

Staging Sepsis for the Emergency Department: Physician



Northwell
HealthSM

Sepsis Continuum

INFECTION + SIRS



SEPSIS



SEVERE SEPSIS



SEPTIC SHOCK



DEATH

**Not
treated**

**Not
treated**

**Not
treated**

**Not
treated**



Sepsis Continuum

SIRS = 2 or more clinical criteria, resulting in Systemic Inflammatory Response Syndrome

Sepsis = SIRS + proven/suspected infection

Severe Sepsis = Sepsis + acute organ dysfunction

Septic Shock = Severe Sepsis + refractory hypotension/elevated lactate

Proposed Sepsis 3.0 definitions 2016

- Sepsis is **life-threatening** organ dysfunction caused by a dysregulated host response to infection.
- Operationalize with qSOFA
 - Altered mental status
 - Respiratory rate ≥ 22 /min
 - Systolic blood pressure ≤ 100 mmHg
 - [these are quite similar to our “super sirs” criteria used in the ED algorithm]

New definitions not yet widely adopted. They point out gaps with SIRS and lactate. Our system adheres to the older definitions as does the surviving sepsis campaign.]

Take home messages from Sepsis 3

The qSOFA looks very similar to our SuperSIRS and makes good sense for an easier screen for ICU admission.

The authors point out that SIRS is still useful for identifying significant infection, though not needed for the definition of sepsis any longer due to lower predictive accuracy.

It is based on a retrospective cohort study. Although they validated it in a split study population, we have seen these types of tools come under scrutiny in the past. **Further validation is called for.**

Adult Patient

Sepsis Definition

Sepsis = SIRS + proven/suspected infection

Two or more SIRS criteria:

- Temperature $> 38.3^{\circ}\text{C}$ (101°F) or $< 36^{\circ}\text{C}$ (96.8°F)
- Heart rate > 90 beats/min
- Respiratory rate > 20 breaths/min
- WBC $> 12,000/\text{mm}^3$, or $< 4,000/\text{mm}^3$ or more than 10% immature neutrophils (bands)

Super SIRS

- Developed by Northwell Health ED Sepsis Group to assist in the early identification of severe sepsis and septic shock
- **“Super SIRS”** is defined as a documented or suspected infection plus any two of the following:
 - Temp of 38.3°C (101°F) or $< 36^{\circ}\text{C}$ (96.8°F)
 - SBP < 90 mm Hg or > 40 mm Hg decrease in SBP from known baseline or MAP < 65 mm Hg
 - Pulse ≥ 120
 - Respiratory rate ≥ 24
 - Unexplained altered mental status

Severe Sepsis

Severe Sepsis = Sepsis + acute organ dysfunction

Indicators of end-organ dysfunction:

Decreased SBP or	SBP < 90 or
Decreased MAP	MAP < 65
Elevated lactate	Lactate > 2.0
Respiratory failure	O ₂ Sat < 90% on RA
Renal failure	Cr > 2.0 or > 50% of baseline
	Urine output < 0.5 ml/kg/hr for > 2 hrs
Coagulopathy	Plt < 100,000/mm ³ INR > 1.5 or aPTT > 60 sec.
Liver failure	Bilirubin > 2.0 mg/dl
AMS	

