previous 14 days
NO
YES
Beta Lactam Allergy
Beta Lactam Allergy
NO
YES
NO
YES
Start antibiotics within 1 hour of recognizing suspected severe sepsis
Start antibiotics within 1 hour of recognizing suspected severe sepsis
Pip/Tazo + Vancomycin + Tobramycin
SUBSTITUTE Ceftriaxone for pip/tazo in suspected meningitis
Aztreonam + Vancomycin + Tobramycin + or - Metronidazole
add metronidazole only if intra-abdominal infection suspected
Meropenem + Vancomycin + Amikacin
Consider previous susceptibilities and/or ID consultation
Aztreonam + Vancomycin + Amikacin + Tigecycline
Consider previous susceptibilities and/or ID consultation
If suspected intra-abdominal catastrophe (i.e. perforation) suspected, add micafungin
If community acquired or health-care associated pneumonia is suspected, add azithromycin

Antibiotic Compatibilities [1,2]

	Amik	Anid	Azith	Aztre	Ceftri	Dopa	Epi	Line	Mero	Met	Mica	Moxi	Norepi	P/T	Tig	Tobra	Vanco
Amikacin (Amik)	-	C	-	C	-	-	-	C	-	C	-	-	-	C	C	-	C
Anidulafungin (Anid)	C	-	-	-	-	C	C	C	C	C	-	-	C	C	-	C	C
Azithromycin (Azith)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	C	-	-
Aztreonam (Aztre)	C	-	-	-	-	C	C	C	-	-	-	-	-	C	C	C	C
Ceftriaxone (Ceftri)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dopamine (Dopa)	-	C	-	C	-	-	C	C	-	C	C	-	C	C	C	-	C
Epinephrine (Epi)	-	C	-	C	-	C	-	-	-	-	-	-	-	-	C	-	C
Linezolid (Line)	C	C	-	C	-	C	-	-	C	C	-	-	-	C	C	C	C
Meropenem (Mero)	-	C	-	-	-	-	-	C	-	-	-	-	C	-	-	-	C
Metronidazole (Met)	C	C	-	-	-	C	-	C	-	-	-	-	-	C	-	-	-
Micafungin (Mica)	-	-	-	-	-	C	-	-	-	-	-	-	C	-	-	-	-
Moxifloxacin (Moxi)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Norepinephrine (Norepi)	-	C	-	-	-	C	-	-	C	-	C	-	-	-	C	-	-
Piperacillin/ Tazobactam (P/T)	C	C	-	C	-	C	-	C	-	C	-	-	-	-	C	-	-
Tigecycline (Tig)	C	-	C	C	-	C	C	C	-	-	-	-	C	C	-	C	C
Tobramycin (Tobra)	-	C	-	C	-	-	-	C	-	-	-	-	-	-	C	-	-
Vancomycin (Vanco)	C	C	-	C	-	C	C	C	C	-	-	-	-	-	C	-	-

1. King Guide to Parenteral Admixture
2. Handbook on Injectable Drugs (Trissel)

Early Antibiotics Improves Survival in Septic Shock



Crit Care Med 2006 Vol. 34, No. 6

Antibiotic Management
Important Things to Remember

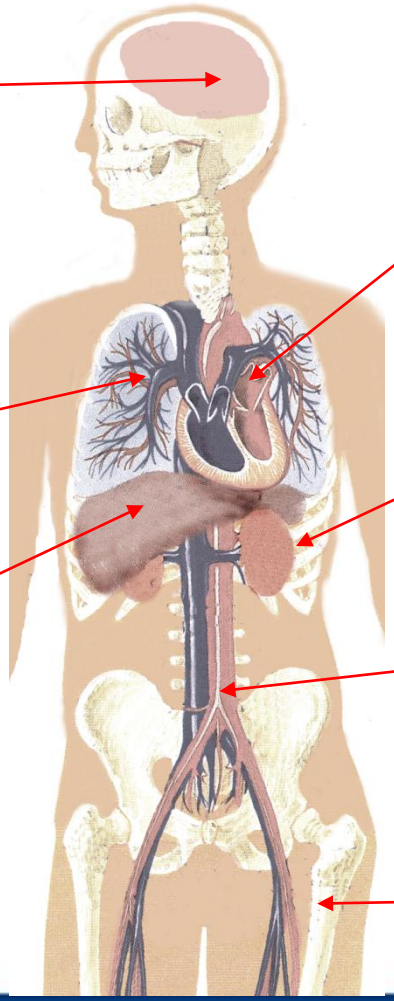
1. Check antibiotic compatibilities to see if antibiotics can be administered concurrently
2. If antibiotics can not be administered together due to incompatibility (e.g. piperacillin/tazobactam and tobramycin), use second peripheral IV line (or different lumens of TLC) to avoid delay
3. If only one IV line available, give gram negative agent first (piperacillin/tazobactam, aztreonam, or meropenem) unless specified (e.g. suspect gram positive line infection)

