



Minnesota Hospital Association

Recognition and Management of Severe Sepsis and Septic Shock



June 17, 2015



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The speaker has no personal financial relationships to disclose.

Recognition and Management of Severe Sepsis and Septic Shock

David M. Larson, MD, FACEP

MHA Web Conference
June 17, 2015

Objectives

- Discuss the use of screening tools for early recognition and treatment of severe sepsis and septic shock
- Review the current evidence based guidelines from the Surviving Sepsis Campaign.
- Discuss recent randomized controlled trials on Early Goal Directed Therapy for the management of Sepsis patients



Severe Sepsis is one of the Time Critical Emergencies



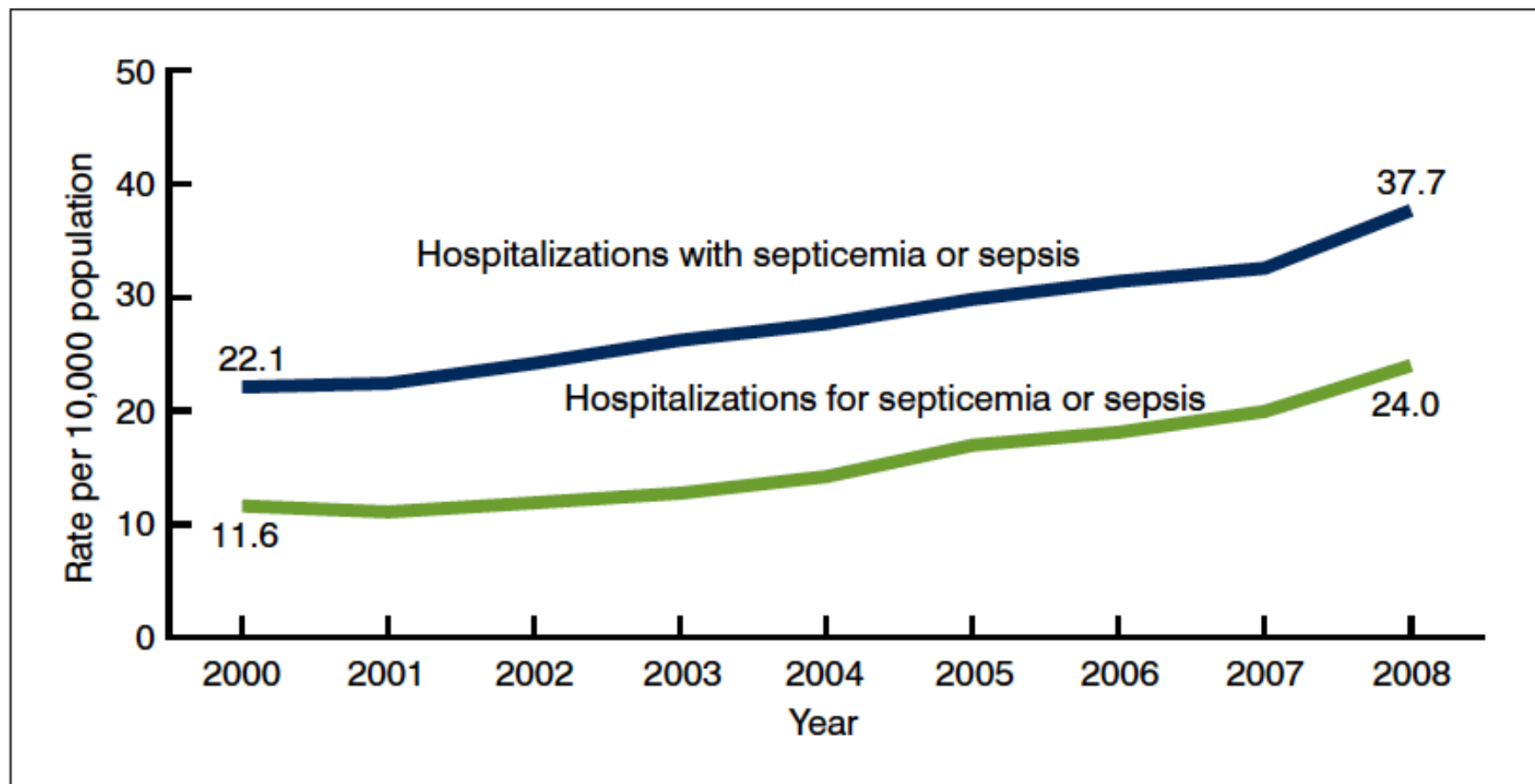
Time Critical Emergencies

- Severe Sepsis/Septic Shock – Highest mortality (5x greater than)
- Trauma
- STEMI
- Stroke

- Sepsis is the leading cause of death in non-coronary care intensive care units, with a mortality rate between 30% and 50%
- From 2007 to 2009, over 2,047,038 patients were admitted with a sepsis-related illness
 - 52.4% are diagnosed in the ED
 - 34.8% on the hospital wards
 - 12.8% in the ICU

Hospitalization rates for septicemia or sepsis more than doubled from 2000 through 2008.

Figure 1. Hospitalizations for and with septicemia or sepsis

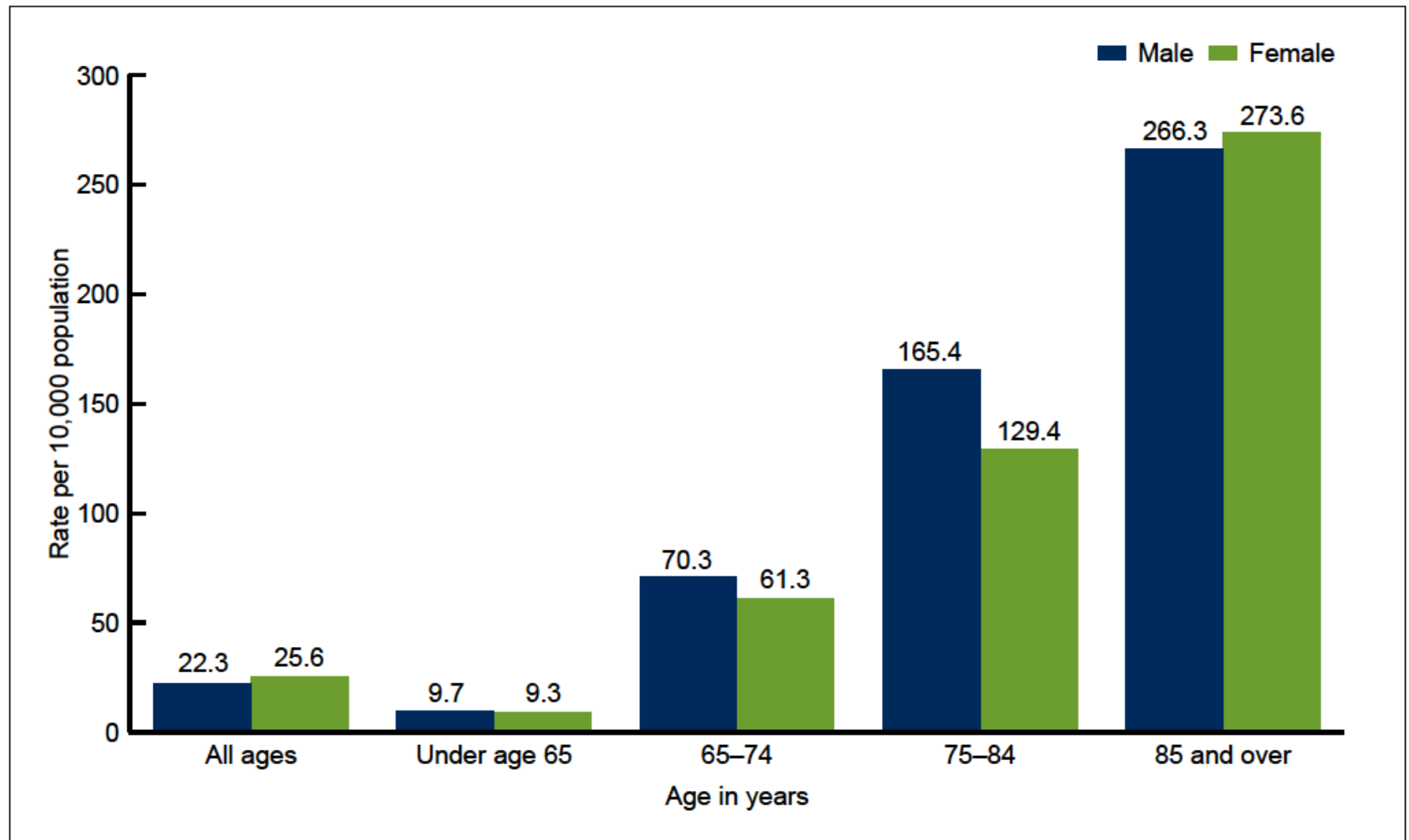


NOTE: Significant linear trend from 2000 through 2008 for both categories.

SOURCE: CDC/NCHS, National Hospital Discharge Survey, 2000–2008.

Hospitalization rates for sepsis or septicemia were similar for males and females and increased with age.

Figure 2. Rates of hospitalization for septicemia or sepsis, by sex and age, 2008



NOTES: Rates are significantly higher for males and females in each successive age group.

SOURCE: CDC/NCHS, National Hospital Discharge Survey, 2008.

Surviving Sepsis Campaign

[ABOUT SSC](#) ▾[GUIDELINES](#)[BUNDLES](#)[DATA COLLECTION](#)[RESOURCES](#) ▾[IMPLEMENT/IMPROVE](#) ▾[CONTACT](#)[Upcoming Events](#) ▸[Education](#) ▸[News and Literature](#) ▸[Protocols and Checklists](#) ▸[Home](#) [Surviving Sepsis Campaign](#) > [Resources](#) > [Protocols and Checklists](#)

Protocols and Checklists

Colleagues share the tools they have developed in their own institutions as they implement the Surviving Sepsis Campaign. Here you'll find locally-created protocols, checklists, policies, and similar documents so you don't have to start from scratch. If you have items to share based on the 2012 guidelines and revised bundles, please email PDFs to info@survivingsepsis.org. Permissions from your institution may be required. The Campaign is creating new materials and anticipates posting on this site in late June 2013.

Campaign Screening Tool Sample

The Surviving Sepsis Campaign provides a paper [screening tool](#) to assist when evaluating patients in the hospital emergency department, medical/surgical/telemetry wards, or in the ICU. The [previous version](#) with callouts to indicate the changes from 2008 to 2012 is available.

Community Resources

[ICU Severe Sepsis Screening Tool - Saint Joseph Mercy Health System](#)

[Patient Units Severe Sepsis Screening Tool - Saint Joseph Mercy Health System](#)

[Sepsis Pocket Card - Saint Joseph Mercy Health System](#)

[Sepsis Recognition and Treatment Protocols - Stony Brook](#)

[Sepsis Pediatric Order Set - Stony Brook](#)

[Pediatric ICU Screening Tool - Stony Brook](#)

Current Surviving Sepsis Campaign Guideline Sponsors

- American Association of Critical-Care Nurses
- American College of Chest Physicians
- American College of Emergency Physicians
- Australian and New Zealand Intensive Care Society
- Asia Pacific Association of Critical Care Medicine
- American Thoracic Society
- Brazilian Society of Critical Care(AIMB)
- Canadian Critical Care Society
- Chinese Society of Critical Care Medicine
- Chinese Society of Critical Care Medicine – Chinese Medical Association
- Emirates Intensive Care Society
- European Respiratory Society
- European Society of Clinical Microbiology and Infectious Diseases
- European Society of Intensive Care Medicine
- European Society of Pediatric and Neonatal Intensive Care
- Infectious Diseases Society of America
- Indian Society of Critical Care Medicine
- International Pan Arab Critical Care Medicine Society
- Japanese Association for Acute Medicine
- Japanese Society of Intensive Care Medicine
- Pediatric Acute Lung Injury and Sepsis Investigators
- Society Academic Emergency Medicine
- Society of Critical Care Medicine
- Society of Hospital Medicine
- Surgical Infection Society
- World Federation of Critical Care Nurses
- World Federation of Pediatric Intensive and Critical Care Societies
- World Federation of Societies of Intensive and Critical Care Medicine

2012 SSC Guidelines



Special Articles

Surviving Sepsis Campaign: International Guidelines for Management of Severe Sepsis and Septic Shock: 2012

R. Phillip Dellinger, MD¹; Mitchell M. Levy, MD²; Andrew Rhodes, MB BS³; Djillali Annane, MD⁴; Herwig Gerlach, MD, PhD⁵; Steven M. Opal, MD⁶; Jonathan E. Sevransky, MD⁷; Charles L. Sprung, MD⁸; Ivor S. Douglas, MD⁹; Roman Jaeschke, MD¹⁰; Tiffany M. Osborn, MD, MPH¹¹; Mark E. Nunnally, MD¹²; Sean R. Townsend, MD¹³; Konrad Reinhart, MD¹⁴; Ruth M. Kleinpell, PhD, RN-CS¹⁵; Derek C. Angus, MD, MPH¹⁶; Clifford S. Deutschman, MD, MS¹⁷; Flavia R. Machado, MD, PhD¹⁸; Gordon D. Rubenfeld, MD¹⁹; Steven A. Webb, MB BS, PhD²⁰; Richard J. Beale, MB BS²¹; Jean-Louis Vincent, MD, PhD²²; Rui Moreno, MD, PhD²³; and the Surviving Sepsis Campaign Guidelines Committee including the Pediatric Subgroup*

Definitions

The degree to which a televised image
broadcast signal is received

def·i·ni·tion n. 1.