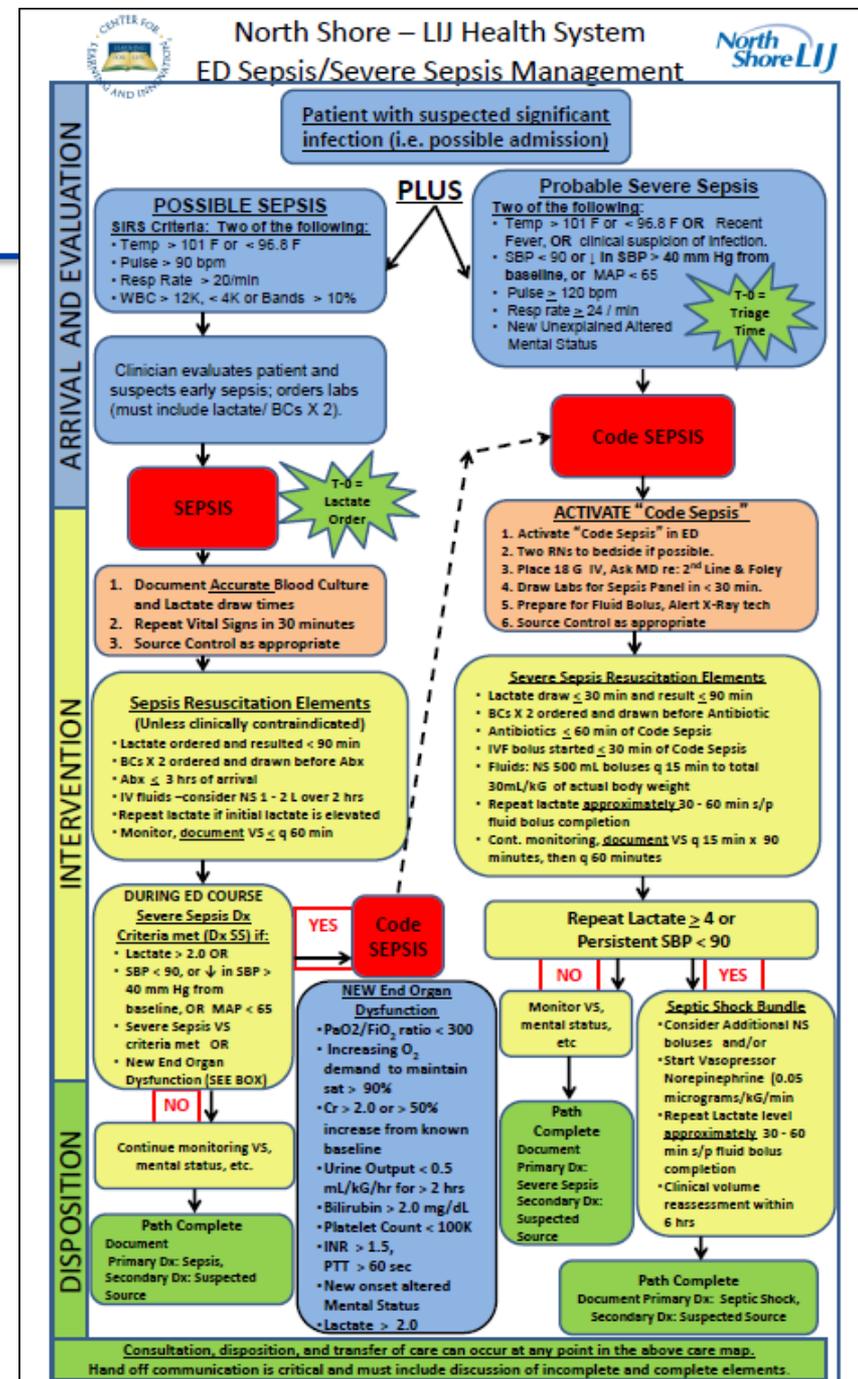
Septic Shock

- **Septic Shock** = Severe Sepsis + refractory hypotension/elevated lactate
- Sepsis with refractory hypotension requiring vasoactive agents **or** lactate ≥ 4.0 mmol/L despite adequate fluid resuscitation

Treating Sepsis

Source control (remove indwelling urinary catheter, address gall bladder, etc).

- Draw **blood cultures** prior to antibiotics, increases the odds of isolating the causative agent(s) allowing tailoring of antibiotic regimens at 72 hrs
- Administration of **antimicrobials** within 180 minutes of recognizing sepsis – broad spectrum to start.
- Diagnostic studies to evaluate for potential organ dysfunction (include **lactic acid** measurement to screen for severe sepsis/septic shock)
- Liberal IV fluids



Treating Severe Sepsis

IVF - at 30 ml/kg body weight at 500 ml boluses
q 15 minutes

- Broad spectrum **antibiotics** within 60 minutes of recognition
- Repeat **lactate** after initial fluid resuscitation if initial was elevated >2 mmol/L

Treating Septic Shock

- **Vasopressor** – if remains hypotensive after 30 mL/kg crystalloid
 - Norepinephrine is first line agent
- **Reassess volume status** after resuscitation with ultrasound, Central Venous Pressure or focused exam including vital signs, cardiopulmonary, capillary refill, pulse, and skin findings
- Repeat **lactate** after initial fluid resuscitation if initial was elevated > 2 mmol/L

Sepsis Bundles

Sepsis bundle:

