Prehospital Sepsis Management: Identification and treatment

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Improving outcomes through education, training, and research

Greenville County EMS

* 80,000+ calls for service annually
* 29 ALS transport units
* 9 QRV's
* 32 Fire departments provide first response

* Over 200 field providers
* Coverage area of 800 sq. miles

* Dr. Martin Lutz Medical control
  * Dr. Tara Connolly Associate Medical Control

Prehospital sepsis care

* Historically, EMS has proven to have significant impact on time sensitive in hospital interventions, through proper identification and notification:
  * STEMI
  * Stroke
  * Trauma

GREENVILLE HEALTH SYSTEM

BON SECOURS ST. FRANCIS HEALTH SYSTEM

* Sepsis Alert

The Burden of Sepsis

* Severe sepsis and septic shock combined are the 10th leading cause of death in the United States
* Over 750,000 cases each year
  * Two-thirds initially seen in the ED
* 215,000 deaths annually
  * 50.37 deaths per 100,000 people
* Number one leading cause of death in non-cardiac ICU's

Melamed et al. Critical Care; 2009
Band et al. Academic Emer Med; 2011
Kaukonen et al. NEJM; 2015

Systemic Inflammatory Response Syndrome

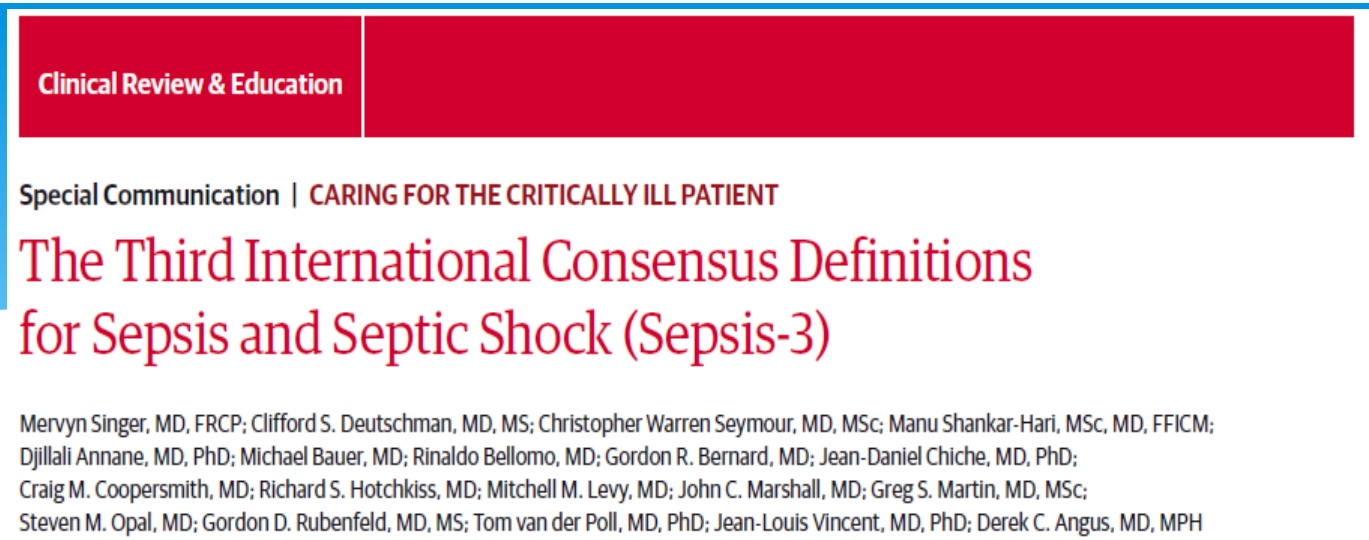
* SIRS
  * Hyperthermia (> 101°F) or hypothermia (< 96.8°F)
  * Heart rate > 90 beats per minute
  * Respiratory rate > 20 breaths per minute or intubated
  * Signs of poor perfusion (such as SBP < 90 mm/hg)

Dillinger et al. Intensive Care Med; 2013

Definitions

* Sepsis:
  * SIRS criteria x2
  * Known or suspected source of infection
* Severe Sepsis:
  * Sepsis with organ dysfunction
    * Lactate ≥ 2.2 mmol
* Septic shock:
  * Severe sepsis with hypotension after fluid resuscitation
    * SBP <90 mmHg
    * Lactate ≥ 4 mmol

Dillinger et al. Intensive Care Med; 2013



* Recommends standard definitions
  * Sepsis
  * Septic Shock
* Screening criteria for organ dysfunction in the presence of infection
  * SOFA
  * qSOFA
  * SIRS

"The proposed criteria should aid diagnostic categorization once initial assessment and immediate management are completed."

