ADEQUACY OF FLUID RESUSCITATION

OHA Statewide Sepsis Initiative

August 17, 2016

OHA QUALITY PROGRAMS TEAM

Collaborating for a Healthy Ohio

Amy Andres
Senior Vice President of Quality and Data

James Guliano
Vice President of Quality Programs

Rosalie Weakland

Ellen Hughes

Ryan Everett

Carol Jacobson

Rhonda Major-Mack

Paul Hicks

AGENDA

OHA Statewide Sepsis Initiative

I. Michael Taylor, MD, FACS
Medical Director, Surgical Critical Care, Cleveland Clinic Fairview Hospital
Medical Director, Critical Care, and Vice Chief of Staff, Cleveland Clinic Avon Hospital
Board of Directors, Sepsis Alliance

II. Kim Biery, DNP, RN, NEA-BC
Director Quality Innovation, Miami Valley Hospital and Miami Valley Hospital South

III. Mary Kate Dilts-Skaggs, DNP, RN, NE-BC
Director of Nursing, Emergency Services, Southern Ohio Medical Center
Elvis Walters, BSN, RN
Nurse Manager, Emergency Services, Southern Ohio Medical Center

Sepsis
Endpoints of Resuscitation

8/17/16

Michael D. Taylor, MD, FACS
Director, Surgical Critical Care—Fairview Hospital, Cleveland, OH
Director, Critical Care—Avon Hospital, Avon, OH

Board of Directors, Sepsis Alliance
http://www.sepsisalliance.org/

Objectives

- Briefly review some key concepts on septic shock from the July 20th presentation
- Discuss the evolution of protocolized fluid resuscitation in the management of sepsis
- Emphasize the role of serum lactate level as an indicator of adequacy of resuscitation
- Summarize the National Inpatient Quality Measures

Shock

- "…tissue perfusion is reduced such that blood flow is inadequate to meet cellular metabolic requirements."
  - Textbook of Critical Care, 6th edition, 2011 Edited by Jean-Louis Vincent

Shock

- "…tissue perfusion is reduced such that blood flow is inadequate to meet cellular metabolic requirements."
  - Textbook of Critical Care, 6th edition, 2011 Edited by Jean-Louis Vincent
- "The rude unhinging of the machinery of life."
  - Samuel Gross, 1872

Sepsis-induced Hypoperfusion

- Increased thrombosis & decreased fibrinolysis
  - Clot forms in the capillaries
    - Decreased microvascular flow
- Capillary leak
  - Increased interstitial fluid
    - Hypovolemia
    - Decreased cardiac compliance
- Increased nitric oxide production
  - Systemic vasodilation
    - Impaired microvascular flow
  - Direct oxidative injury
  - Impaired mitochondrial function

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Septic Shock

- Hypovolemic
- Distributive
- Cardiogenic

Septic Shock

- Hypovolemic
- Distributive
- Cardiogenic

Septic Shock

- We’re pretty good at figuring out when to start the fluid resuscitation
- How do we know if our resuscitation is adequate?

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 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*

N Engl J Med, Vol. 345, No. 19 · November 8, 2001

Single U.S. center
263 patients enrolled
EGDT vs. "usual therapy"
Mortality: EGDT 30.5% Usual therapy 46.5%

↓

Central venous oxygenation as a goal of therapy

Goals of Resuscitation

- Time sensitive
- Aggressive fluids
- Oxygen delivery/consumption

Endpoints of Resuscitation

Lactate

- “Measuring lactate levels can risk stratify patients with suspected sepsis, to prompt aggressive early treatment, and help monitor the impact of therapy”
  - Chee C et al. Crit Care Med 2015