- Lactate
- Blood cultures before antibiotic infusion
- Antibiotic within 180 minutes of diagnosis

Severe Sepsis/Septic Shock 3-hour bundle:

- Lactate
- Blood cultures before antibiotic infusion
- Antibiotic within 60 minutes of diagnosis
- IVF – 30ml/kg of actual body weight, 500 ml boluses of crystalloid every 15 min

Sepsis Bundles

Septic Shock Six Hour Bundle

Complete 3 hour bundle first

- **Lactate**
- **Blood cultures** before antibiotic infusion
- **Antibiotic** within 60 minutes of diagnosis
- **IVF** – 30ml/kg of actual body weight, 500 ml boluses of crystalloid every 15 min

Then continue with the 6 hour elements

- **Repeat lactate** after initial fluid resuscitation if initial was elevated >2 mmol/L
- **Vasopressor** to achieve $\text{MAP} > 65$
- **Reassess volume status after resuscitation** with ultrasound or focused exam including vital signs, cardiopulmonary, capillary refill, pulse, and skin findings

Pediatric Patient

Pediatric SIRS

Present if **two or more** of the following are identified:

- Temperature $> 38.0^{\circ}$ C (100.4° F) or $< 36^{\circ}$ C (96.8° F)
- Tachycardia in excess of the range of age specific heart rates adjusted for body temperature (Refer to table on next slide)
- Bradycardia (this can be an ominous sign)
- Tachypnea or use of mechanical ventilation

Age-Specific Heart Rates as a Function of Body Temperature

Heart Rate: *Upper Limit of Normal*

Temperature	0-1 year	2-5 years	6-12 years	13-18 years
< 37.8°C (100°F)	180	140	130	110
38.3°C (101°F)	185	145	135	115
38.9°C (102°F)	190	150	140	120
39.4°C (103°F)	195	155	145	125
40.0°C (104°F)	200	160	150	130
40.6°C (105°F)	205	165	155	135
41.1°C (106°F)	210	170	160	140

The upper limit of normal for heart rate increases by 5 bpm for each one degree increase in Fahrenheit of body temperature over 100° F.

Severe Sepsis

Severe Sepsis exists when *Sepsis* is present, with **at least one** or more of the following:

- Prolonged capillary refill ≥ 3 seconds or cool, mottled extremities
- Hypotension (may occur *late!*)
 - Systolic B/P < 60 in an infant less than one month old
 - Systolic B/P < 70 in an infant less than one year old
 - Systolic B/P $< 70 + (2 \times \text{age in years})$ if older than 1 year but less than 10 years old
 - Systolic B/P < 90 if ≥ 10 years old
 - Widened pulse pressure (Systolic B/P $> 2 \times$ diastolic B/P)
- Acute Respiratory Distress
 - FiO₂ of $> 50\%$ required to maintain a SpO₂ $> 92\%$
- Decreased urine output < 0.5 ml/kg/hr for at least 2 hrs
- Altered mental status
- Lactate > 4 mmol/L or SvO₂ $< 65\%$
- Two or more of the following:
 - Platelet count $< 100,000$ or 50% reduced
 - INR > 2
 - Serum Creatinine $\geq 2 \times$ baseline (if known) or normal for age
 - Total bilirubin ≥ 4 mg/dl

Septic Shock

No improvement in perfusion despite appropriate fluid resuscitation up to a total of 60 ml/kg or more of crystalloid IV fluid

Fluid Resuscitation

Severe Sepsis/Septic Shock

- Start with isotonic fluid (0.9% normal saline or RL) boluses of 20ml/kg up to a total of 60ml/kg
- Give over 5 to 20 minutes when in a hypovolemic state
- Reassess after each fluid bolus
- If cardiogenic factors are suspected or develop, administer smaller fluid boluses of 5 to 10 ml/kg over 10 to 20 minutes

Admission to the PICU

- > 40 ml/kg of isotonic IV fluid boluses were administered
- Vasopressor or inotropic infusions were started
- Ongoing evidence of poor perfusion as evidenced by: clinical assessment, elevated serum lactate levels, decreased ScvO₂
- Ongoing organ dysfunction, inadequate urine output, or abnormal lab values
- Pulmonary requirement of $\geq 50\%$ FiO₂ to maintain adequate oxygen saturations (> 92%)