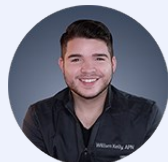


SEPSIS AND SEVERE INFECTIONS: A PRIMER FOR NURSES

PUBLISHED: DECEMBER 19, 2022

LAST UPDATED: DECEMBER 24, 2022



WILLIAM KELLY, MSN, FNP-C

Author | Nurse Practitioner

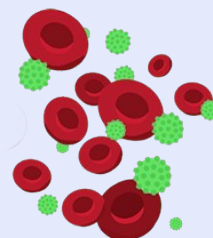


INFECTIOUS DISEASE

EMERGENCY NURSING

MED-SURG NURSING

ICU NURSING



Sepsis is a potentially life-threatening condition that occurs **when the body has a systemic response to an infection**. It is not caused by a specific type of bacteria but can be triggered by *any* type of infection, including bacterial, viral, or fungal. Most cases of sepsis in the hospital will be caused by severe bacterial infections. According to the CDC, sepsis is a leading cause of death in the United States. It is estimated that **more than 1.7 million cases** of sepsis occur each year, and kills about **270,000 people** each year. The mortality rate for sepsis varies, but it **can be as high as 50%** in severe cases. This mortality rate is highest in patients who are over 75 and have multiple comorbidities.

It is important for nurses to be aware of the signs and symptoms of sepsis and to know how to recognize and manage it.

WHAT IS SEPSIS?

Sepsis is a common **clinical syndrome** that represents the body's **response to severe bacterial infection**. Within the hospital, you will take care of patients with sepsis in any department, but especially in the ER and ICU.

Sepsis is a severe condition with a poor prognosis.

Early sepsis— while not clearly defined — is the presence of **infection and bacteremia** (bacteria in the blood) — which can and likely *will* progress to sepsis without intervention. Recognizing and **intervening early** when the sepsis is still early can significantly improve patient outcomes.

THE DEFINITION OF SEPSIS CHANGED IN 2016



Sepsis is now defined as **life-threatening organ dysfunction** in response to infection. Organ dysfunction, usually from hypoperfusion, can be evidenced by hypotension, altered mental status, tachypnea, or increased **SOFA SCORE** by 2 points.

WHAT IS SIRS?

Sepsis used to be identified using **SIRS criteria**– *Systemic Inflammatory Response syndrome*. This is **somewhat outdated** and no longer used, but you still may often hear about this in your hospital. SIRS was a term that was used to describe the **early stages of sepsis**. It was defined as the presence of two or more of the following criteria:

- Body temperature above 100.4°F or below 96.8°F
- Heart rate above 90 beats per minute
- Respiratory rate above 20 breaths per minute or PaCO₂ below 32 mm Hg
- White blood cell count above 12,000/mm³, below 4,000/mm³, or more than 10% immature neutrophils (bands)

The idea behind using the SIRS criteria to diagnose sepsis was that it could help identify patients who were at risk of developing sepsis and who may need early intervention. However, over time, it became clear that the **SIRS criteria were not sensitive or specific enough to accurately diagnose sepsis**.

As a result, the SIRS criteria are no longer used to diagnose sepsis. Instead, the more recent Sepsis-3 criteria is recommended.

SEPSIS-3 CRITERIA

The Sepsis-3 criteria is now used to help clinicians detect and diagnose sepsis, which includes the following 3 criteria:

1. A suspected or confirmed infection
2. An elevated lactic acid (>2 mmol/L)
3. At least one of the following:
 - **Hypotension** requiring vasopressors to maintain a mean arterial pressure (MAP) of 65 mm Hg or higher
 - A serum lactate level greater than 2 mmol/L after **adequate fluid resuscitation**
 - An **acute increase in the serum lactate** level by at least 2 mmol/L within 24 hours