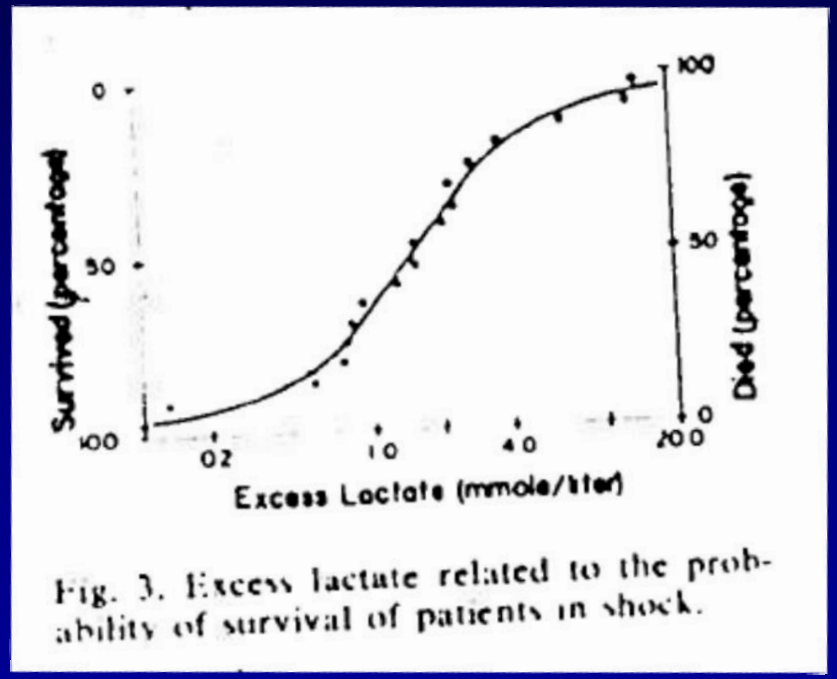


Fig. 3. Excess lactate related to the probability of survival of patients in shock.

Broder G, Weil M. *Science* 1964;143:1458

Endpoints of Resuscitation

- Initial lactate, as well as response of lactate to resuscitative measures correlates with outcome
  - Crit Care Med 1983;11:449

- Patients whose lactate normalizes by 24 hours survive
  - Normalization by 24-48 hours had 25% mortality
  - Elevated lactate after 48 hours had 86% mortality
    - J Trauma 1993;35:584

Lactate Clearance vs Central Venous Oxygen Saturation as Goals of Early Sepsis Therapy

A Randomized Clinical Trial

JAMA, February 24, 2010—Vol 303, No. 8 739

3 U.S. hospitals
300 patients with enrolled
Lactate clearance vs. $S_{cv}O_2$ normalization
No difference in mortality

Table 5. Hospital Mortality and Length of Stay

Variable	Lactate Clearance Group (n = 150)	$Scvo_2$ Group (n = 150)	Proportion Difference (95% Confidence Interval)	*P* Value[b]
In-hospital mortality, No. (%)[a]				
Intent to treat	25 (17)	34 (23)	6 (–3 to 15)	
Per protocol	25 (17)	33 (22)	5 (–3 to 14)	
Length of stay, mean (SD), d				
ICU	5.9 (8.46)	5.6 (7.39)		.75
Hospital	11.4 (10.89)	12.1 (11.68)		.60
Hospital complications				
Ventilator-free days, mean (SD)	9.3 (10.31)	9.9 (11.09)		.67
Multiple organ failure, No. (%)	37 (25)	33 (22)		.68
Care withdrawn, No. (%)	14 (9)	23 (15)		.15

Endpoints of Resuscitation

- Other endpoints that have been considered
  - Base deficit
  - Serum bicarbonate
  - Supranormal oxygen delivery
  - Heart rate variability
  - Orthogonal polarization spectral imaging
  - Transcutaneous oxygenation
  - Transcutaneous, sublingual, esophageal, or gastric capnometry
  - P_aCO_2 to $ETCO_2$ difference

Endpoints of Resuscitation

Lactate

- “The prognostic value of lactate levels exceeds that of blood pressure.”
- “Many studies have confirmed the association between initial serum lactate level and mortality independently of clinical signs of organ dysfunction”
  - Cecconi M, et al. *Intensive Care Med* 2014;40:1795
- “In this multicenter, open-label randomized controlled study, lactate monitoring during the first 8 hours of ICU admission, aimed at reducing lactate levels by at least 20% per 2 hours, significantly reduced ICU length of stay and also ICU and hospital mortality”
  - Jansen TC, et al. *Am J Respir Crit Care Med* 2010;182:752

Endpoints of Resuscitation

- Initial resuscitation
  - "We recommend the protocolized, quantitative resuscitation of patients with sepsis-induced tissue hypoperfusion"
  - "We suggest targeting resuscitation to normalize lactate in patients with elevated lactate levels as a marker of tissue hypoperfusion"
    - Surviving Sepsis Guidelines

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 MAY 1, 2014 VOL. 370 NO. 18