In-Hospital Treatment

* Identification
  * SIRS, WBC, Elevated serum lactate
* Set of blood cultures
  * Anaerobic, Aerobic
* Fluid administration
* Administration of broad spectrum antibiotic

CMS
CENTERS FOR MEDICARE & MEDICAID SERVICES

EMS and Sepsis

* Very little education related to Sepsis during initial Paramedic education
* Prehospital sepsis research is limited
  * Identification
  * Severity of patients
  * Effect of sepsis alert

Resuscitation 81 (2010) 193–197

Contents lists available at ScienceDirect

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

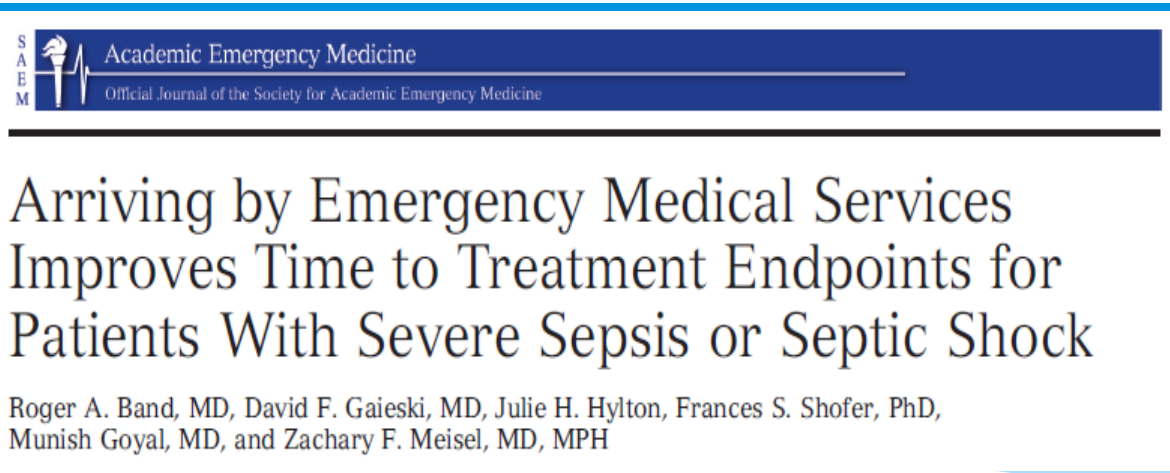
Clinical paper

Opportunities for Emergency Medical Services care of sepsis☆

Henry E. Wang[a,*], Matthew D. Weaver[b], Nathan I. Shapiro[c], Donald M. Yealy[b]

* EMS transports 34% of all patients diagnosed with sepsis, and 60% of all severe sepsis patients arriving to the ED
* More likely to present with severe sepsis or septic shock
* "EMS systems may offer important opportunities for advancing sepsis diagnosis and care"

Wang et al. Resus.; 2010



* Arrival by EMS is associated with decreased time to IVF and antibiotics
  * Median time to antibiotics was 116 minutes for EMS vs. 152 minutes for non-EMS
  * Median time to initiation of IVF was 34 minutes for EMS and 68 minutes for non-EMS
* "EMS may represent an effective part of efforts to rapidly diagnose and treat ED patients with critical, time-sensitive illnesses"