Acute Organ Dysfunction in Severe Sepsis

Altered
Consciousness
Confusion
Psychosis

Tachypnea
PaO_2 <70 mm Hg
SaO_2 <90%
PaO_2/FiO_2 ≤300

Jaundice
↑ Enzymes
↓ Albumin
↑ PT



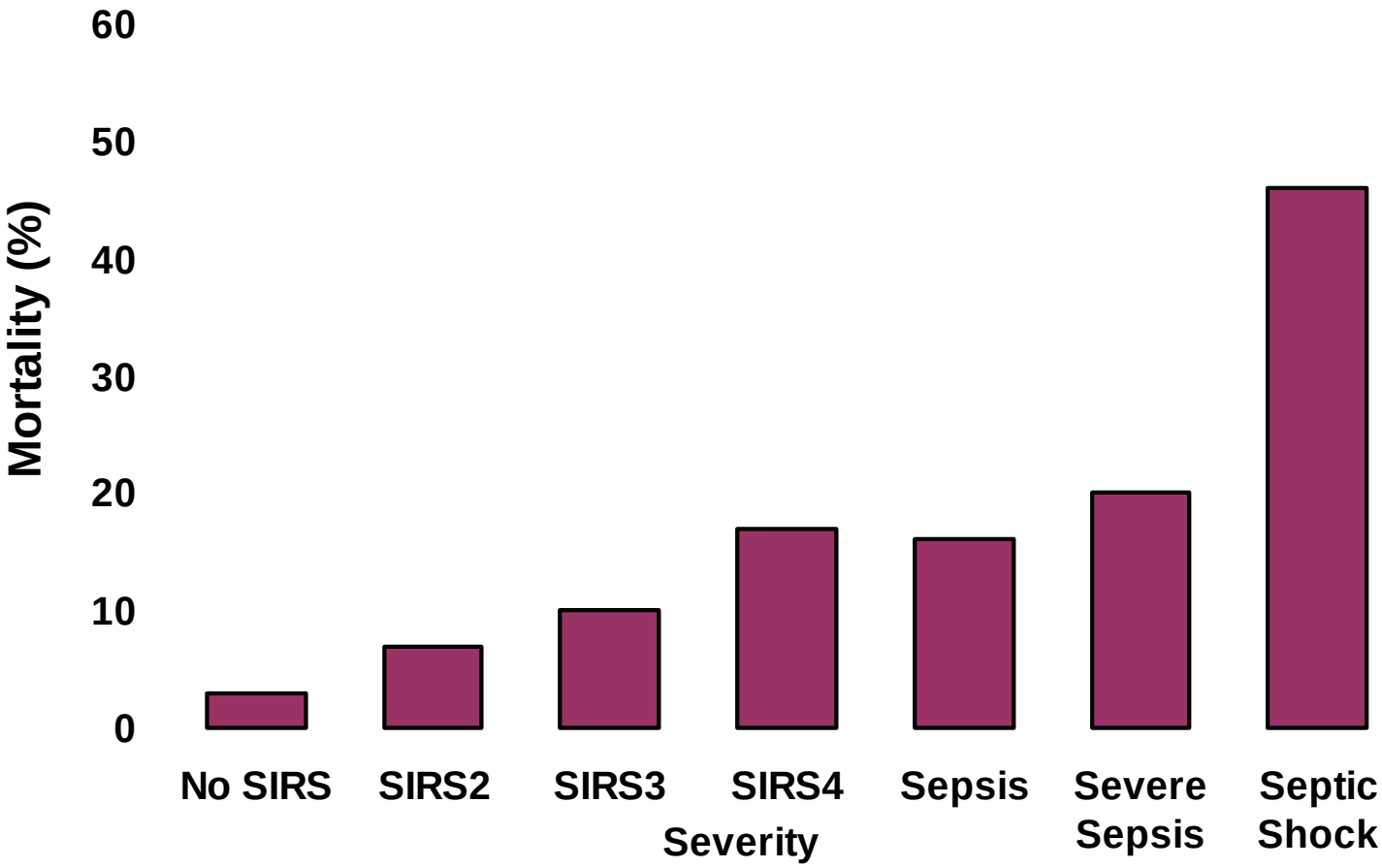
Tachycardia
Hypotension
Vasodilatation
↓ Contractility