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

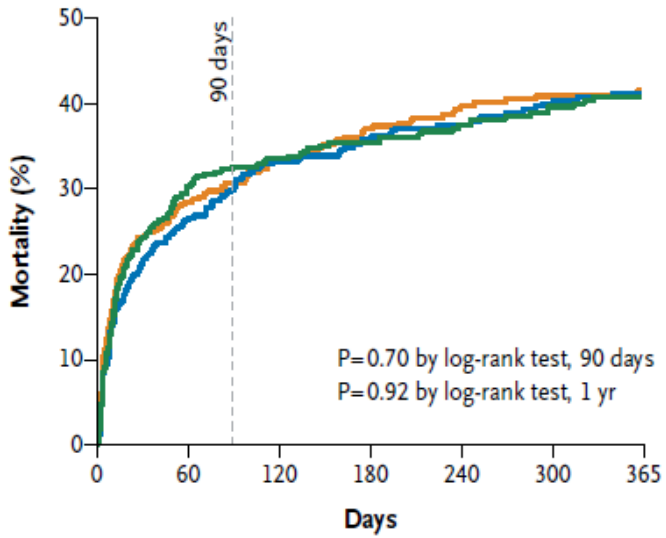
The ProCESS Investigators*

31 U.S. academic centers

1341 patients

EGDT vs. protocol-based therapy (SBP, shock index) vs. “usual care”

No differences in mortality



The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

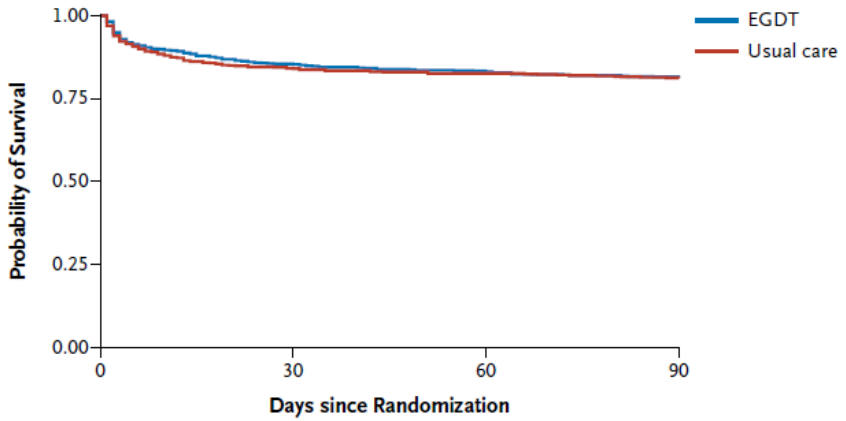
Goal-Directed Resuscitation for Patients with Early Septic Shock

The ARISE Investigators and the ANZICS Clinical Trials Group*

ABSTRACT

N ENGL J MED 371;16 NEJM.ORG OCTOBER 16, 2014

51 centers in Australia & New Zealand
1600 patients enrolled
EGDT vs. “usual care”
No difference in mortality



The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

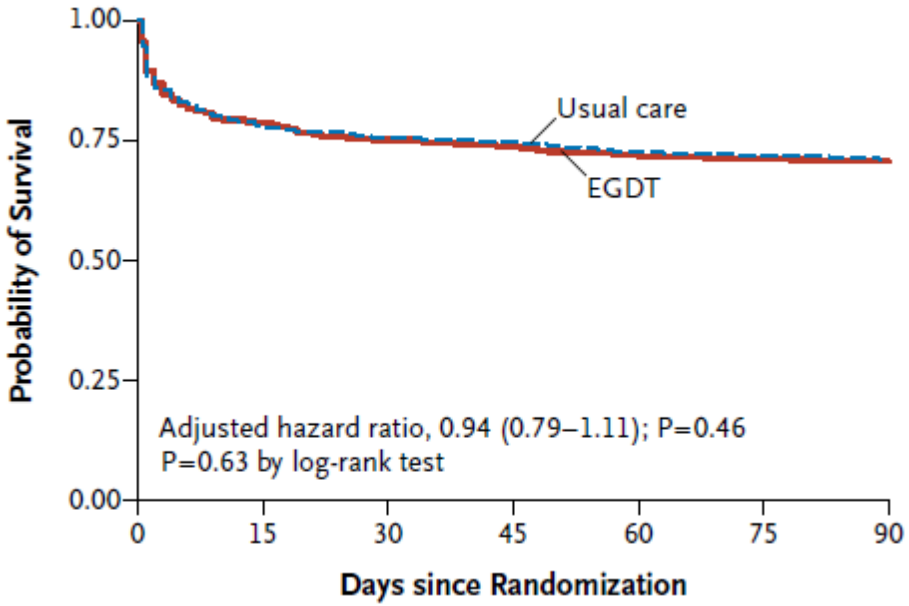
Trial of Early, Goal-Directed Resuscitation for Septic Shock