Band et al. Academic Emer. Med 2011

American Journal of Emergency Medicine (2012) 30, 51–56

ELSEVIER

The American Journal of Emergency Medicine

www.elsevier.com/locate/ajem

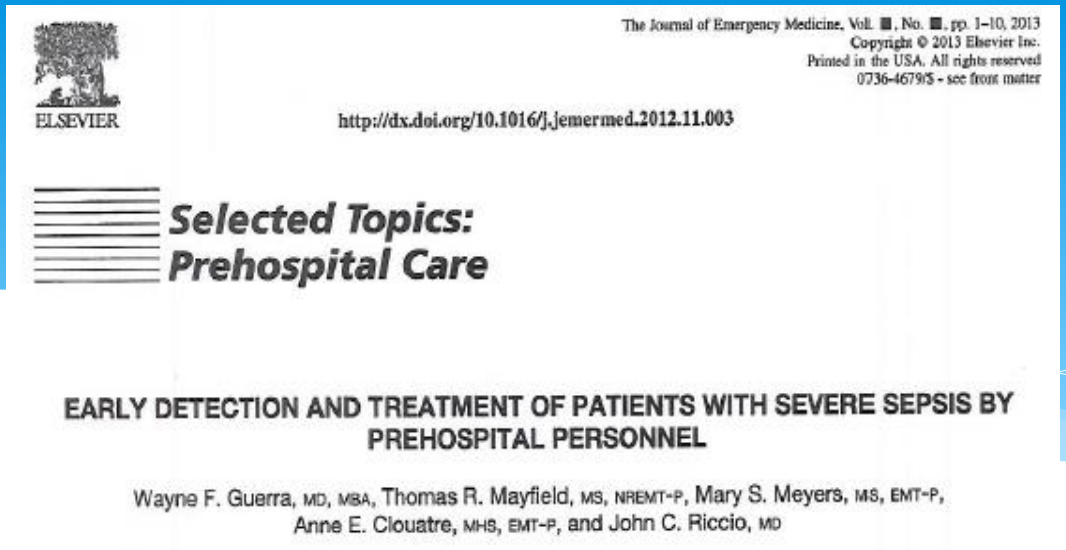
Original Contribution

The impact of emergency medical services on the ED care of severe sepsis☆

Jonathan R. Studnek PhD[a,b], Melanie R. Artho MD[a], Craymon L. Garner Jr[a], Alan E. Jones MD[a,*]

* If sepsis is identified by EMS personnel, the reduction in time to antibiotics initiation is substantial (69 vs 131 minutes)
* EMS transported patients had more organ failure
* "If sepsis is recognized by EMS personnel, the reduction in time to antibiotic and EGDT initiation is more substantial"

Studak et al. AJEM; 2010



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0736-4679/$ - see front matter

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http://dx.doi.org/10.1016/j.jemermed.2012.11.003

Selected Topics:
Prehospital Care

EARLY DETECTION AND TREATMENT OF PATIENTS WITH SEVERE SEPSIS BY PREHOSPITAL PERSONNEL

Wayne F. Guerra, MD, MBA, Thomas R. Mayfield, MS, NREMT-P, Mary S. Meyers, MS, EMT-P, Anne E. Clouatre, MHS, EMT-P, and John C. Riccio, MD

* Sepsis alert with use of a prehospital lactate monitor
  * Fluid administration and pre alert
* EMS "Sepsis Alert": severe sepsis mortality significantly decreased (13.6% vs 26.7%)

Guerra et al. Journal of EM; 2013

International EMS

Epidemiology of Sepsis and Its Recognition by Emergency Medical Services Personnel in the Netherlands

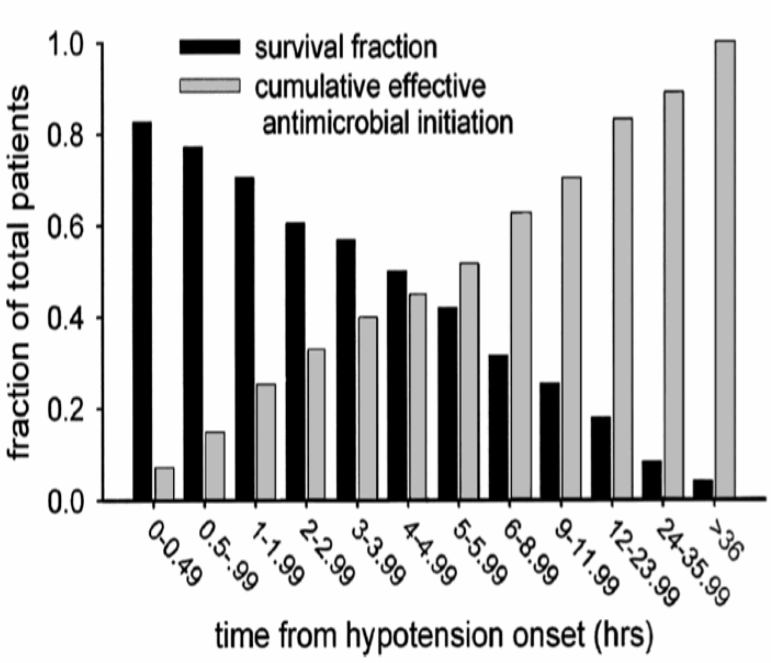
Lena C. W. van der Wekken, MD, Nadia Alam, MD, Frits Holleman, MD, PhD, Pieternel van Exter, MD, Mark H. H. Kramer, MD, PhD, FRCP, Prabath W. B. Nanayakkara, MD, PhD, FRCP