The teacher gave definitions
of the new words.
of an image (picture)

Definitions (ACCP/SCCM)

- **Systemic Inflammatory Response Syndrome (SIRS)**: 2 or more of the following
 - Fever or hypothermia ($T > 100.4$ or < 96.8)
 - Tachycardia ($HR > 90$)
 - Tachypnea ($RR > 20$ or $PaCO_2 < 32$)
 - Leukocytosis, leukopenia or left shift ($WBC > 12,000$, $< 4,000$ or $> 10\%$ bands)
- **Sepsis**
 - SIRS as a result of infection

Definitions

- **Severe Sepsis**

- Sepsis associated with organ dysfunction, hypoperfusion, or hypotension.
- Hypoperfusion and perfusion abnormalities may include: lactic acidosis, oliguria or acute alteration in mental status.

- **Septic shock**

- A subset of severe sepsis with hypotension (BP < 90 or drop of > 40 from baseline), despite adequate fluid resuscitation

Systemic Inflammatory Response Syndrome to Septic shock: A Continuum

SIRS → **Sepsis** → **Severe Sepsis**

A Clinical response arising from a nonspecific insult with 2 of the following

Temp > 100.9 or > 96.8F

HR > 90

RR > 20 or pCO₂ < 32

WBC > 12 K, < 4 K, > 10% Bands

SIRS with a presumed or confirmed infectious process

Sepsis induced tissue hypoperfusion or organ dysfunction

Respiratory

Renal, GI

CNS

Hematologic

Refractory hypotension

Septic Shock

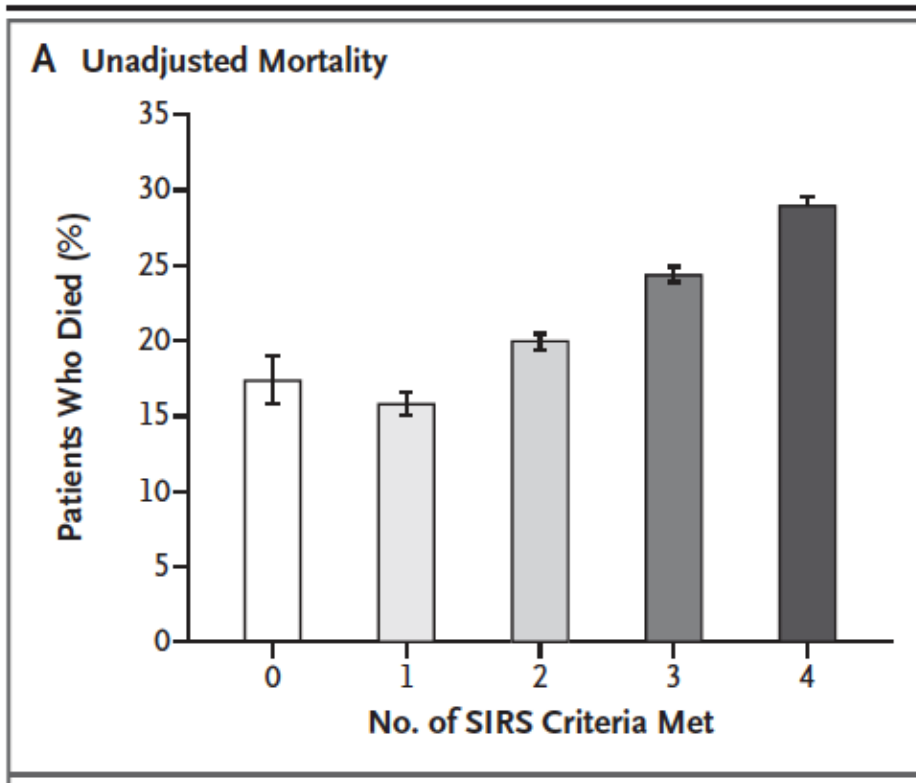
ORIGINAL ARTICLE

Systemic Inflammatory Response Syndrome Criteria in Defining Severe Sepsis

Kirsi-Maija Kaukonen, M.D., Ph.D., Michael Bailey, Ph.D., David Pilcher, F.C.I.C.M.,
D. Jamie Cooper, M.D., Ph.D., and Rinaldo Bellomo, M.D., Ph.D.

- Data from 172 ICUs in Australia/New Zealand
- 96,385 patients with Infection with organ failure
- 12.2% did not meet SIRS criteria

SIRS in Severe Sepsis



- Most Common SIRS criteria
 - Elevated HR
 - Elevated RR
- Only 60% had abnormal Temp
 - 30% high
 - 30% low

NEJM April 23, 2015

2001 SCCM/ESICM/ACCP/ATS/SIS International Sepsis Definitions Conference

Mitchell M. Levy, MD, FCCP; Mitchell P. Fink, MD, FCCP; John C. Marshall, MD; Edward Abraham, MD; Derek Angus, MD, MPH, FCCP; Deborah Cook, MD, FCCP; Jonathan Cohen, MD; Steven M. Opal, MD; Jean-Louis Vincent, MD, FCCP, PhD; Graham Ramsay, MD; For the International Sepsis Definitions Conference



Surviving Sepsis Campaign: International Guidelines for Management of Severe Sepsis and Septic Shock: 2012

R. Phillip Dellinger, MD¹; Mitchell M. Levy, MD²; Andrew Rhodes, MB BS³; Djillali Annane, MD⁴; Herwig Gerlach, MD, PhD⁵; Steven M. Opal, MD⁶; Jonathan E. Sevransky, MD⁷; Charles L. Sprung, MD⁸; Ivor S. Douglas, MD⁹; Roman Jaeschke, MD¹⁰; Tiffany M. Osborn, MD, MPH¹¹; Mark E. Nunnally, MD¹²; Sean R. Townsend, MD¹³; Konrad Reinhart, MD¹⁴; Ruth M. Kleinpell, PhD, RN-CS¹⁵; Derek C. Angus, MD, MPH¹⁶; Clifford S. Deutschman, MD, MS¹⁷; Flavia R. Machado, MD, PhD¹⁸; Gordon D. Rubenfeld, MD¹⁹; Steven A. Webb, MB BS, PhD²⁰; Richard J. Beale, MB BS²¹; Jean-Louis Vincent, MD, PhD²²; Rui Moreno, MD, PhD²³; and the Surviving Sepsis Campaign Guidelines Committee including the Pediatric Subgroup*

Definitions – 2012 Surviving Sepsis Guideline

- **Sepsis:** The presence (probable or documented) of infection together with systemic manifestations of infection

(More than just SIRS plus infection)

TABLE 1. Diagnostic Criteria for Sepsis

Infection, documented or suspected, and some of the following:

General variables

Fever ($> 38.3^{\circ}\text{C}$)

Hypothermia (core temperature $< 36^{\circ}\text{C}$)

Heart rate $> 90/\text{min}^{-1}$ or more than two sd above the normal value for age

Tachypnea

Altered mental status

Significant edema or positive fluid balance ($> 20\text{ mL/kg}$ over 24 hr)

Hyperglycemia (plasma glucose $> 140\text{ mg/dL}$ or 7.7 mmol/L) in the absence of diabetes

Inflammatory variables

Leukocytosis (WBC count $> 12,000\ \mu\text{L}^{-1}$)

Leukopenia (WBC count $< 4000\ \mu\text{L}^{-1}$)

Normal WBC count with greater than 10% immature forms

Plasma C-reactive protein more than two sd above the normal value

Plasma procalcitonin more than two sd above the normal value

Table 1 Continued. Criteria for sepsis

Hemodynamic variables

Arterial hypotension (SBP < 90 mm Hg, MAP < 70 mm Hg, or an SBP decrease > 40 mm Hg in adults or less than two SD below normal for age)

Organ dysfunction variables

Arterial hypoxemia ($P_{aO_2}/F_{iO_2} < 300$)

Acute oliguria (urine output < 0.5 mL/kg/hr for at least 2 hrs despite adequate fluid resuscitation)

Creatinine increase > 0.5 mg/dL or 44.2 $\mu\text{mol/L}$

Coagulation abnormalities (INR > 1.5 or aPTT > 60 s)

Ileus (absent bowel sounds)

Thrombocytopenia (platelet count < 100,000 μL^{-1})

Hyperbilirubinemia (plasma total bilirubin > 4 mg/dL or 70 $\mu\text{mol/L}$)

Tissue perfusion variables

Hyperlactatemia (> 1 mmol/L)

Decreased capillary refill or mottling

Definitions

- **Severe Sepsis:** Sepsis plus sepsis-induced organ dysfunction or tissue hypoperfusion
 - Sepsis-induced hypotension: Systolic Blood pressure <90 mm Hg or MAP <70 mm Hg or SBP decrease > 40mm Hg
- **Septic Shock:** Sepsis induced hypotension persisting despite adequate fluid resuscitation

TABLE 2. Severe Sepsis

Severe sepsis definition = sepsis-induced tissue hypoperfusion or organ dysfunction (any of the following thought to be due to the infection)

Sepsis-induced hypotension

Lactate above upper limits laboratory normal

Urine output $< 0.5 \text{ mL/kg/hr}$ for more than 2 hrs despite adequate fluid resuscitation

Acute lung injury with $\text{PaO}_2/\text{FiO}_2 < 250$ in the absence of pneumonia as infection source

Acute lung injury with $\text{PaO}_2/\text{FiO}_2 < 200$ in the presence of pneumonia as infection source

Creatinine $> 2.0 \text{ mg/dL}$ ($176.8 \text{ }\mu\text{mol/L}$)

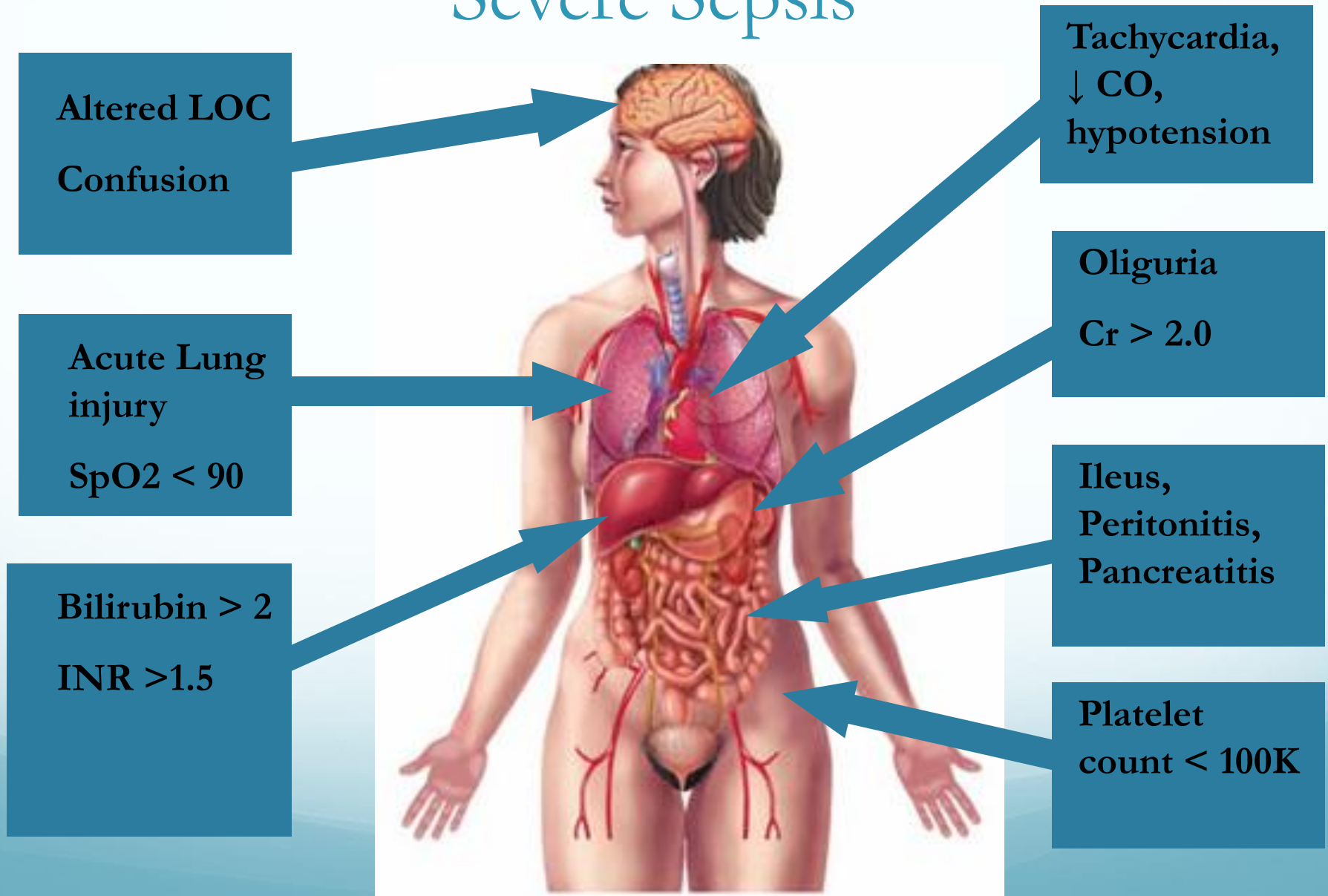
Bilirubin $> 2 \text{ mg/dL}$ ($34.2 \text{ }\mu\text{mol/L}$)

Platelet count $< 100,000 \text{ }\mu\text{L}$

Coagulopathy (international normalized ratio > 1.5)

Adapted from Levy MM, Fink MP, Marshall JC, et al: 2001 SCCM/ESICM/ACCP/ATS/SIS International Sepsis Definitions Conference. *Crit Care Med* 2003; 31: 1250–1256.