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*

N ENGL J MED 372;14 NEJM.ORG APRIL 2, 2015

JAMA, February 24, 2010—Vol 303, No. 8 **739**

56 English NHS hospitals
1260 patients enrolled
EGDT vs. “usual care”
No difference in mortality



Surviving Sepsis

	EGDT 2001		ProCESS 2014			ARISE 2014		ProMISE 2015	
	EGDT	Usual	EGDT	Protocol	Usual	EGDT	Usual	EGDT	Usual
Crystalloid L	5.0	3.5	2.8	3.3	2.3	2.0	1.7	2.0	1.8
Pressors %	36.8	51.3	54.9	52.2	44.1	76.3	65.8	57.9	52.6
Dobutamine %	15.4	9.2	8.0	1.1	0.9	15.4	2.6	17.7	6.5
RBC %	68.4	44.5	14.4	8.3	7.5	13.6	7.0	12.6	8.5
Mortality %	30.5	46.5	21.0	18.2	18.9	18.6	18.8	29.5	29.2

National Inpatient Quality Measures

- Within 3 hours of identification of severe sepsis:
  - Initial lactate level measurement
  - Broad spectrum or other antibiotics administered
  - Blood cultures drawn prior to antibiotics
- Within 6 hours:
  - Repeat lactate measurement if initially elevated

National Inpatient Quality Measures

- Within 3 hours of identification of septic shock:
  - Initial lactate level measurement
  - Broad spectrum or other antibiotics administered
  - Blood cultures drawn prior to antibiotics
- Within 6 hours:
  - Repeat lactate measurement if initially elevated
  - Resuscitation with 30 ml/kg crystalloid fluids
  - Vasopressors if hypotension persists after fluid administration

National Inpatient Quality Measures

Repeat volume status and tissue perfusion assessment consisting of either

A focused exam including:

- Vital signs, AND
- Cardiopulmonary exam, AND
- Capillary refill evaluation, AND
- Peripheral pulse evaluation, AND
- Skin examination

OR

Any 2 of the following:

- Central venous pressure measurement
- Central venous oxygen measurement
- Bedside Cardiovascular Ultrasound
- Passive Leg Raise or Fluid Challenge

Challenges

- What predominates?
  - Capillary leak (Hypovolemic shock)
  - Vasodilation (Distributive shock)
- How to assess intravascular volume?
- How to assess tissue perfusion?

Challenges

- What predominates?
  - Capillary leak (Hypovolemic shock)
  - Vasodilation (Distributive shock)
    - Capillary refill
- How to assess intravascular volume?
    - Ultrasound, straight leg raise
- How to assess tissue perfusion?
    - Clinical exam, lactate, S_vO_2

Surviving Sepsis

- Whatever methods are being utilized, FREQUENT REASSESSMENT is crucial to assess adequacy of resuscitation

Surviving Sepsis

- Sepsis is a time sensitive problem, just like
  - Trauma
  - Acute myocardial infarction
  - Stroke

Sepsis Success Story

Kim Biery, DNP, RN, NEA-BC
Director Quality Innovation
Miami Valley Hospital
Miami Valley Hospital South
Jamestown

Agenda

- Premier Health Partners
- Success Story
- Sepsis Tools

FACTS ABOUT MIAMI VALLEY HOSPITAL

FOUNDED IN 1890, MIAMI VALLEY HOSPITAL IS A FULL-SERVICE, ACUTE CARE HOSPITAL LOCATED IN DAYTON, OHIO.

Miami Valley has the region's only Level I Trauma Center and is a Magnet® hospital for nursing excellence.

SERVICES

- The area's only Level I trauma center with CareFlight, the area's first air ambulance service
- Bone Marrow Transplant Unit and Accreditation with Commendation from the Commission on Cancer
- The Dayton region's first Comprehensive Stroke Center as designated by The Joint Commission
- The only regional adult burn center
- The area's first high-risk maternity and neonatal intensive care unit (NICU) in the same facility
- The area's first robotic surgery program, and the only local program with four robots
- The area's largest center for emergency heart care, and angioplasty for heart attack patients

KEY FACTS

Licensed Beds	970
Physicians	1,142
Physician Specialties	70+
Employees	6,711
Volunteers	756
Inpatient Admissions	39,368
Outpatient Visits	289,642
ER Visits	128,804

125

1890 YEARS OF EXCELLENCE 2015

Success Story

Severe sepsis presentation=4/12/16@0116 - met with criteria.

a) infection: 4/11/16@2301 - sepsis

b) SIRS: 4/11/16@2308 (wbc) and 4/12-16@0033 (pulse)

c) organ dysfunction: 4/12@0116 (lactate=2.2)

Repeat lactate timely.

Blood culture/ATB timely.

Septic shock met with documentation of septic shock on 4/12@0140.