* Retrospective review of Sepsis patients transported by EMS.
  * 13.7% diagnoses and documented as severe sepsis or septic shock.
  * 45.8% presented with SIRS criteria and sources of infection but were not identified.
  * "Recognition of sepsis depends on knowledge about the syndrome and the completeness of the primary survey"

Van der Wekken, L., PEC; 2016

Time to antibiotic

* 2012 Surviving Sepsis Guidelines
  * Within one hour of identification
* For every hour sooner that antibiotics were delivered decreased mortality by 8% per hour
* Antibiotic therapy within the first hour of severe sepsis recognition contributed to 80% survival



Gaieski et al. Crit Care Med; 2010
Dillinger et al. Intensive Care Med; 2013

Kumar et al. Crit Care Med; 2006

GCEMS Sepsis pilot

* July 2014 – analysis of the sepsis patient treated by EMS
  * 3-5 Sepsis patients transported per day within Greenville County
  * Average time to antibiotics was 101 minutes once arrived at the ED
    * Not including the time with EMS (average 58 mins including transport)
* If Sepsis could be identified by EMS in the field, this would significantly decrease the time to antibiotic administration, thereby decreasing mortality.

GCEMS Sepsis

* Prehospital Antibiotic administration – Pilot (DHEC – Bureau of EMS)
  * Was not on the state formulary
* November 2014 – Blood culture collection and alert
* February 2015 – Incorporated IV antibiotics into treatment

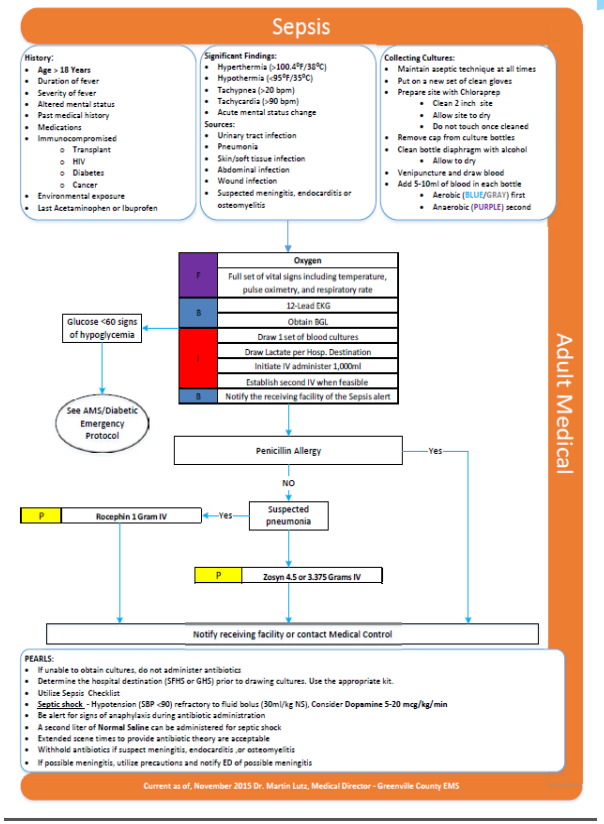
* Total patients – 1115 sepsis alerts
* Blood cultures – 900
* Antibiotics – 533

GCEMS and Sepsis

* Training:
  * 170 ALS providers completed 12 hours of education over 3 months
    * Sepsis identification
    * Sepsis protocol
    * Sepsis treatment
    * Aseptic technique
    * Blood culture collection
    * IV Antibiotic administration
* Didactic and simulation training on hi-fidelity simulation mannequins

GCEMS Sepsis Protocol

* Identification of Sepsis
* Blood Culture Collection
* Blood collection for serum lactate
* Fluid resuscitation
* Broad spectrum antibiotic administration
* “SEPSIS Alert”