Manifestations of Organ Dysfunction in Severe Sepsis



60% of Severe Sepsis/Septic Shock patients have an elevated Troponin

Correct Coding for Sepsis

- Sepsis 995.91
- Severe Sepsis 995.92
- Septic Shock 785.52

There is NO diagnostic code for:

1. "Urosepsis"
2. "Septicemia"
3. "Sepsis syndrome"
4. "Sepsis syndrome in shock"
5. "Septicemia"
6. "Bacteremia"
7. "Gram negative sepsis"
8. "Gram positive sepsis"

Early Recognition and Treatment

- Screening for Sepsis
- Usefulness of Lactate in screening
- Early Antibiotic Treatment

Screening for Sepsis

- **2012 Severe Sepsis Guideline:**
 - “We recommend routine screening of potentially infected seriously ill patients for severe sepsis to increase the early identification of sepsis and allow implementation of early sepsis therapy” (grade 1C)

Routine Screening for Severe Sepsis

- Early recognition of sepsis and implementation of early evidenced based therapies improves outcomes and decreases mortality
- Sepsis screening tools should be utilized in all hospitals (ED, ICU and general medical ward)

Reminders



Recognizing Sepsis Begins in Triage



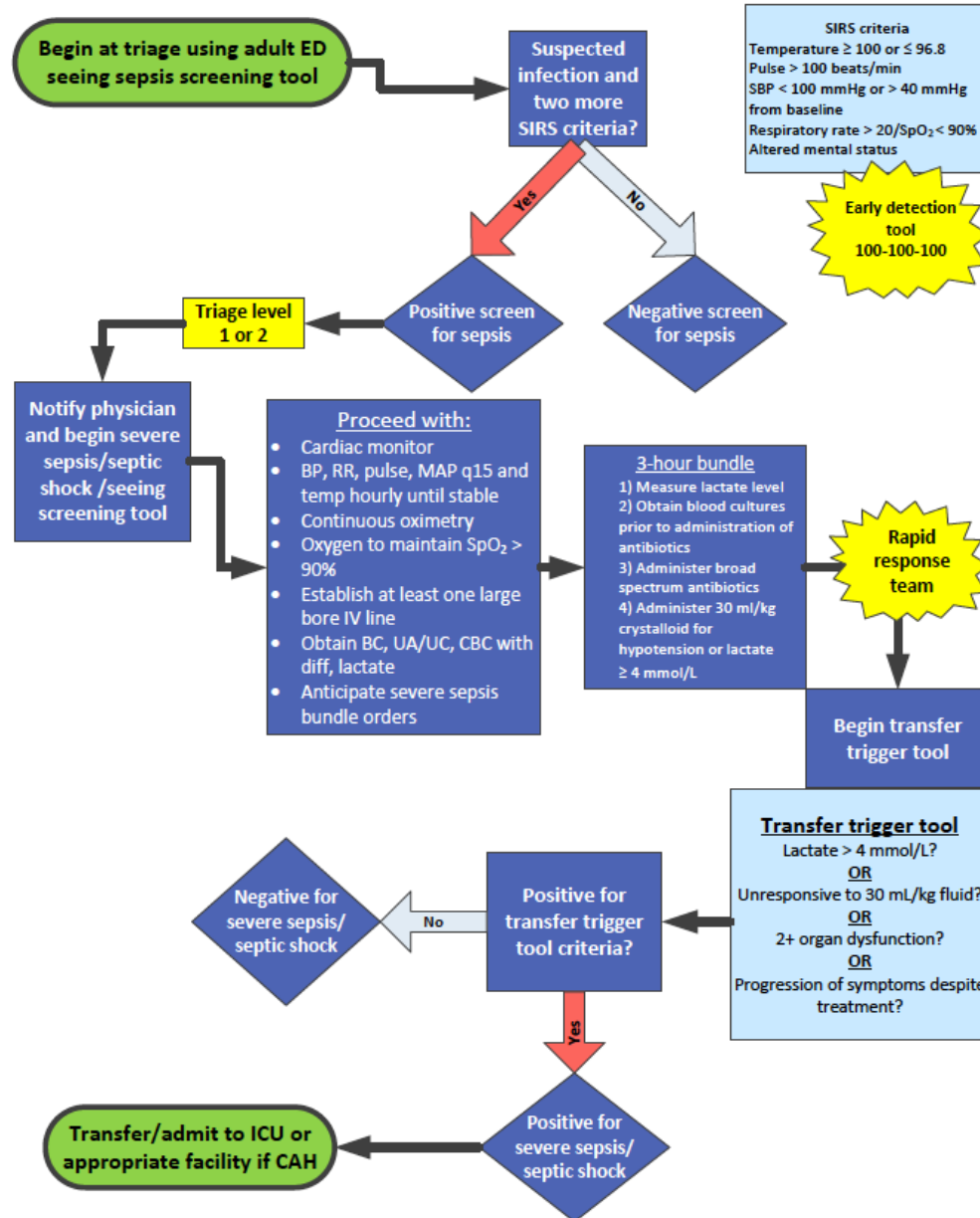
Screening for Sepsis

- Nurses screen for sepsis on medical floor and ICU every shift on every patient
- Pre-hospital screening by paramedics
- Screening in Nursing Homes

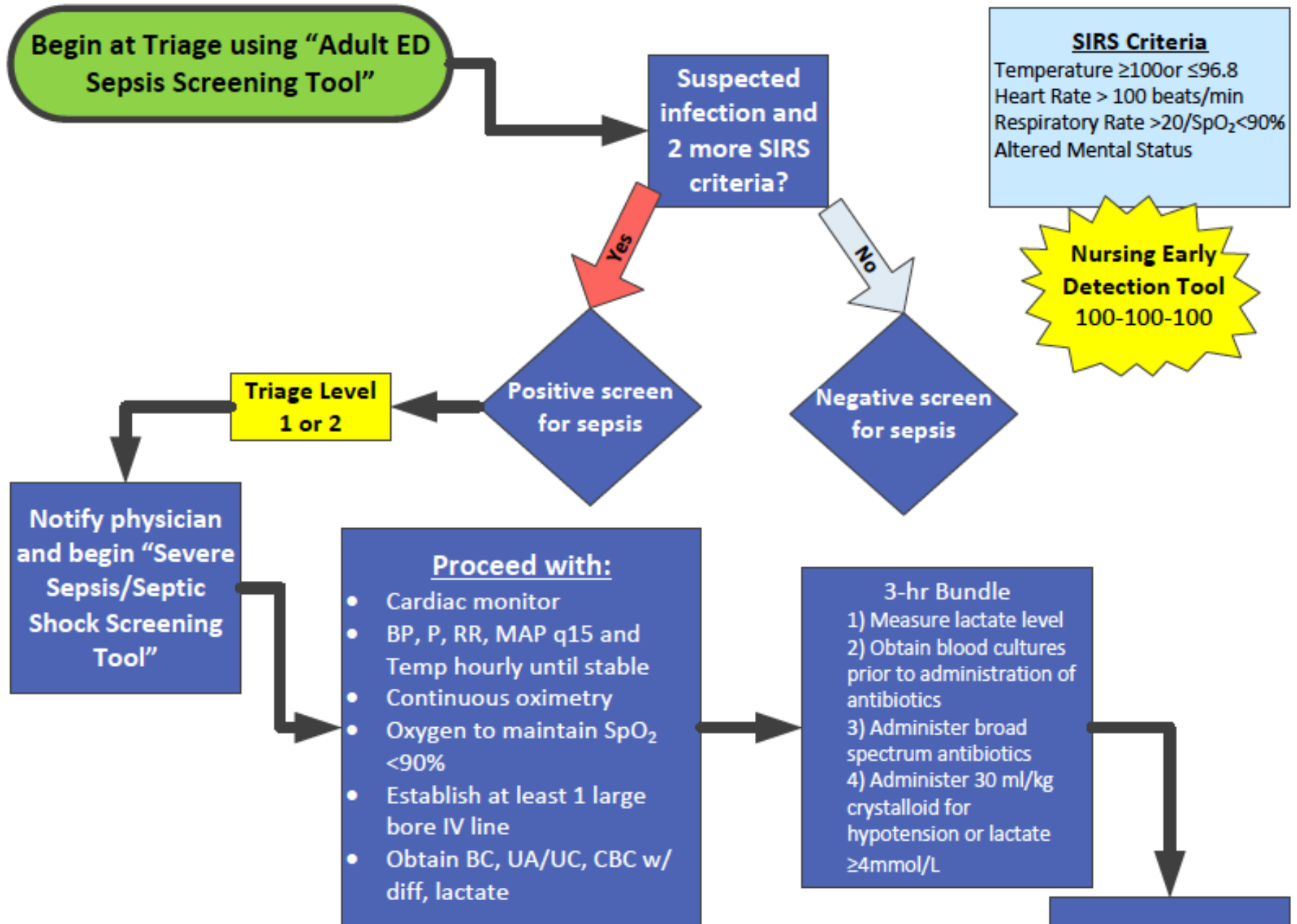
Screening in the ambulance



Emergency department & general floor sepsis algorithm



Emergency Department & General Floor Sepsis Algorithm



Positive Triage Screen for Sepsis

- In a patient with suspected infection and 2 or more of the following: (3-100 rule)
 - Temp >100
 - HR > 100
 - Systolic BP < 100
 - RR > 20 /SpO₂ < 90
 - Altered LOC

Nurse response to positive Sepsis screen

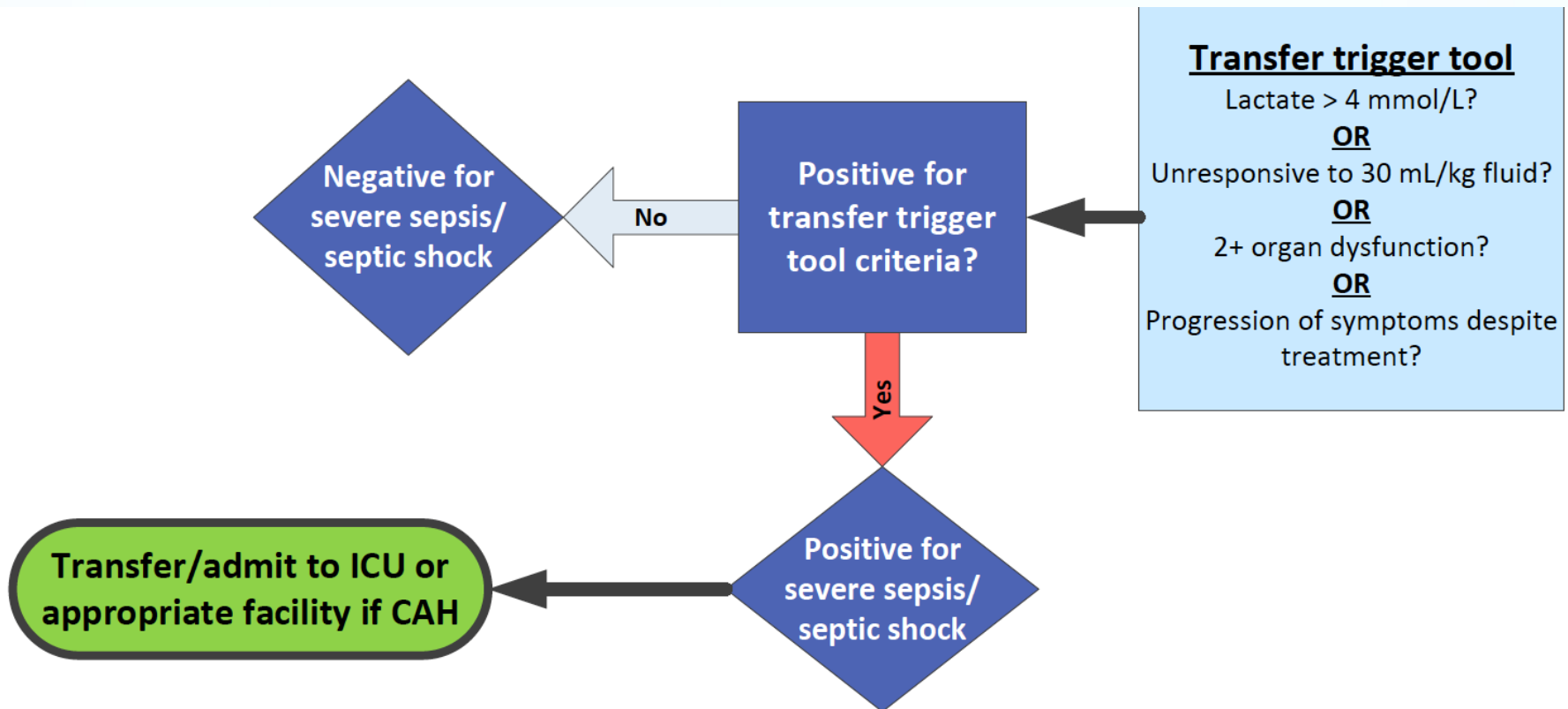
- Initiate evaluation for Severe Sepsis/Septic Shock
- Order stat Lactate, CBC, Blood culture, UA/UC, metabolic profile
- Cardiac monitor, non-invasive BP monitor, oximetry
- Start IV fluids
- Notify physician immediately

Trigger to implement severe sepsis/septic shock resuscitation protocol

The patient has all three of the following:

1. Suspected infection
2. Meets SIRS criteria: (at least 2 of 4)
 - Temp > 100.4 or < 96.8F
 - RR > 20
 - HR > 100
 - WBC > 12,000 or < 4,000
3. Systolic BP < 90 after fluid bolus **OR**
Lactate > 4, **OR**
2 or more organ dysfunctions

Transfer Trigger Tool



Severe Sepsis/Septic Shock Protocol

- Every hospital should have a written protocol for the initial resuscitation of severe sepsis
 - Currently only 28% of Minnesota hospitals have a sepsis protocol in the ED and 25% in the inpatient unit.
- Protocol based on:
 - 2012 Surviving Sepsis Campaign Guideline and Bundles

Recognizing Sepsis in Older Patients



Difficulties in recognizing Sepsis in older patients

- Fever may be absent
 - 13% in patients > 65yrs vs. 4% in < 65yrs
- Lower incidence of tachycardia and hypoxemia
- Infection may not be apparent
 - More likely to have altered mental status (confusion, delirium)
 - Other non specific complaints such as weakness, falls, anorexia, incontinence

Ask The Question?