Crystalloid fluids given @ rate of 30ml/kg.

Sepsis order set - both ED and IP initiated.

NO OFIs

Patient HPI

- 76 year old male
- Nursing home
- Altered mental status and nonresponsive
- Being treated as an outpatient with Levaquin for right middle lobe pneumonia
- Found not responsive
- Nursing home called family
- Advised him to come to the hospital for further evaluation and treatment
- Arrived on 15 L non-rebreather.

Physical Exam – Vital Signs

- Temp: **101 °** F (38.3 ° C) (04/11/16 2227)
- Temp Source: Axillary (04/11/16 2227)
- Pulse: 92 (04/11/16 2227)
- Rhythm: Normal sinus rhythm (04/12/16 0103)
- Resp: 20 (04/11/16 2227)
- BP: **(!) 161/94 mmHg** (04/11/16 2227)
- MAP: Noninvasive: 119 mmHg (04/11/16 2227)
- SpO2: 98 % (04/11/16 2227)
- Oxygen Liters Per Minute: 15 LITERS PER MINUTE (04/11/16 2227)
- Oxygen Source: Mask (04/11/16 2227)
- Height: 177.8 cm (5' 10") (04/11/16 2227)
- Weight: 81.647 kg (180 lb) (04/11/16 2227)

Sepsis Tools

- Sepsis Core Bundle
- Sepsis BPA workflow
- Order Sets
  - System ED Sepsis/Septic Shock
  - System Sepsis/Septic Shock Admission
- Sepsis Scorecard
- Individual abstraction reports
- Reports
- A4Action Plan

SEPSIS CORE MEASURES

(ALL or NONE BUNDLE)

Must have *all* care met for both timeframes:

- **Within 3 hours: (severe sepsis)**
  1. Initial lactate drawn and if > 2mmol (18 mg/dl UVMC), repeat level drawn (repeat must be drawn w/in 6 hours of severe sepsis presentation time)
  2. Blood cultures collected (before antibiotic is started)
  3. Broad spectrum antibiotic
  4. IF the patient meets criteria for **SEPTIC SHOCK** (Hypotension (SBP < 90 or MAP < 65, Lactate >/= 4.0 mmol/L (36 mg/dl) **OR** MD/APN/PA documents it) : **Administer 30 ml/kg crystalloid fluid.**
- **Within 6 hours:(septic shock)**
  1. Vasopressors if hypotension persists **after** crystalloid fluid administration
  2. Repeat volume status **AND** tissue perfusion assessment **consisting of either**:
     - all parts of FOCUSED EXAM performed by Provider: (Vital Signs, Cardiopulmonary Assessment, cap refill, Peripheral Pulse eval, Skin Exam with reference to color and circulatory status)