GCEMS Sepsis assessment tool

Greenville County EMS
301 University Ridge Suite 1100 Greenville SC 29681

EMS Evaluation and treatment of Sepsis tool

Green Sepsis patient sticker

Date: _____ EMS Arrival Time: _____ Truck Number: _____

Lead Medic: _____ Culture Drawn by: _____

Evaluation for Sepsis

1. ***Are any two of the following symptoms present AND new to the patient?***
   - ☐ Hyperthermia (> 101°F or 38°C) or hypothermia (< 96.8°F or 36°C)
   - ☐ Heart rate > 90 beats per minute
   - ☐ Respiratory rate > 20 breaths per minute or mechanical ventilation
   - ☐ Signs of poor perfusion (such as SBP < 90 mm/hg)
2. ***Is the patient's presentation suggestive of any of the following infections?***
   - ☐ Pneumonia (cough/thick sputum)
   - ☐ Urinary tract infection
   - ☐ Acutely AMS change
   - ☐ Blood stream/Catheter related
   - ☐ Abdominal pain and/or diarrhea
   - ☐ Wound infection
   - ☐ Skin/soft tissue infection

Temperature

Result: _____

Glucose

Result: _____ mg/dl
Normal Range 80-120 mg/dl

If positive for sepsis, call a sepsis alert and follow the directions on the back

GCEMS Sepsis treatment tool

GCEMS – both sides of this sheet must be copied and turned in or emailed to Jason Walchok

Treatment for sepsis

Confirm no PCN allergy – If PCN allergy DO NOT ADMINISTER ANTIBIOTICS

Draw Blood Culture (8cc-10cc of blood in each vial) Time drawn: _____

- Prepare a 2 inch site area with chloraprep and allow to dry
- Disinfect the top of each culture bottle with alcohol and allow to dry
- Inoculate the aerobic (blue cap) bottle first and then the anaerobic (purple cap) bottle.
- Minimum of 3cc of blood in aerobic bottle is required to proceed with antibiotic therapy
- If unable to draw cultures **DO NOT ADMINISTER ANTIBIOTICS**

Draw point of care lactate (only good for 30 min) Time Drawn: _____

Begin fluid resuscitation: **Normal Saline 1,000cc** Total given: _____

Presumed sepsis from pneumonia: **Rocephin 1 Gram IV** Time hung: _____

Presumed sepsis **not** from pneumonia: **Zosyn (3.375) 4.5 Grams IV** Time hung: _____

Sepsis Kits

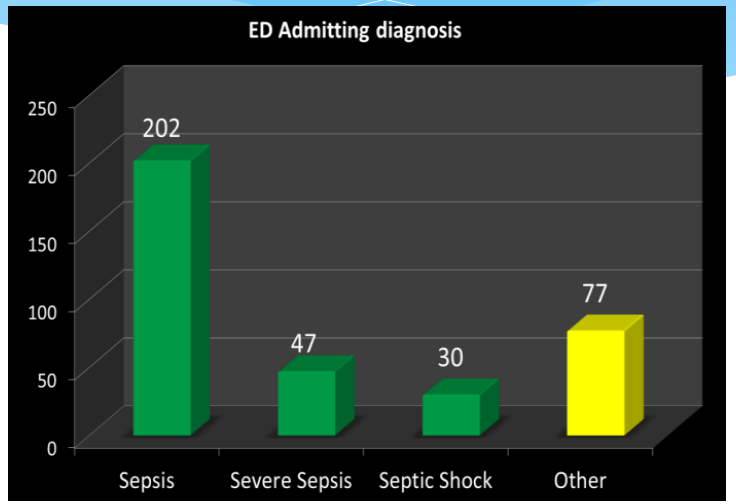
* Blood draw contents
  * Specific for each facility
* Prehospital assessment sepsis assessment tool
* Antibiotics
* Mini bag

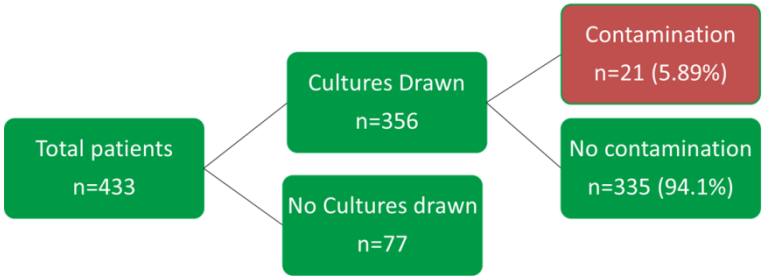
Blood culture collection

* Area of major concern for hospital laboratory
  * Initial 3 month trial to prove low contamination rate
* No prehospital research