“Could this be Sepsis?”

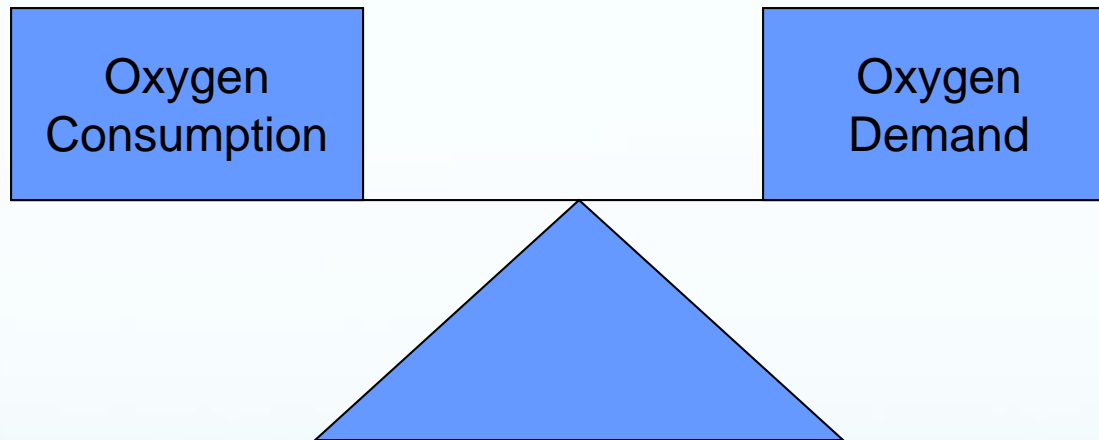
- Patients presenting with:
 - Weakness
 - Syncope
 - Vomiting
 - Confusion

Why lactate?



Why lactate?

- When oxygen demand exceeds consumption, anaerobic metabolism results in lactic acidosis.



Lactate

- Lactate is a marker of “occult” severe sepsis or septic shock before hypotension or altered mental status develops.
- Any lactate elevation above normal is associated with increased mortality
- Lactate ≥ 4 is reported as a Critical Value by RMC lab.

Every hospital should be able to perform a lactate with results within 30 minutes

In a recent survey by the Minnesota Hospital Association, 24% of Minnesota hospitals are not able to perform a lactate.

“If a patient is sick enough to order a blood culture, then they are sick enough to order a lactate” (Scott Davis, MD, Director of ICU SCH)

Link lactate to blood
culture order

What if my hospital can not perform a lactate?



- I-Stat Analyzer
- Cost ~ \$10,000
- Can also perform blood gas, electrolytes.
- Can be a backup for platform analyzer

Is there a role for Procalcitonin in screening?

- Precursor of calcitonin.
- Rises in response to proinflammatory stimulus especially of bacterial origin.
- Can be used as a marker of severe sepsis caused by bacteria
- May help differentiate sepsis from non-bacterial causes of SIRS
- Not a good screening test for bacteremia as sensitivity is 76% and specificity is 70%

Early Antibiotics

- **2012 Severe Sepsis Guideline**
 - “The administration of effective intravenous antimicrobials within the first hour of recognition of septic shock (grade 1B) and severe sepsis (grade 1C) should be the goal of therapy”

Hospital Mortality by Time to Antibiotics

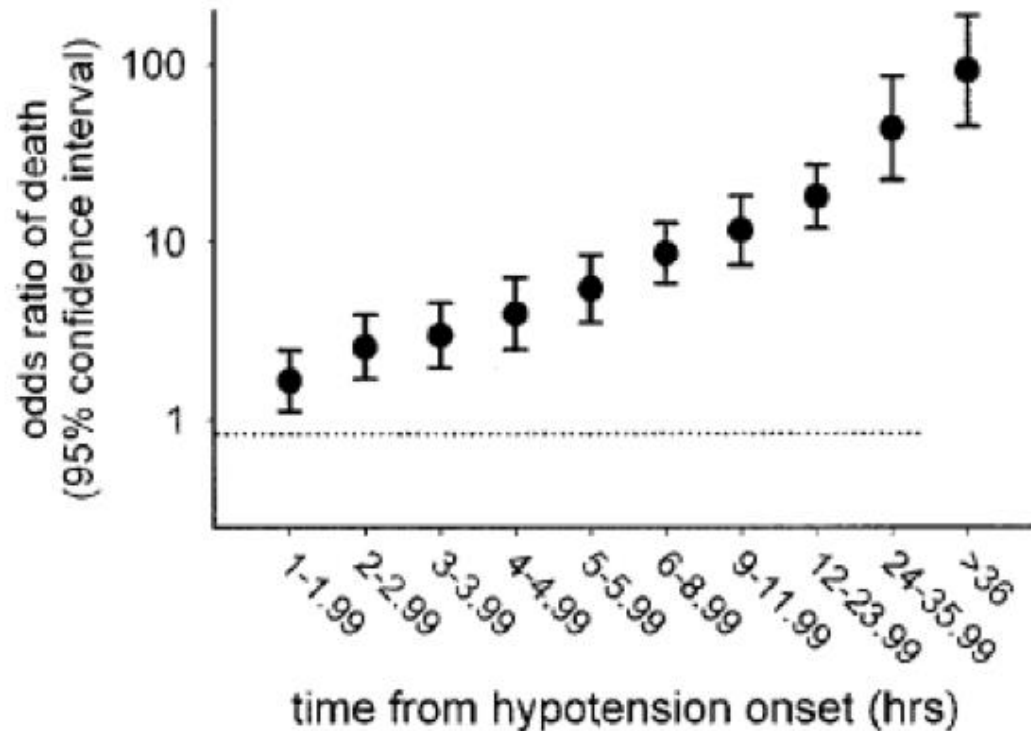


Figure 2. Mortality risk (expressed as adjusted odds ratio of death) with increasing delays in initiation of effective antimicrobial therapy. Bars represent 95% confidence interval. An increased risk of death is already present by the second hour after hypotension onset (compared with the first hour after hypotension). The risk of death continues to climb, though, to >36 hrs after hypotension onset.

In septic shock every hour delay in antibiotic administration was associated with a 7.6% decrease in survival *Kumar, Crit Care Med 2006; 34:1589*

In patients with
undifferentiated shock, start
broad spectrum antibiotics as
soon as possible

Early Antibiotics Treatment

- **Empiric initial regimen:**

- Piperacillin/tazobactam 4.5 gm IV q6h
- Vancomycin 20mg/kg, max 2gm) IV stat then adjust per pharmacy

If penicillin allergy, then:

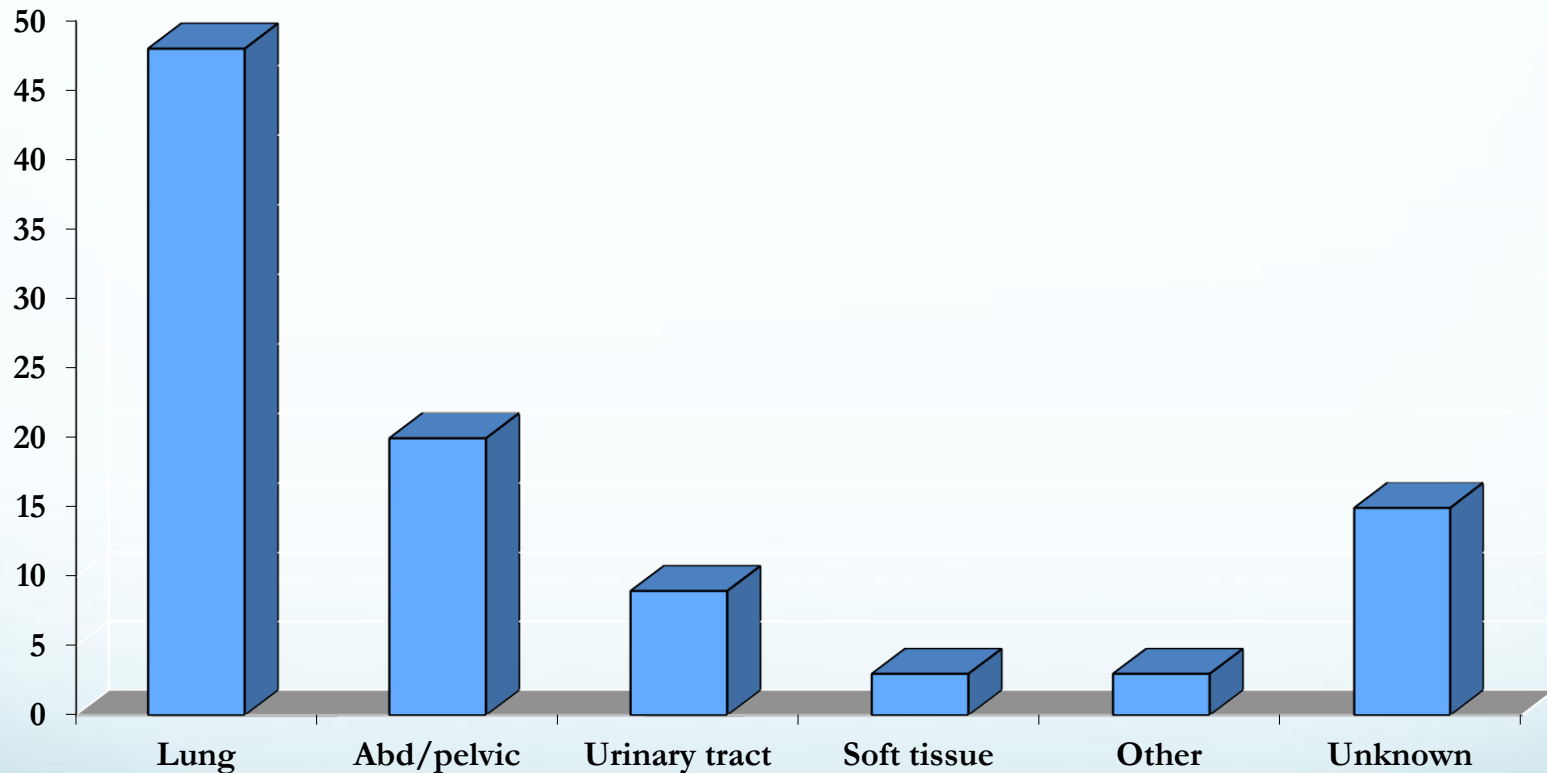
- Meropenem 1g IV q8hr

If community acquired pneumonia suspected, add:

- Levofloxacin 750mg IV q24hr or
- Azithromycin 500mg IV q24hrs

Source Control

Sites of Infection in Severe Sepsis

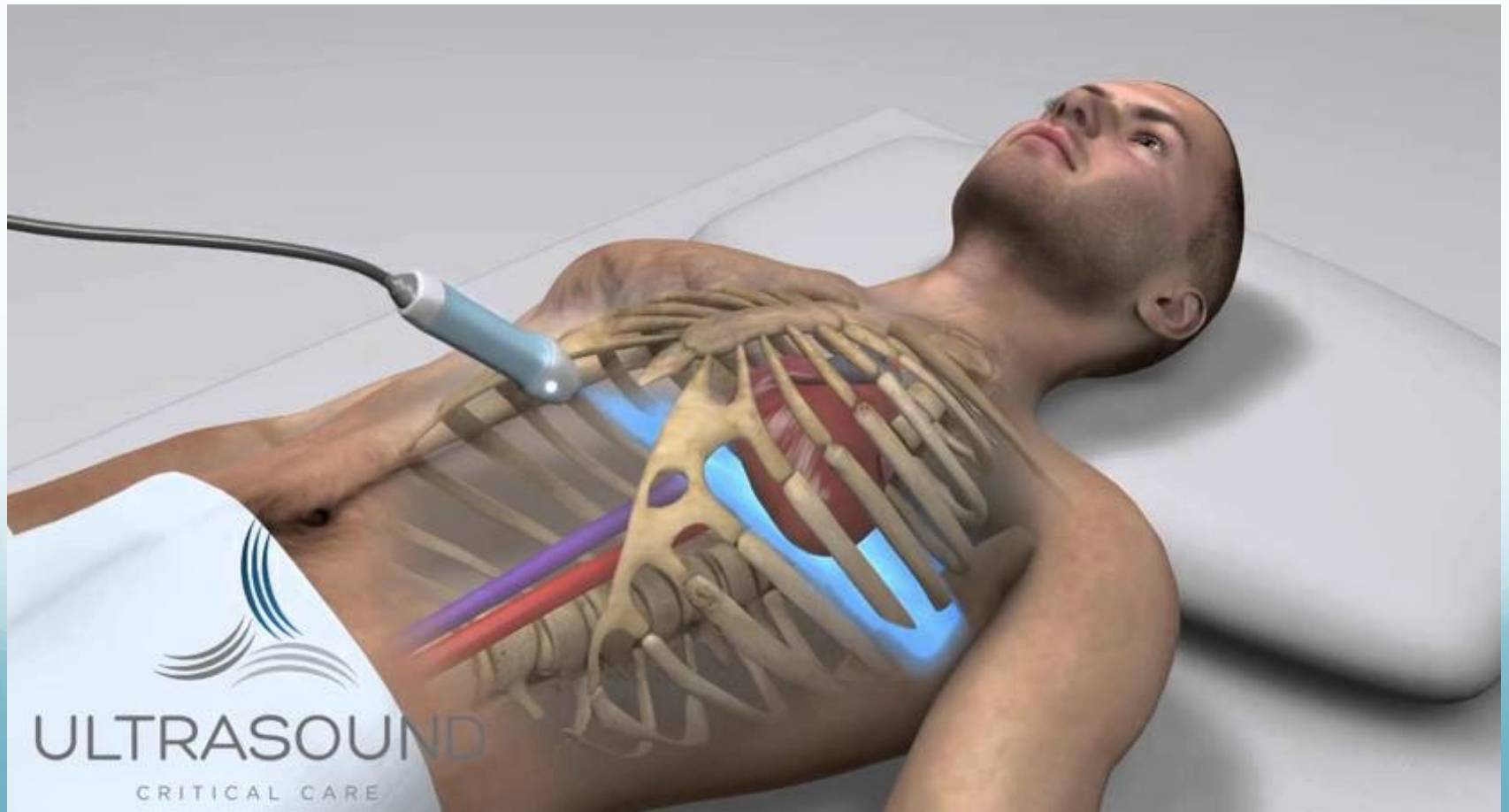


Wheeler NEJM
1999

Imaging

- Limited bedside abdominal ultrasound
- CT – chest/abdomen/pelvis

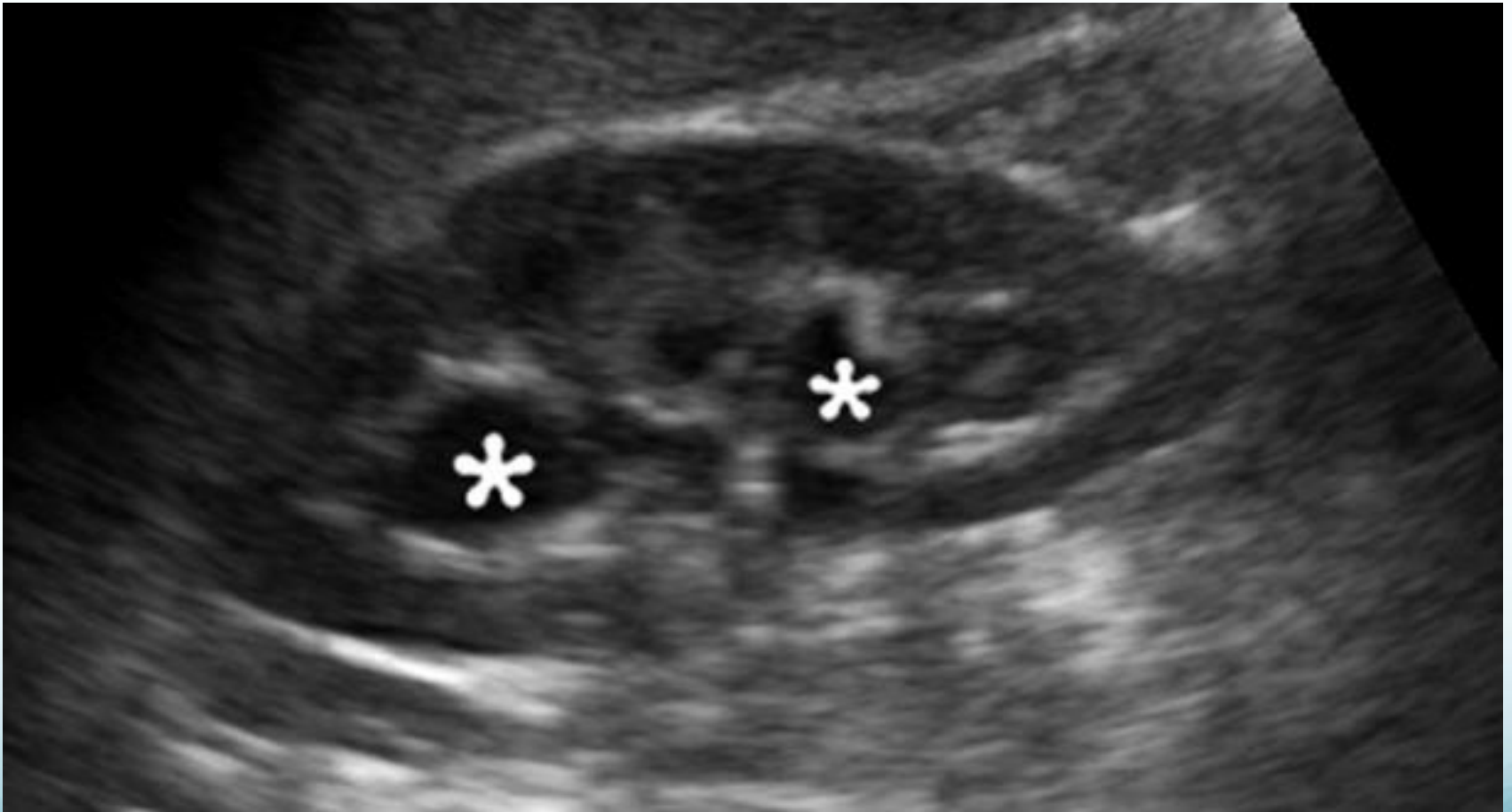
Focused Abdominal Sonography in Sepsis (FASS Exam)



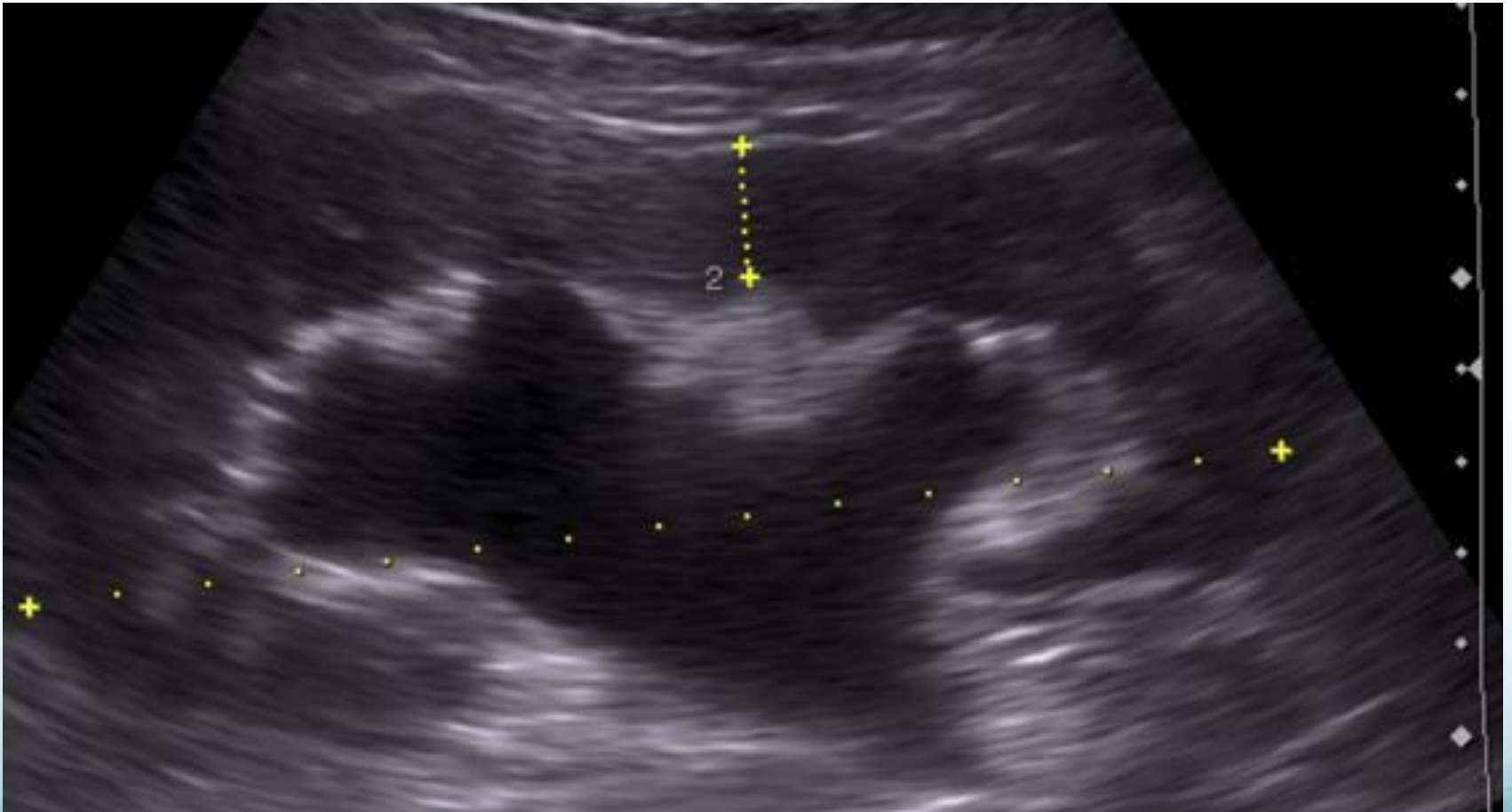
FASS Exam (5 views)

- Right Kidney
- Left Kidney
- Bladder and Pelvis
- Gallbladder
- Subcostal cardiac and IVC