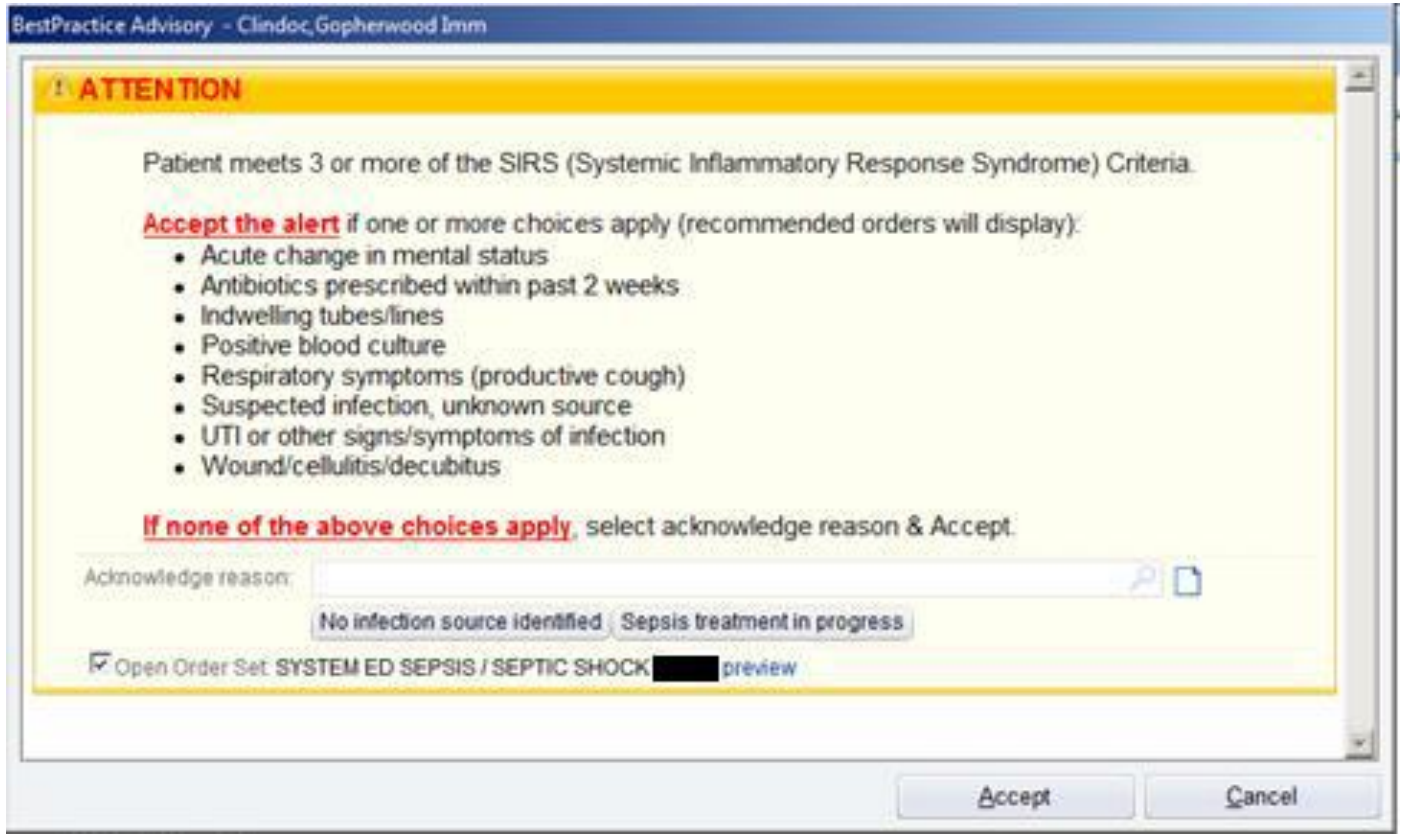
     OR

     - Any 2 of following: CVP,SVO2, CV ultrasound, passive leg raise, fluid challenge

Sepsis BPA

- ED – Fires to the physician
- IP – Fires to the Registered Nurse

BPA


BestPractice Advisory - Clindoc,Gopherwood Imm
ATTENTION
Patient meets 3 or more of the SIRS (Systemic Inflammatory Response Syndrome) Criteria.
Accept the alert if one or more choices apply (recommended orders will display):
Acute change in mental status
Antibiotics prescribed within past 2 weeks
Indwelling tubes/lines
Positive blood culture
Respiratory symptoms (productive cough)
Suspected infection, unknown source
UTI or other signs/symptoms of infection
Wound/cellulitis/decubitus
If none of the above choices apply, select acknowledge reason & Accept.
Acknowledge reason:
No infection source identified
Sepsis treatment in progress
Open Order Set: SYSTEM ED SEPSIS / SEPTIC SHOCK [redacted] preview
Accept
Cancel

Order Sets

- System **ED** Sepsis/Septic Shock essential orders
- System Sepsis/Septic Shock **Admission**

Profile Title: Sepsis Core Measure Sub Scorecard -2016 Miami Valley Hospital		
MIDAS Indicator - Profile Core Sepsis Detail		
Facility: Miami Valley Hospital	**Achievement threshold (50th Ptile)**	**Benchmark Mean of Top Quartile**
Indicator		
Mortality (OHA Defn)	OHA Collaborative State Mean	OHA Target Improvement
Sepsis Mortality		
Sepsis Mortality Denominator		
Sepsis Mortality %	**20.5**	**14.9**
Core Measures	***Benchmarks not avail till 1Q2016***	
Core SEP1 -OFI Group: Early Management Bundle, Severe Sepsis/Septic Shock		
Core SEP1 - numerator		
Core SEP1 - denominator		
Core SEP1 - Early Management 3 hour Bundle, Severe Sepsis/Septic Shock		
SEP1aa -Initial Lactate OFI		
SEP1aa -Initial Lactate 3 Hours (Numerator)		
SEP1aa -Severe Sepsis Present (Denominator)		
SEP1aa -Initial Lactate within 3 Hours %		
SEP1ac-BC OFI		
SEP1ac-BC within 3 Hours (Numerator)		
SEP1ac-Severe Sepsis Present (Denominator)		
SEP1ac-BC within 3 Hours %		
SEP1ab-ATB OFI		
SEP1ab-ATB within 3 Hours (Numerator)		
SEP1ab-Severe Sepsis Present (Denominator)		
SEP1ab-ATB within 3 Hours %		
SEP1b - severe sepsis - repeat lactate level measurement not in 6hr		
SEP1b - severe sepsis - repeat lactate level (Numerator)		
Core SEP1 - denominator		
SEP1b - severe sepsis -% repeat lactate level measurement not in 6hr		
SEP1c - Septic shock - resuscitation w/ crystalloid fluids OFI		
SEP1c -Crystalloid Fluid (Numerator)		
SEP1c -Septic Shock Present (Denominator)		
SEP1c Septic shock - resuscitation w/ crystalloid fluids %		