Oliguria
Anuria
↑ Creatinine

↓ Platelets
↑ PT/APTT
↓ Protein C
↑ D-dimer

Neuropathy
Myopathy

Increased Mortality Along a Continuum



Rangel-Frausto, et al. *JAMA* 1995;273:117-23.

Severe Sepsis Criteria

Patient meets sepsis definition and has at least 1 sign of organ dysfunction*:

- SBP < 90 mmHg, MAP < 65 mmHg for at least one hour despite adequate fluid resuscitation (30 ml/kg saline) or use of vasopressors
- Lactate > 4 mmol/L
- Urine output < 0.5 ml/kg/hr after adequate fluid resuscitation or rise in creatinine > 0.5 mg/dL over baseline
- PaO2/FiO2 ratio < 300 or requiring ≥ 4 liters oxygen via nasal cannula to maintain SpO2 > 90%
- Platelets < 100,000/mm3, INR > 1.5, PTT > 60s

*Organ dysfunction must be new onset

Severe Sepsis Order Set/Pathway (cont'd)

- Begin broad spectrum IV antibiotics within 1 hour of RECOGNITION of severe sepsis* (see Figure)
- Administer 0.9% sodium chloride x 2 liter IV fluid bolus (or 30cc/kg)
- Place foley catheter to monitor urine output

Severe Sepsis Order Set (continued)

- If MAP < 65 or SBP < 90 after initial bolus, place central venous line (preferably SC or IJ) and initiate vasopressors

- Continue IV fluids as per physician discretion

- Document vital signs (HR, BP including MAP, RR, O2 sat) and I&Os Q1hour x 2 sets, then frequency as per physician discretion

Early Recognition and Management of Sepsis in Inpatients

- First step: SIRS alert and clinical evaluation
- Second step: Send BC x2 and lactate
- Third step: Initiate Severe Sepsis Order Set/Pathway and promptly transfer to ICU

Antibiotic Management

- **Begin intravenous antibiotics within 1 hour of recognizing severe sepsis**
- Use broad spectrum agents active against likely bacterial/fungal pathogens and with good penetration into presumed source (see Figure on next slide)
- Reassess antimicrobial regimen daily to optimize efficacy, prevent resistance, and avoid toxicity

Hemodynamic Management

- Administer 0.9% Sodium chloride 30 ml/kg IV bolus for volume resuscitation
- If MAP < 65 or SBP < 90 after initial bolus, place central venous line (ideally SC or IJ) and initiate vasopressors
- Continue IV fluids as per physician discretion

Vasopressor Management

- If MAP < 65 or SBP < 90 **after initial volume resuscitation**, initiate norepinephrine at 0.1 mcg/kg/min (preferred)
- If patient has persistent or increasing vasopressor requirements, initiate epinephrine or vasopressin infusion
- All patients on vasopressors require vital signs with every titration and every 1 hour once blood pressure goal is achieved
  - IV site should be checked frequently if administered peripherally

Importance of Documentation

- Document in a manner that is accurate and accessible to all disciplines:
  - Necessary for the ongoing treatment of the patient
  - Necessary to monitor quality of care metrics
    - Blood cultures before antibiotics
    - Early, appropriate, adequate antibiotics
    - Initial fluid resuscitation
    - Use of vasopressors for hypotension despite initial fluids

Rapid Triage to ICU

- Patients identified as having **SEVERE SEPSIS** should be admitted/transferred to ICU promptly:

  ******Process of transfer should not delay therapy ******

  - **Antibiotics MUST be initiated at current location**
  - **Provide vasopressors, additional IV fluids, perform imaging, etc. as needed prior to transfer**

Continued Sepsis Management

- Promptly de-escalate/ alter antibiotics based on culture results and other clinical data
- Stop antimicrobial therapy if cause found to be noninfectious
- Remove catheters (central lines, foley) as soon as no longer required
- Limit duration of antibiotic therapy to 7-10 days; longer if response is slow or there are undrainable foci of infection or immunologic deficiencies