EMS Blood cultures

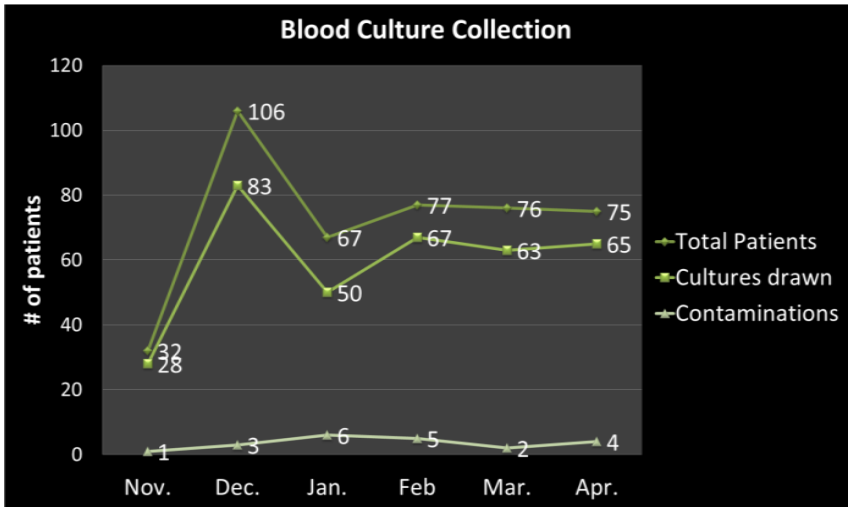
* 356 Blood cultures collected from 433 patients
* Patient demographics included 55.3% male and mean age of 65
* Most common admitting diagnosis was Sepsis 202/356 (56.7%)





Walchok JG, Lutz ME, Shope CF, Gue G, Furmanek D, Pirrallo RG, Dix AC: How Can Paramedics Draw Uncontaminated Blood Cultures Prior to Prehospital Antibiotic Administration? Prehospital Emergency Care 2016;20:154 (A76)

EMS Blood Cultures



Primary Infection		
Total Cultures	n=356	
Pulmonary	162	46%
GU	84	24%
Unknown	58	16%
Skin	22	6%
GI	16	4%
Other	10	3%
Implanted device	4	1%

* Contamination was found in 5.89% (21/356) with 14/21 (66.7%) of these identified as skin flora (coagulase negative Staphylococci)

Lactate collection

* Blood collected in the field is used in the ED to determine the initial serum lactate level prior to fluid administration.

Heparin, can be rapidly processed in ABG machine upon arrival

Stable 20mins, immediate

Contains potassium oxalate / sodium fluoride that inhibits glycolysis

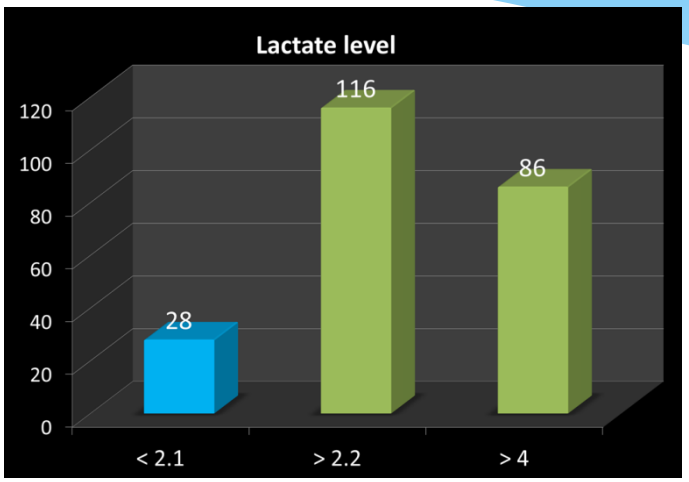
Stable 2hrs, 1 hour turn around

Lactate monitors

* Point of care lactate monitoring can assist with sepsis identification though it has limited prehospital availability
  * No CLIA waved devices
  * Require moderate complexity license

* Is a Paramedic's assessment enough?

Is a Paramedic's assessment enough?