Reports

- BPA reports for ED physicians and nursing by unit
- Individual abstraction reports
- Weekly fallout reports
- Individual Feedback reports
- Peer Review

Sepsis System A4 Action Plan

Date: 7/29/2016

Purpose/Description: Achieve top decile performance by conducting an analysis of the current state and implementing best practices that will lead to sustained system-wide improvements.

Prevention Strategies	Action (Plan)	Action Owner	Due Date	Update (Do)

Ongoing Performance:

(Study) Sepsis/Septic Shock Overall Bundle- CMS Sample

Thank You!!!

from

Premier Health Partners

Sepsis Initiative

Southern Ohio Medical Center

Case Studies

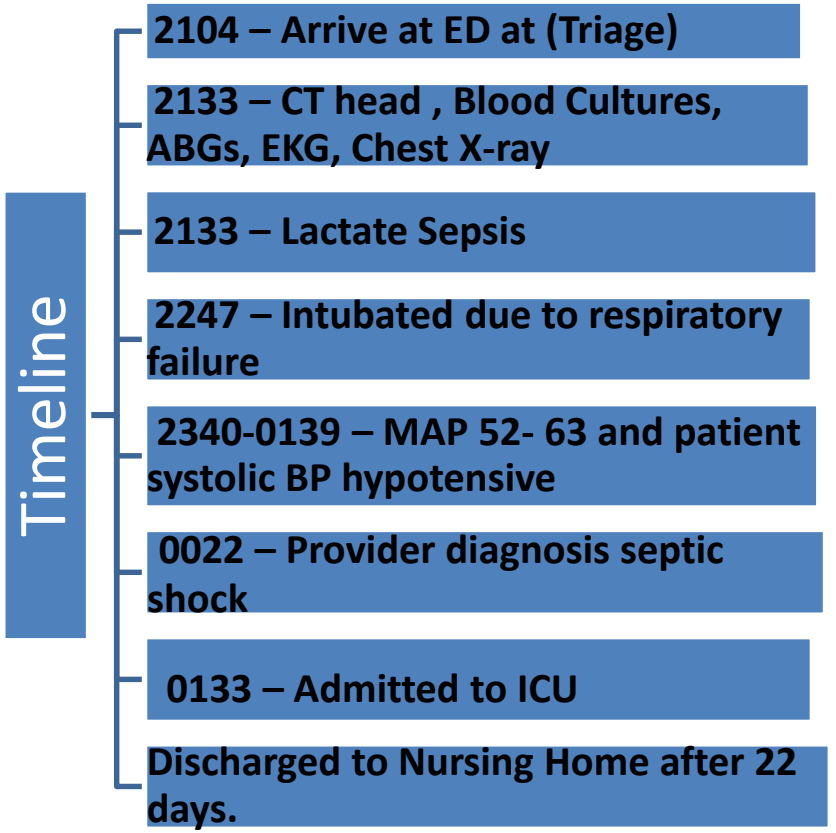
August 17 , 2016

Southern Ohio Medical Center

Very Good things are happening here

Case Study #1

- 88 year male presents to ED with c/o of weakness, lethargy, SpO2 of 84% on RA, Nursing Home stated possible aspiration.
- Arrival to ED – respiratory distress – unable to localize discomfort, BP 81/27 98% on 6L per NC.



Time Zero = 0022

3 Hour Bundle

- Lactate –
  - Venous at 2133 (0.8mmol/L)
  - Arterial at 2205 (1.0mmol/L)
- Antibiotics
  - Vancomycin at 2248
  - Levaquin at 0053
  - Maxipime at 0054
- Crystalloids
  - Sodium Chloride 30ml/kg started at 2248