Hydronephrosis



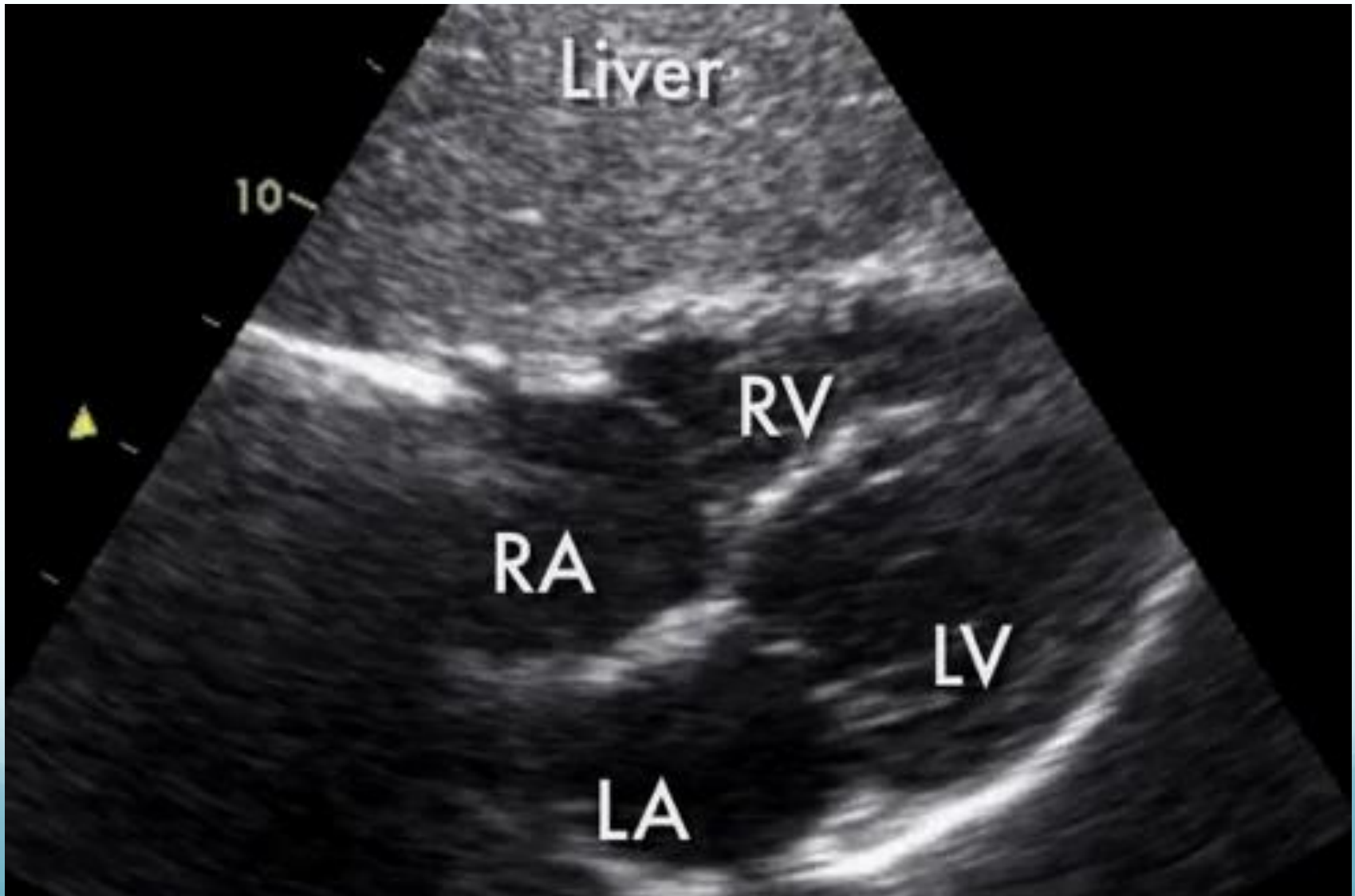
Hydronephrosis



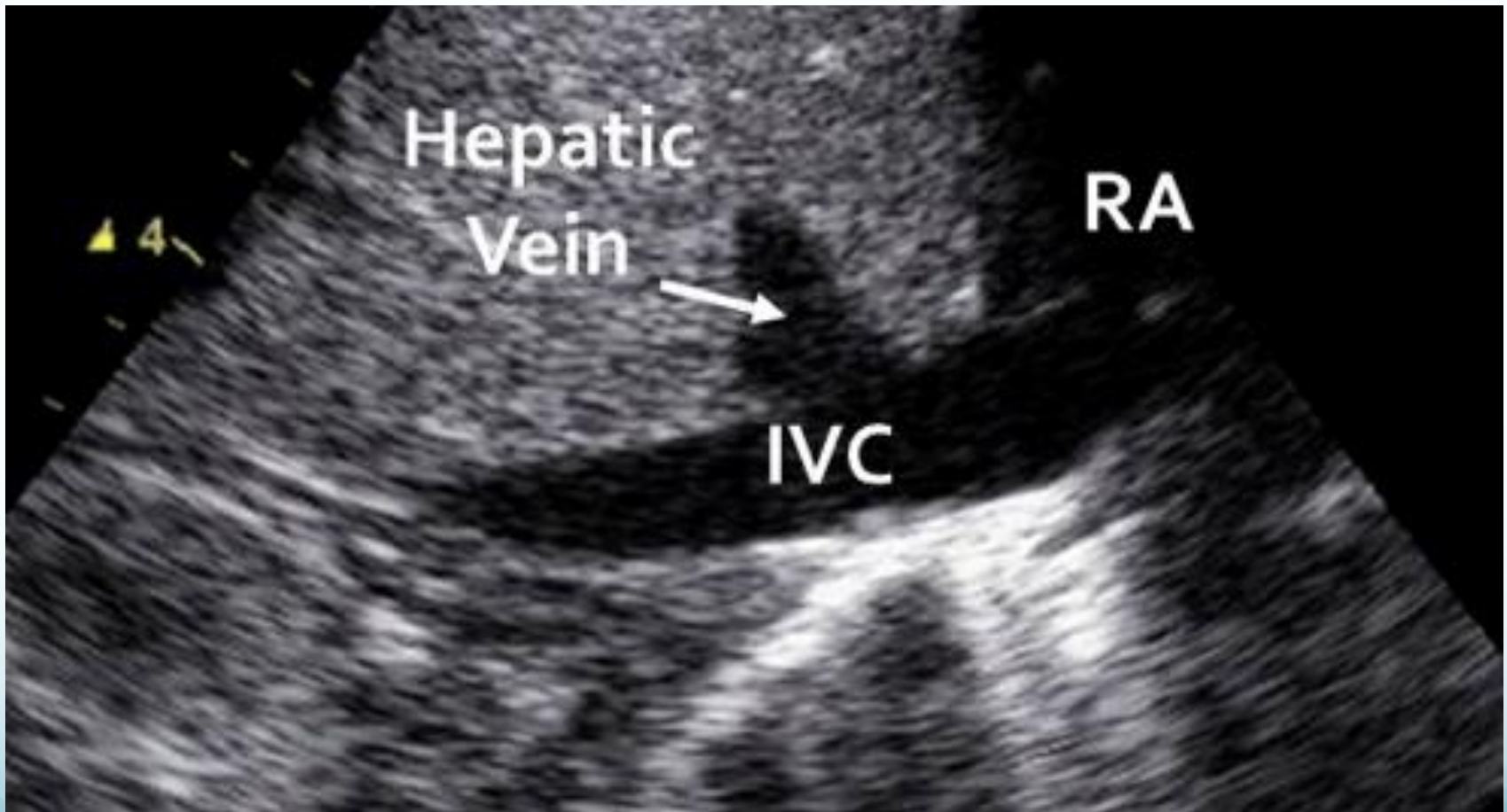
Cholecystitis



Subcostal Cardiac



IVC



Ridgeview Protocol for Severe Sepsis/Septic Shock



Sepsis Team

- ED physician
- ED RN
- Respiratory Therapist
- Pharmacist
- Lab technician
- Radiology technician
- ICU RN
- ICU MD

Early Goal Directed Therapy in Severe Sepsis



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

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

ABSTRACT

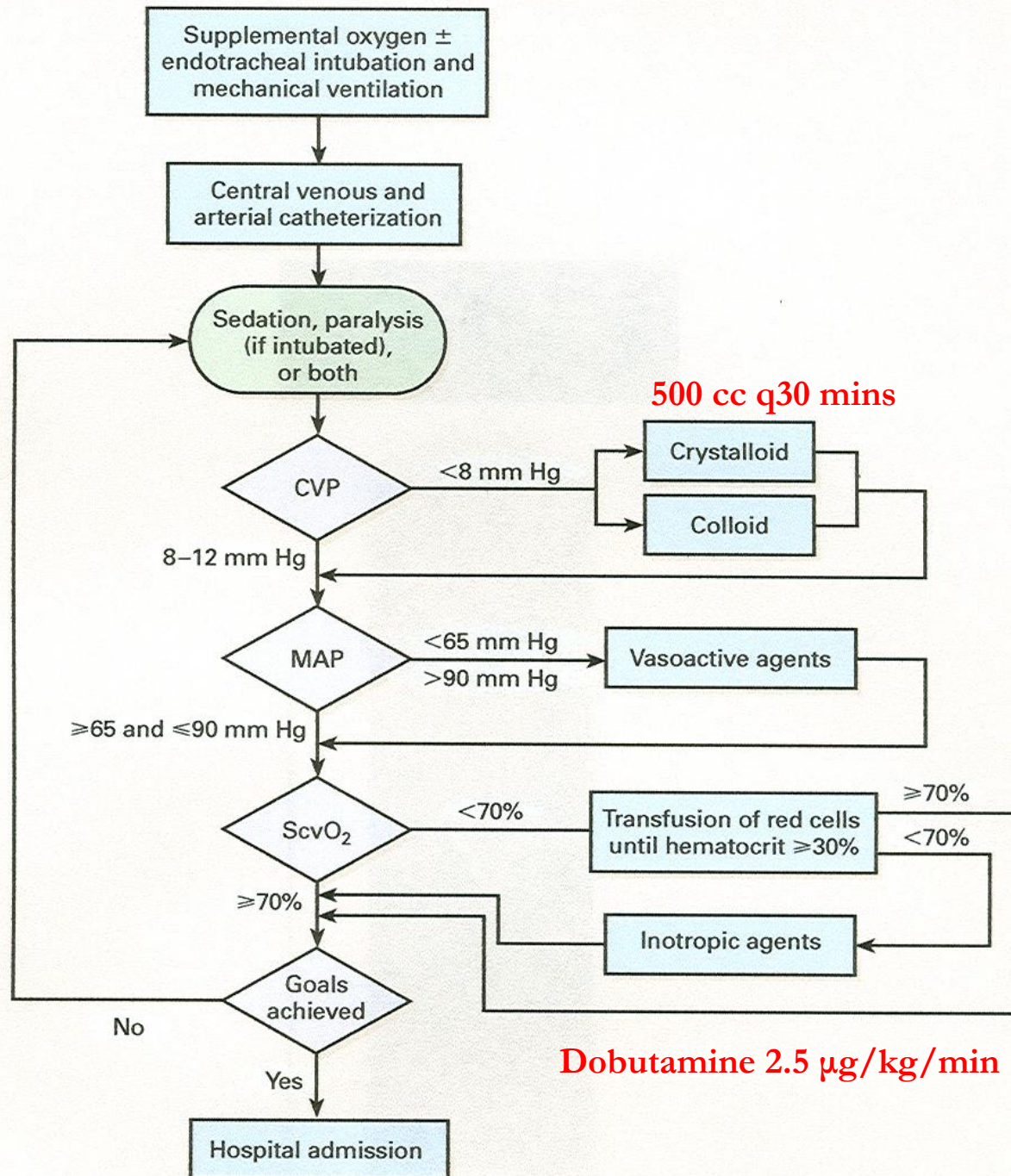
Background Goal-directed therapy has been used for severe sepsis and septic shock in the intensive care unit. This approach involves adjustments of cardiac preload, afterload, and contractility to balance oxygen delivery with oxygen demand. The purpose of this study was to evaluate the efficacy of early goal-directed therapy before admission to the intensive care unit.

Methods We randomly assigned patients who arrived at an urban emergency department with severe sepsis or septic shock to receive either six hours of early goal-directed therapy or standard therapy (as a control) before admission to the intensive care unit. Clinicians who subsequently assumed the care of the patients were blinded to the treatment assignment. In-hospital mortality (the primary efficacy outcome), end points with respect to resuscitation, and Acute Physiology and Chronic Health Evaluation (APACHE II) scores were obtained serially for 72 hours and compared between the study groups.

Results Of the 263 enrolled patients, 130 were randomly assigned to early goal-directed therapy and 133 to standard therapy; there were no significant differences between the groups with respect to base-line characteristics. In-hospital mortality was 30.5 percent in the group assigned to early goal-directed therapy, as compared with 46.5 percent in the group assigned to standard therapy ($P=0.009$). During the interval from 7 to 72 hours, the patients assigned to early goal-

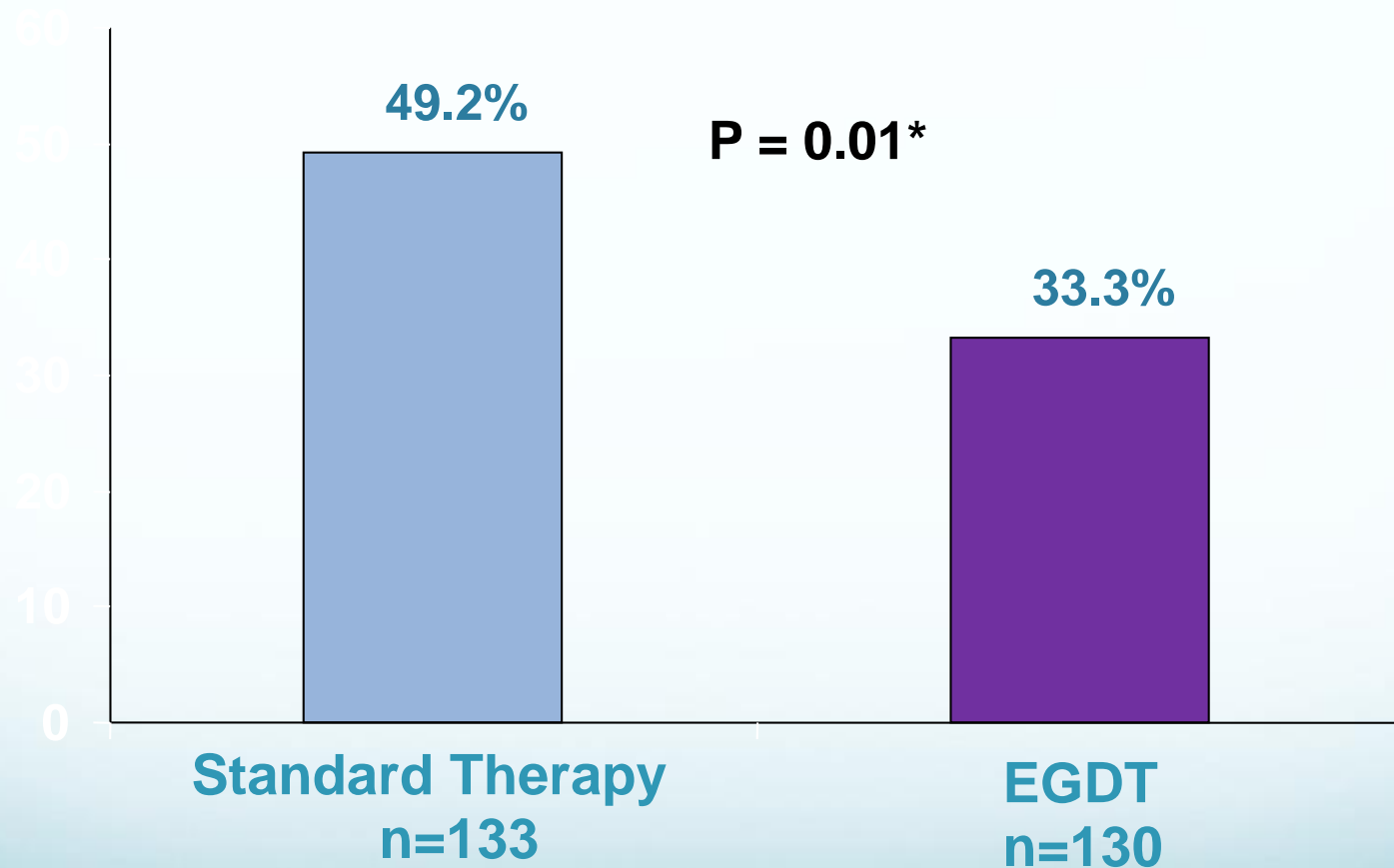
THE systemic inflammatory response syndrome can be self-limited or can progress to severe sepsis and septic shock.¹ Along this continuum, circulatory abnormalities (intravascular volume depletion, peripheral vasodilatation, myocardial depression, and increased metabolism) lead to an imbalance between systemic oxygen delivery and oxygen demand, resulting in global tissue hypoxia or shock.² An indicator of serious illness, global tissue hypoxia is a key development preceding multiorgan failure and death.² The transition to serious illness occurs during the critical "golden hours," when definitive recognition and treatment provide maximal benefit in terms of outcome. These golden hours may elapse in the emergency department,³ hospital ward,⁴ or the intensive care unit.⁵