Primary Infection		
Source	n=144	
Pulmonary	58	40%
GU	39	27%
Unknown	25	17%
Skin	10	7%
GI	6	4%
Other	6	4%

* Retrospective case review of all Paramedic Sepsis Alerts between 8 January 2015 and 30 April 2015
* Compared EMS "Sepsis Alert" to ICD9 ED admitting diagnosis

Is a Paramedic's assessment enough?

ED Diagnosis	n=144	
Sepsis	91	63%
Severe Sepsis	18	13%
Septic Shock	25	17%
Viral	4	3%
COPD	2	1%
Sinusitis	1	1%
Renal Failure	1	1%
Seizure	1	1%
Anxiety	1	1%

* The admitting diagnosis of Sepsis was 93%
* The lactate level was greater than 4.0 in 60% of patients and greater than 2.2 in 80%

Walchok JG, Lutz ME, Shope CF, Gue G, Furmanek D, Pirrallo RG, Dix AC: How Well Does A Prehospital Sepsis Assessment Tool Correlate With Serum Lactate Levels: Is A Paramedic's Assessment Enough? Prehospital Emergency Care 2016;20:154 (A77)

Antibiotic administration

* Broad spectrum capability consistent with in-hospital treatment at local ED's.

* Rocephin (Ceftriaxone) 1Gram
  * Pneumonia / Pulmonary
* Zosyn (Piperacillin/Tazobactam) 4.5 Grams (OR 3.375 Grams)
  * All other sources

* Both administered IV via the Mini-Bag + system

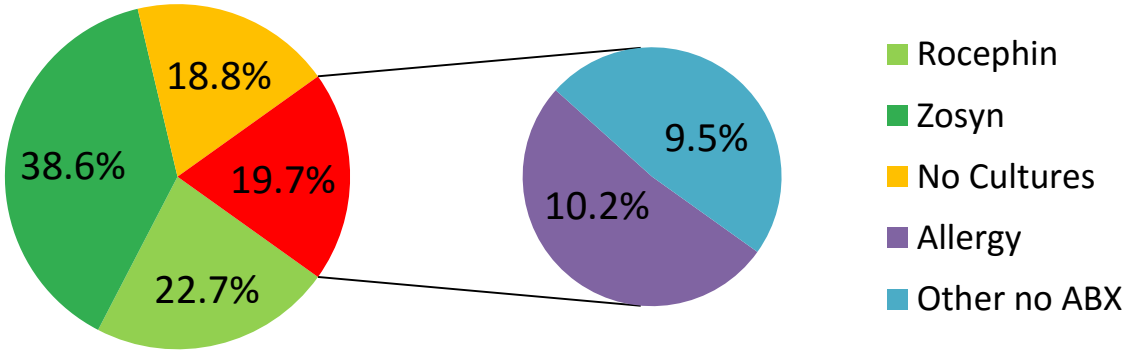
Mini-Bag Plus system

* Extremely stable for prehospital use
* ABX is reconstituted at the time of treatment
* Administered via 10gtts over 30 minutes

Antibiotic Administration

* 532 total antibiotics administered
  * 867 sepsis patients
  * February 2015 – February 2016

* Zosyn – 335
* Rocephin – 197



* No adverse effects or reactions

Fluid resuscitation

* 30ml/kg initial bolus
  * 1liter followed by a second during extended transports
* Observe for signs of fluid overload
  * Pulmonary Edema
* Consider Dopamine 2-20mcg/kg/min
  * After fluid administration and SBP <90mmHg (Septic Shock)

ED arrival

* Pre hospital interventions are continued
* Patient is tracked by use of “Green sheet”
* Labs and blood cultures are sent to the laboratory
  * EMS Tech code
* CMS Core Measures:
  * EMS blood cultures
  * EMS administered ABX

Outcomes

* Average time to ABX in the ED decreased
  * From 101 minutes prior to Sepsis Alert protocol
  * 60 minutes upon arrival after Sepsis Alert protocol implementation
* Lowest mortality rate in the history of Greenville Health System
* Fewer admissions to the ICU
* Significant savings in-hospital
* **Preliminary** data comparing historical (pre) sepsis patients and EMS administered antibiotics:
  * 25.6% mortality vs 9.3% mortality
    * Severe sepsis and Septic shock

Next

* Continue enrolling patients
* Retrospective review
  * Training
  * Identification
  * Blood culture collection
  * Appropriateness of ABX administration

  * Statewide review of sepsis patients treated by SC 911 EMS agencies

Questions

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