SEPSIS-3 CRITERIA

	CRITERIA	DESCRIPTION
1	Suspected or confirmed infection	The presence of a suspected or confirmed infection, such as pneumonia, urinary tract infection, or septicemia
2	Serum lactate level above normal	A serum lactate level above the upper limits of normal, indicating tissue hypoperfusion and cellular injury
3a	Hypotension requiring vasopressors	Hypotension that requires the use of vasopressors to maintain a mean arterial pressure of 65 mm Hg or higher
3b	Serum lactate level greater than 2	A serum lactate level greater than 2 mmol/L after adequate fluid resuscitation
3c	Acute increase in lactate level	An acute increase in the serum lactate level by at least 2 mmol/L within 24 hours

Only need one of the last 3 items (3a, 3b, and/or 3c)

These criteria are designed to be more sensitive and specific than the SIRS criteria. It's also more specific to identifying patients who are at high risk of dying from sepsis and are more likely to need aggressive intervention.

WHAT IS SEPTIC SHOCK?

Septic shock is a type of *distributive* shock and occurs when the body is under severe distress and releases a lot of mediators and toxins which can cause vasodilation, decrease circulating blood volume, and tank the blood pressure. Septic shock is generally diagnosed when the patient has a **MAP <65 mmHg and a lactic >2.0 mmol/L**, often after their initial fluid bolus. These patients require vasopressors and should be monitored in the ICU.

Septic shock is a medical emergency and requires **immediate treatment**. If not treated promptly, it can lead to multiple organ failure and death.

CAUSES OF SEPSIS AND SEPTIC SHOCK

Sepsis can be caused by any infection that is left untreated or resistant to antibiotics that eventually causes systemic infection and reaction. While severe viral or fungal infections can cause sepsis, this is less common. Common **bacterial infections** that are more likely to cause sepsis include:



URINARY TRACT INFECTION (UTI)

Urinary Tract Infections (UTIs) are common causes of sepsis in elderly individuals. When a Cystitis (inflammation/infection of the bladder) can also travel up the ureters to the kidneys and cause pyelonephritis (infection of the kidney), which is more likely to cause sepsis as well. When a UTI becomes sepsis, this is called **Urosepsis**.



PNEUMONIA

Pneumonia is a bacterial infection of the lungs. Left untreated, this commonly causes sepsis. In fact, severe sepsis can occur in almost half of patients admitted to the hospital with pneumonia.



CELLULITIS

Cellulitis is infection of the skin and surrounding tissue. Patient's with severe cellulitis often have other risk factors, like obesity, diabetes, and other comorbid conditions which increase their likelihood of becoming septic.

ASSESSMENT OF SEPSIS

SYMPTOMS

Since sepsis isn't only caused by one thing, the symptoms are going to **depend on the underlying infection**. However, there are some common symptoms that all sepsis usually share. These include:



FEVER & CHILLS

Fevers and chills are classic for infection. A true fever is greater than 100.4° F or 38° C. Sepsis often presents with even higher fevers of 102°, 103°, or 104° F

Chills are subjective, and many patients will report them (even for minor infections). However, patients with sepsis often have significant chills and tremors.



WEAKNESS & FATIGUE

Whenever the body is fighting infection, it takes a toll on energy levels. With sepsis it also does this, but to an even larger degree as this is a systemic response.



ALTERED MENTAL STATUS

Altered Mental Status (AMS) commonly occurs with sepsis. This is due to **decreased perfusion of the brain**, as well as their body's systemic reaction. Older and sicker patients are more likely to experience this. This is often exacerbated by dehydration. This can manifest as:

- Drowsiness
- Lethargy
- Confusion

Other symptoms of sepsis will depend on the underlying cause of the infection. Some examples include:

- **Pneumonia:** productive cough, shortness of breath
- **UTI:** Dysuria, urinary frequency, pain (flank, back, or suprapubic region)
- **Cellulitis:** Redness, swelling, and swelling of skin (often the legs)
- **Abdominal Abscess:** Abdominal pain
- **Diverticulitis:** Abdominal pain, diarrhea, bloody BMs

The patient should be asked about symptoms that may indicate a cause for the infection.