Early hemodynamic assessment on the basis of physical findings, vital signs, central venous pressure,⁶ and urinary output⁷ fails to detect persistent global tissue hypoxia. A more definitive resuscitation strategy involves goal-oriented manipulation of cardiac preload, afterload, and contractility to achieve a balance between systemic oxygen delivery and oxygen demand.² End points used to confirm the achievement of such a balance (hereafter called resuscitation end points) include normalized values for mixed venous oxygen saturation, arterial lactate concentration, base deficit, and



Early Goal-Directed Therapy Results

28-day Mortality



*Key difference was in sudden CV collapse, not MODS

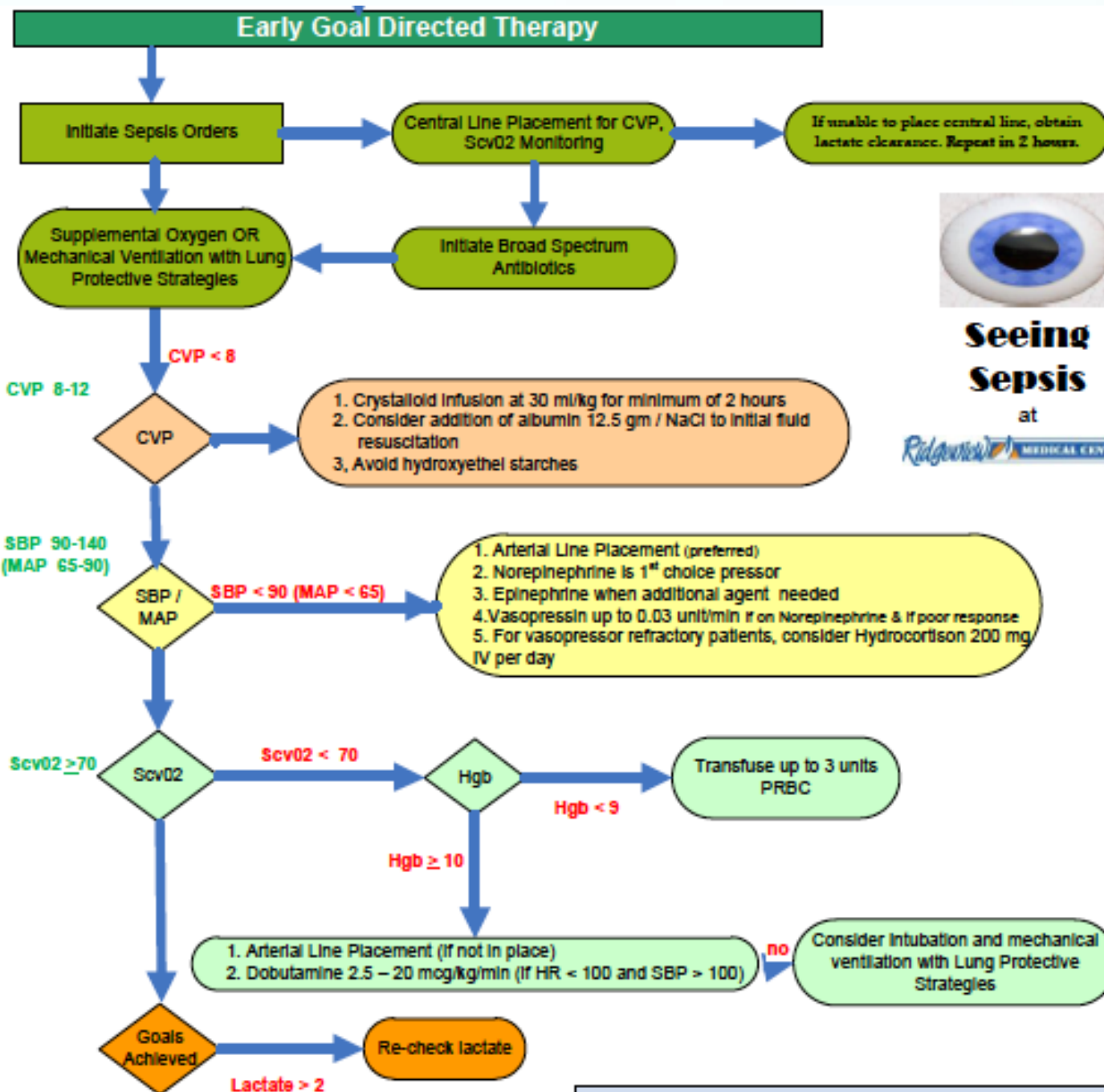
Early Goal Directed Therapy Protocol

- Goal Directed Resuscitation
 - May start in ED or ICU
 - Recommend placement of a Central Line for monitoring of CVP, ScvO₂ and administration of vasopressors if needed.
 - Arterial line recommended in septic shock requiring vasopressors

Early Goal Directed Therapy

- Goals within 6 hrs:
 - CVP 8-12 mmHg
 - MAP \geq 65
 - UO \geq 0.5 ml/kg/hr
 - Superior vena cava oxygen saturation (ScvO₂) of 70%
 - Lactate normalization

The Golden Hours of Early Intervention



ORIGINAL ARTICLE

A Randomized Trial of Protocol-Based Care for Early Septic Shock

March 18, 2014

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Goal-Directed Resuscitation for Patients with Early Septic Shock

The ARISE Investigators and the ANZICS Clinical Trials Group*

Oct 1, 2014

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Trial of Early, Goal-Directed Resuscitation for Septic Shock

Paul R. Mouncey, M.Sc., Tiffany M. Osborn, M.D., G. Sarah Power, M.Sc., David A. Harrison, Ph.D., M. Zia Sadique, Ph.D., Richard D. Grieve, Ph.D., Rahi Jahan, B.A., Sheila E. Harvey, Ph.D., Derek Bell, M.D., Julian F. Bion, M.D., Timothy J. Coats, M.D., Mervyn Singer, M.D., J. Duncan Young, D.M., and Kathryn M. Rowan, Ph.D., for the ProMISe Trial Investigators*
April 2, 2015

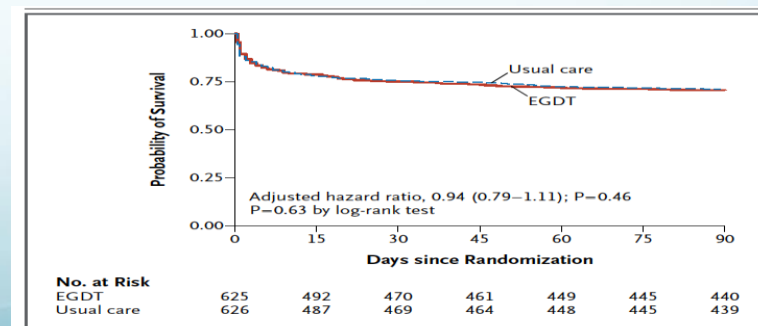
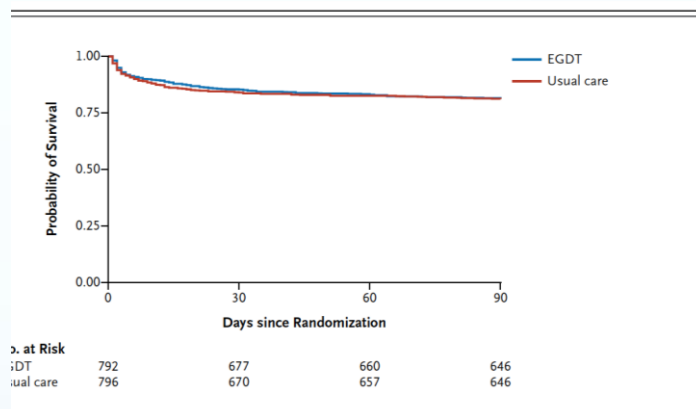
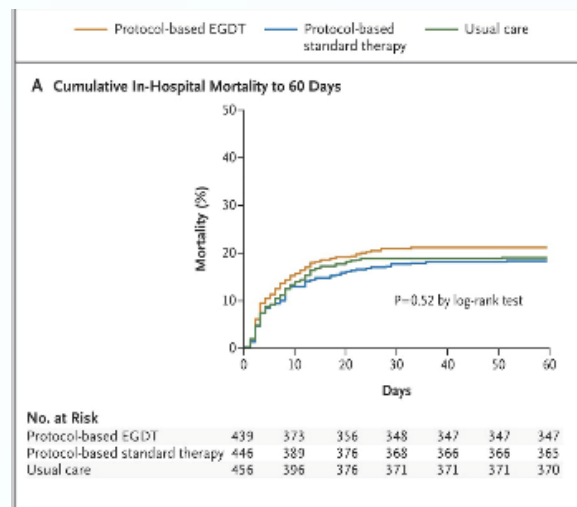


Figure 2. Kaplan-Meier Survival Estimates. Shown is the probability of survival for patients with severe sepsis receiving early, goal-directed therapy (EGDT) and those receiving usual care at 90 days.

	Rivers	PROCESS	ARISE	PROMISE
Location	US	US	Austrailia	United Kingdom
N	263	1,351	1,600	1,260
Fluids before Randomization	20-30cc/kg	20-30cc/kg	1,000cc	1,000cc
Intervention	EGDT 6hrs	EGDT 6hrs	EGDT 6hrs	EGDT 6 hrs
Control	Usual care	Protocol Rx Usual care	Usual care	Usual care
Primary endpoint	In hosp mortality	60 day mortality	90 day mortality	90 day mortality
Intervention	30.5%	21% (EGDT) 18.2% (Proto)	18.6%	29.2%
Usual Care	46.5%	18.9%	18.8%	29.2%

Interventions in Usual Care

	PROCESS	ARISE	PROMISE
CVP line	56.5% 57.9%	62%	50.9%
Art line	?	76%	62.2%
Vasopressors	52.2% 44.1%	58%	46.6%
Fluids in 1 st 6 hrs	3,300cc 1,200cc	1,713cc	1,750cc

How do we apply this recent new data?

- Early diagnosis of septic shock is essential
- Lactate still useful for screening
- Early fluid resuscitation still important (all groups in Process received more than 2 liters prior to randomization)
- Early Antibiotics (75% received antibiotics before randomization)
- Having a protocol is important (70% of hospitals had some form of sepsis protocol)
- Central lines used in 50-60% of control groups

Who needs a central line?

- IV access issues
- Patients needing vasopressors
- Unable to assess fluid responsiveness with ultrasound

Resuscitation Bundles

- Operationalize Guidelines
- Measurement of Quality
- Hospitals will begin reporting on Sepsis measures Oct 1, 2015
- Pay for Performance - 2017



NATIONAL
QUALITY FORUM

Surviving Sepsis Campaign/National Quality Forum Bundle

- TO BE COMPLETED WITHIN 3 HRS*:
 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 mmole/L

* “Time of presentation” is defined as the time of triage in the Emergency Department or, if presenting from another care venue, from the earliest chart annotation consistent with all elements severe sepsis or septic shock ascertained through chart review

Surviving Sepsis Campaign/National Quality Forum Bundle

- TO BE COMPLETED WITHIN 6 HRS*:
 5. Apply vasopressors (for hypotension that does not respond to fluid resuscitation) to maintain a mean arterial pressure (MAP) ≥ 65 mmHg.
 6. In the event of persistent arterial hypotension after initial fluid administration (MAP < 65 mm Hg) or if the initial lactate was ≥ 4 mmol/L, ***re-assess volume status and tissue perfusion and document findings according to Table 1.***
 7. Re-measure lactate if initial lactate was elevated*

*Targets for quantitative resuscitation included in the guidelines are CVP of ≥ 8 mm Hg, ScvO₂ of $\geq 70\%$ and lactate normalization.

Table 1

DOCUMENT REASSESSMENT OF VOLUME STATUS
AND TISSUE PERFUSION WITH:

EITHER

- Repeat focused exam (after initial fluid resuscitation) by licensed independent practitioner including vital signs, cardiopulmonary, capillary refill, pulse and skin findings

OR TWO OF THE FOLLOWING:

- Measure CVP
- Measure ScvO₂
- Bedside cardiovascular ultrasound
- Dynamic assessment of fluid responsiveness with passive leg raise or fluid challenge

How Can We Implement a Sepsis Protocol at our Hospital?