6 Hour Bundle

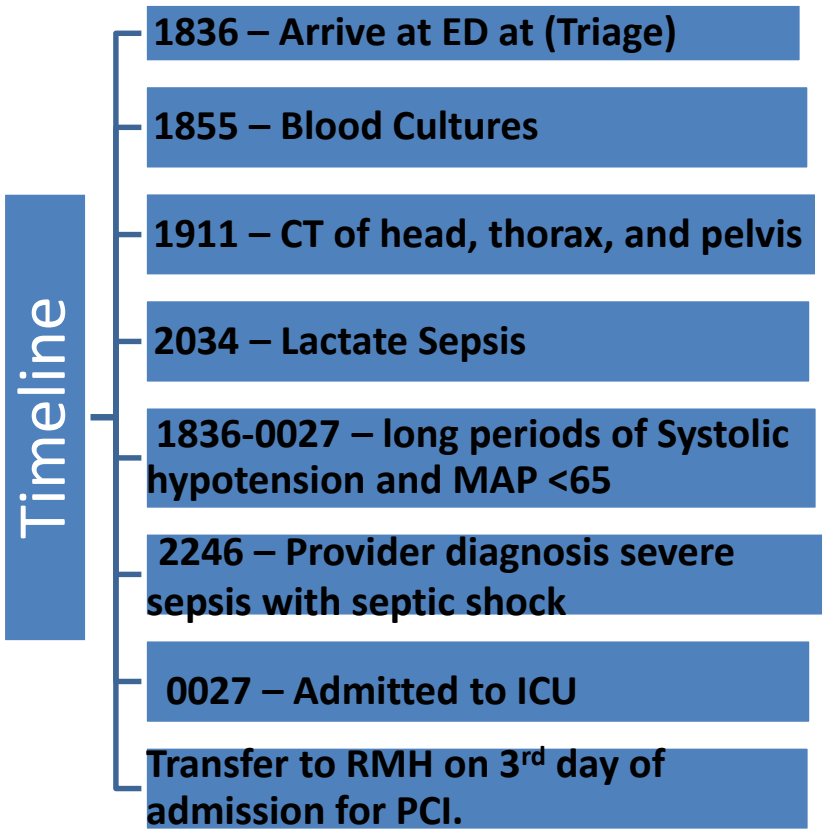
- Lactate
  - Arterial at 0041 (1.0mmol/L)
- Vasopressors
  - Vital signs stabilized
- Volume Reassessment
  - Vital Signs stabilized

Review

Went Well	Lessons Learned
• 3 hour bundle lactate, antibiotics, and blood cultures completed • Fluid started at 30ml/kg used with pressure bag	• No sepsis screen done at triage • No stop time for crystalloid infusion • Failed repeat lactate in 6 hour bundle (ICU) • No infectious source identified prior to diagnosis of septic shock • 2 lactate drawn prior to time zero (Septic Shock time)

Case Study #2

- 94 year old female presents to ED
- c/o fall, tachycardia, generalized weakness
- Arrival to ED – alert and oriented, respirations easy, tachycardia - rate of 159, hypotensive 99/54 with MAP of 64



Time Zero = 2002

3 Hour Bundle

- Lactate –
  - Venous at 2002 (3.0mmol/L)
- Antibiotics
  - Invanz at 0003
- Crystalloids (2250ml)
  - Sodium Chloride (2 IVs)
    - 1000ml (1902-2009)
    - 1000ml (1910-2030)
    - 1000ml (2044-2133)
    - 150ml/hr (2008 – to ICU)

6 Hour Bundle

- Lactate
  - venous at 2305 (2.4mmol/L)
- Vasopressors
  - NeoSynephrine 200mg IVP at 2007 for 2 doses
  - Norepinephrine at 0025 – to ICU
- Volume Reassessment
  - No hypotension after fluid bolus completed at 2133

Review

Went Well	Lessons Learned
• Severe Sepsis and Septic Shock identified in the ED • All bundle elements addressed • Patient remained Normotensive post fluid resuscitation	• No sepsis screen done at triage but completed by provider • No sepsis checklist done • Checklist now utilized on Severe Sepsis and Septic Shock patients; handoff communication tool.

Any Questions?

Southern Ohio Medical Center

Very Good things are happening here

Mary Kate Dilts Skaggs, DNP, RN, NE-BC
Director of Nursing
Emergency Services

Elvis Walters, BSN, RN
Nurse Manager
Emergency Services

Safety ♦ Quality ♦ Service ♦ Relationships ♦ Performance

QUESTIONS?

OHA collaborates with member hospitals and health systems to ensure a healthy Ohio

James V. Guliano, MSN, RN-BC, FACHE

Vice President, Quality Programs

James.Guliano@ohiohospitals.org

Ohio Hospital Association
155 E. Broad St., Suite 301
Columbus, OH 43215-3640

T 614-221-7614
ohiohospitals.org

HelpingOhioHospitals

@OhioHospitals

www.youtube.com/user/OHA1915