PHYSICAL EXAM

The physical exam is essential in patients with sepsis, as these patients are often very sick or on their way to becoming very sick.

It is important to note that **not all people with sepsis will have the same physical findings**, and some may not have any physical findings at all. This is why it is important for healthcare providers to perform a thorough and complete assessment to identify any signs or symptoms of sepsis.



VITAL SIGNS

- **Temp:** A fever above 100.4°F (38°C)
 - Could be hypothermic in severe sepsis
- **BP:** Often low, hypotensive < 90/60 mmHg or MAP < 65 is worrisome
- **Pulse/HR:** Tachycardic, may be between 90-140 bpm
- **Respirations:** Normal but often somewhat increased (above 20 rpm)
- **Pulse Ox:** May be normal or low, especially with respiratory infections



INSPECTION

- **NEURO:** Altered mental status (AMS)
- **HEENT:** Dry mucous membranes
- **RESPIRATORY:** Fast breathing, respiratory distress
- **SKIN:** pale or flushed, may have rashes, redness, or swelling



AUSCULTATION

- **Heart:** Often rapid and regular
- **Lungs:** May have crackles and/or Rhonchi if a respiratory infection is present



PALPATION

- **CARDIOVASCULAR:** Peripheral pulses may be faint, cap refill often delayed, distal extremities may be warm
- **ABDOMEN:** Usually non-tender;
 - **UTI:** May have suprapubic tenderness
 - **Pyelo/Kidney stone:** Flank pain, Costovertebral angle tenderness
 - **Abdominal abscess:** May have abdominal tenderness
- **BACK:** Mid-line spinal tenderness with should prompt evaluation for spinal abscess

NURSING INTERVENTIONS FOR SEPSIS

When you suspect sepsis, there are multiple things you should do as the patient's nurse. Timing is so important, and that's why so many departments have quality metrics and procedures in place for septic patients to **get things done quickly**. The faster we act, the better the chances of the patient surviving.



BEDSIDE MONITOR

Hook up the patient to the bedside monitor to monitor their vitals frequently, especially their **heart rhythm** and **their blood pressure**. Set the machine to check BP **every 15 minutes**.



NOTIFY PROVIDER

Be sure to **notify the provider** ASAP, as these patients are very sick and need orders STAT.



PLACE THE IV

Place **at least two IVs**, 18-20g, and draw blood. This is for fluid and medication administration such as antibiotics and maybe even vasopressors until a central line can be placed.



DRAWING BLOOD

Once placing the IV, you can grab labs off of the IV site. You will want to grab a basic rainbow (Blue top, Mint or gold top, and a lavender top), as well as **blood cultures** and a **lactic** (if your facility protocol allows 1 blood culture from the IV site).



PRIME YOUR FLUIDS

Prime **fluids** to be given once ordered – probably at least 2 liters. **Septic patients need at least 30ml/kg bolus of isotonic fluids** to improve their symptoms, stabilize their vitals, improve their lactic acidosis, and improve their survival rates!



CHF OR ESRD?

Should your patient with ESRD or CHF get the same amount of fluids? Keep reading below to find out!

WORKUP OF SEPSIS

Since sepsis is a clinical syndrome, there's not exactly a lab test that will definitely tell you whether the patient is in sepsis or not. However, there are common labs and imaging that may be ordered.

BLOOD WORK



CBC

Usually have WBC counts **above 12,000/mm³**, although severe sepsis can also present with leukopenia of **< 4,000/mm³**. **Bands over 10%** are consistent with sepsis.



BANDS & "LEFT SHIFT"

Bands are a type of immature white blood cells that when present in higher numbers indicate severe infection and sepsis. **Bands are normally 0-5%, and bands >10% are worrisome.**

A "left-shift" is an ill-defined term that refers to an increased number of bands in the absolute neutrophil count.