- Organize a Multidisciplinary Team
- Use Process Improvement Techniques
- Make use of Resources
 - Surviving Sepsis Campaign
 - Minnesota Hospital Association

Sepsis Care at Ridgeview Medical



Ridgeview Sepsis Initiative

- Participants in the IHI *“Improving Outcomes for the High Risk and Critically Ill Patient”* Collaborative
- Inaugural multidisciplinary Sepsis Huddle Team 2008



Sepsis Huddle Team

- 2008 began weekly 30 minute huddles

- Membership

ED Physician

Hospitalist

Primary Care Providers ED Nursing

Critical Care Nursing

Laboratory

Pharmacy

Respiratory Care

Quality Improvement

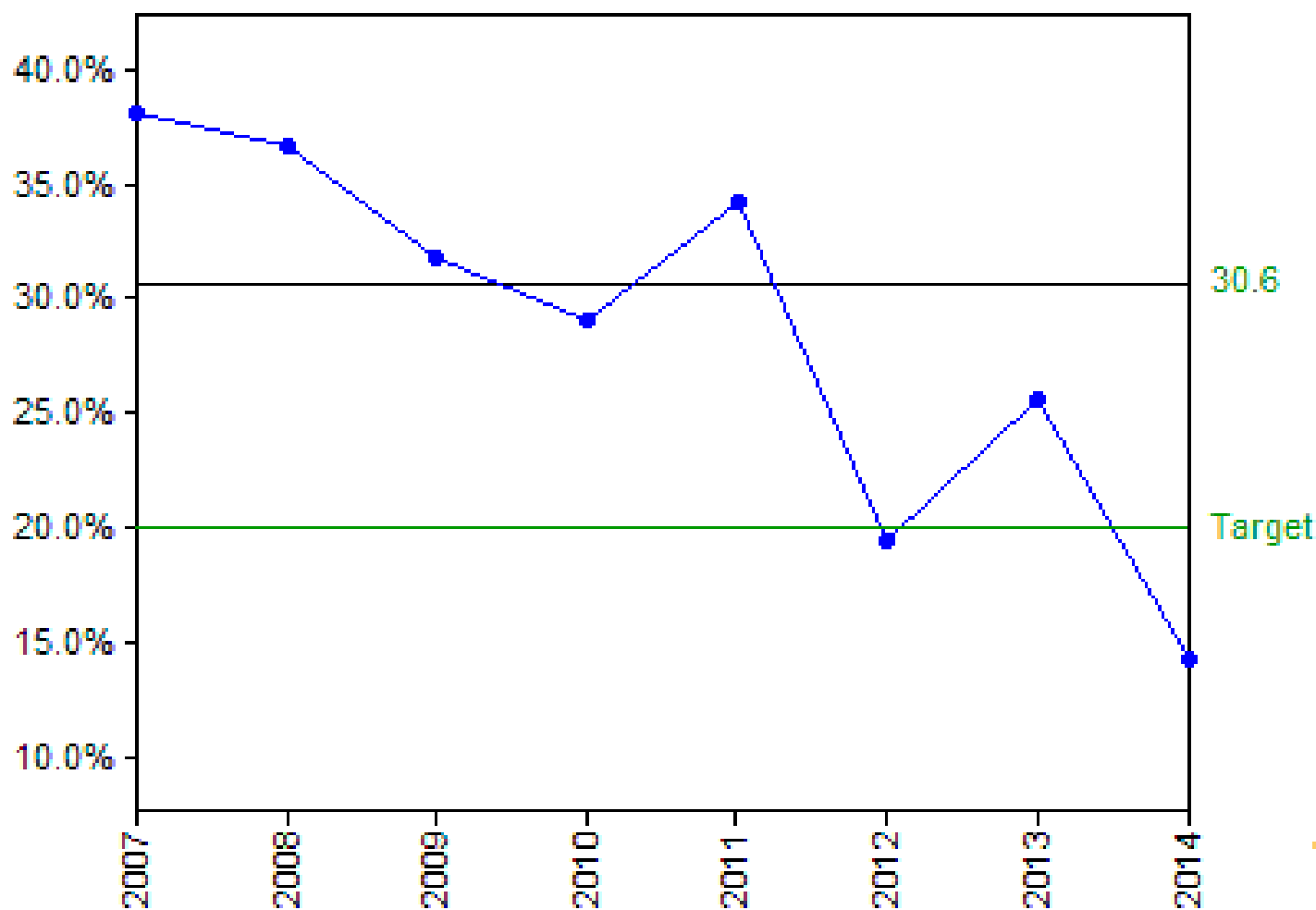
Ridgeview Sepsis Protocol

- *Adult Severe Sepsis/Septic Shock* order set
- Hospital wide colored pictorial *Stop Sepsis* algorithm
- Sepsis Scorecard
- *ED Severe Sepsis/Septic Shock*
Screening tool and checklist
- RRT protocol includes screening for severe sepsis
- Sepsis Response Team



Ridgeview Sepsis Mortality

SEP-Historical Sepsis Mortality by Year



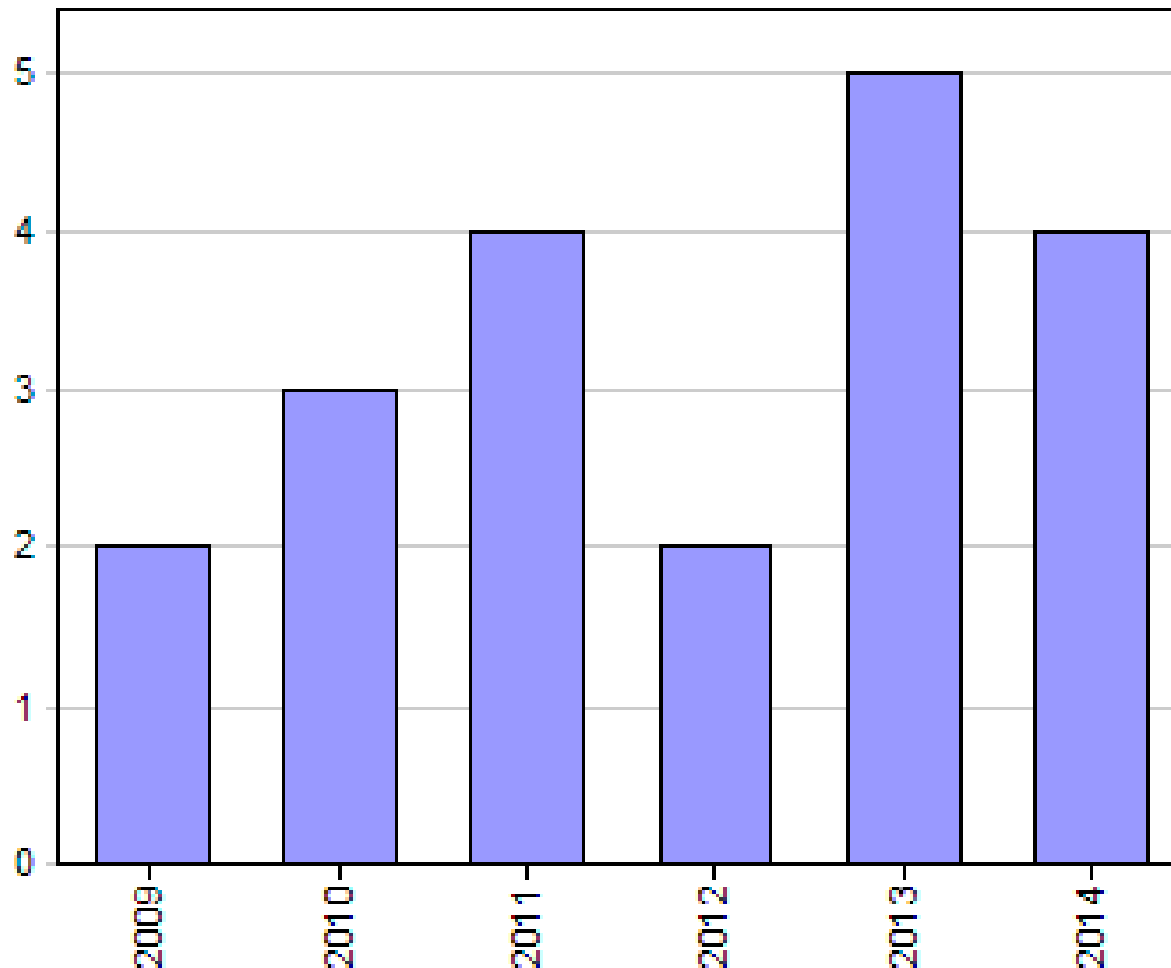
Ridgeview Lives Saved

Avg =3

SEP-Sepsis Lives Saved

Bar Chart

+



-

Financial Impact

- Reduced LOS
- Reduced Cost of care:
 - \$213,068 savings: Jan 2013 - June 2014

Ridgeview Sepsis Scorecard

Quality

▲	SEP-Percent of Patients identified in ICU	100.0%	n/a		Jun 2014
▼	SEP-Percent of Patients identified in ED	0.0%	n/a		Jun 2014
—	SEP-Percent of Comfort Care/palliative care/AD contradicting sepsis Rx	0.0%	n/a		Jun 2014
—	SEP-Percent of ED or IP sepsis screening tool used	100.0%	n/a		Jun 2014
● —	SEP-Percent of Serum lactate measured within 3 hrs of Time Zero	100.0%	95.0%		Jun 2014
● —	SEP-Percent of broad spectrum antibiotics administered w_in 3 hrs from TZ	100.0%	95.0%		May 2014
● —	SEP-Percent of blood cultures obtained prior to antibiotic administration	100.0%	95.0%		Jun 2014
	SEP-Percent of initial minimum of 30ml/kg of crystalloid started within 3 hrs of TZ	n/a	95.0%		Jul 2014
	SEP-Percent of Vasopressors administered for a MAP less than 65 w_in 6 hrs of TZ	n/a	n/a		Jul 2014
● —	SEP-Percent of central line placed within 6 hrs of Time Zero	0.0%	50.0%		Jun 2014
	SEP-Percent of CVP measured within 6 hrs of Time Zero	n/a	95.0%		Jul 2014
	SEP-Percent of ScvO2 measured within 6 hrs of Time Zero	n/a	95.0%		Jul 2014
● ▼	SEP-Percent of serum lactate re-measured within 6 hrs of Time Zero	0.0%	95.0%		Jun 2014

CMS *LEAPT*

Leading Edge Advance Practice Topics

- LEAPT created by CMS
- Partnering with MHA HEN (Hospital Engagement Network)
- Embed evidence based interventions of the *Surviving Sepsis Campaign* into care processes in hospitals across the state and beyond





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PATIENT SAFETY



You are here: [Patient safety in Minnesota hospitals](#) > [Current Safety & Quality Initiatives](#) > [Severe Sepsis and Septic Shock](#)

Patient Safety

Current Safety & Quality Initiatives

- [Adverse Drug Events](#)
- [Controlling CDI](#)
- [Delirium](#)
- [Emergency Overhead Pages](#)
- [Falls](#)
- [Health Care-Associated Infections](#)
- [Obstetrics & Newborn](#)
- [Patient & Family Engagement](#)
- [Patient Handling](#)
- [Patient Safety Culture](#)
- [Pressure Ulcers](#)
- [Preventing Harm Across the Board](#)

SEEING SEPSIS: EARLY IDENTIFICATION SAVES LIVES

Severe sepsis can be associated with a mortality rate of up to 50 percent in hospitals that do not utilize an early detection and treatment bundle. The Minnesota Hospital Association, funded by the CMS' Leading Edge Advanced Practice Topics (LEAPT), has coordinated the development of this Seeing Sepsis Tool Kit to facilitate the adoption of severe sepsis early detection tools and the Surviving Sepsis Campaign three- and six-hour care bundles by hospitals of all sizes.

For more information, contact [Karen Olson](#), MHA HEN patient safety/quality coordinator, 651-603-3521.

 [Seeing Sepsis Tool Kit](#)

<http://www.mnhospitals.org/patient-safety/current-safety-quality-initiatives/severe-sepsis-and-septic-shock>

SEEING SEPSIS VIDEO GALLERY

Sepsis Physician Simulcast

View a rebroadcast of the Sepsis Physician Simulcast and learn how St. Cloud Hospital decreased mortality due to severe sepsis/septic shock by 49 percent, saving more than 400 lives. Also see how Ridgeview Medical Center in Waconia made early identification of sepsis in the E.D. a priority and decreased mortality due to severe sepsis/septic shock by 60 percent.



[Click above to view presentation](#)

Seeing sepsis part 1: Definitions

Learn background definitions and basic pathophysiology for the sepsis continuum.



[Watch Video](#)

Seeing sepsis part 2: Early detection

Learn tips and tools to help front line staff detect sepsis early,



72 yr old female

- Presented to the ED with a complaint of 36 hrs of low back pain and “flu like” symptoms with vomiting and diarrhea.
- Initial Vitals: (2:49am) BP 138/62, HR 93, T 98.6 R 20
- Repeat Vitals:(4:03am) T 103, BP 143/56, HR 108, R 22
- Lab: WBC 12.2 with 93% PMNs, Lactate 3.4, UA positive nitrites.
- Blood cultures, broad spectrum antibiotics and IV fluids started in the ED.
- Abd/Pelvic NC CT scan: 3mm stone distal left ureter with mild to mod hydronephrosis

- Urology was consulted and the patient was admitted to a monitored bed at 5:00am
- At 7:41am she became abruptly hypotensive with systolic BP in the 70s.
- Crystalloid volume resuscitation was initiated and was taken to the OR promptly for urethral stenting.
- Intraoperatively, CVP and arterial lines placed
 - Initial CVP 6, MAP 50, ScvO₂ 82%
 - CVP improved with fluid resuscitation
 - Required pressor support with Norepinephrine
 - Lactate 6 hrs later 1.9 mmole/L
- She developed acute kidney injury and a mild coagulopathy. Blood and Urine cultures: positive for E.coli

Bundle goals achieved?

- 3 hr:
 - Lactate drawn – yes
 - Blood cultures prior to antibiotics - yes
 - Broad spectrum antibiotics – yes
 - Fluids: 30ml/kg for hypotension – yes
- 6 hr
 - Apply vasopressors for hypotension – yes
 - Measure CVP – yes
 - Measure ScvO₂ – yes
 - Remeasure Lactate if elevated - yes

Key Points

- Recognize severe sepsis/septic shock as a time critical emergency
- Screen for Sepsis – in the ED, Medical Floor and ICU
- Utilize lactates if screen positive for sepsis
- Aggressive fluid resuscitation (30/kg initial bolus)
- Early broad spectrum antibiotics and source control
- Repeat lactates to monitor resuscitation

Thank you