CMP

A complete metabolic panel is drawn to see evidence of anything else going on, any possible source of infection, or of any **organ damage** that the sepsis may have already occurred. This will look at:

- Kidney function (creatinine, BUN)
- Liver function (AST/ALT, Alk Phos, Bili, etc)
- Acid-base (Agap, CO2)
- Glucose & Electrolytes

CO2 = BICARB

Look at the **CO2 in the CMP**. This is equivalent to the Bicarb in a venous blood gas sample. If it is < 18, they are likely acidotic, *probably* from lactic acidosis



COAGS

Coag studies (PT/INR, PTT) are ordered in septic patients to detect **clotting abnormalities**. Severe sepsis can activate the clotting cascade, cause organ dysfunction, and ultimately lead to **DIC**.



BLOOD CULTURES

Aerobic and **anaerobic** blood cultures should be obtained from **two different sites**. This will be used for a **gram stain** and will be **cultured** to see if any bacteria grows, as well as to perform sensitivity reports to various antibiotics.



PROCALCITONIN

Procalcitonin is a non-specific inflammation marker (kind of like ESR and CRP). This isn't always ordered for Sepsis, but it can help show clinical response to antibiotics, especially from **bacterial respiratory infections**. This can help guide the Provider to know when to switch to oral antibiotics or stop the antibiotics altogether.



LACTIC ACID (LACTATE)

If the lactic acid, or lactate, is greater than 2 mmol/L, this indicates **lactic acidosis**. High lactate levels indicate decreased tissue perfusion of the organs, which is classic in Sepsis.

This will often be **repeated every 4-6 hours** until the level becomes normal.

Remember that Lactic acid is checked with a gray top (sometimes dark green), and should be transported **ON ICE!**

LACTATE FROM WHERE?

Remember in cell biology learning about how cells make energy or **ATP**? They do this primarily with oxygen using the Krebs cycle. When oxygen isn't as available, it switches to a **backup method** of creating energy called **glycolysis**, which a byproduct of that is lactic acid.



OTHER LABS



URINALYSIS

Checking a urine sample is a **MUST** for anybody with sepsis, as urinary tract infections are a super common cause of sepsis. The presence of leukocyte esterase and WBCs, nitrites, and bacteria supports a UTI diagnosis. Check out the full article on [how to interpret a UA!](#)



OTHER COLLECTIONS

Other labs that might be ordered depending on the symptoms of the patient includes:

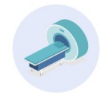
- Anaerobic and Aerobic culture **swabs of open wounds**
- Sputum culture if productive cough
- Stool culture, ova/parasite, C-diff

IMAGING



A CHEST X-RAY

A CXR is **always** ordered in patients with sepsis to see if there is any pneumonia or to detect any other possible abnormalities.



CT ABDOMEN/PELVIS W/ CONTRAST

Sometimes an abdominal CT may be ordered if the patient has abdominal signs/symptoms, or significantly elevated liver enzymes. **Contrast is preferred** as this will **better visualize any abscesses** or fluid collections present, *assuming* their kidney function isn't too bad.



CT THORAX W/O CONTRAST

A CT of the thorax without contrast is sometimes recommended but the radiologist after a chest x-ray is obtained. A chest-xray only has a sensitivity for pneumonia of about 43%. aren't perfect and could miss pneumonia or other findings that the **CT will have much better sensitivity for picking up infection.**

"PAN SCAN"

Sometimes a CT chest, abdomen, and pelvis is ordered when there is no known source for infection – this can be especially **helpful when there is little history** to go off of, and the patient is unable to express their symptoms.



TREATMENT OF SEPSIS

Remember that sepsis is a systemic response to infection. Our first priority is to **stabilize their vital signs** and **provide support**. Our second priority is to **give antibiotics** to kill the bacteria. Because sepsis has such a high mortality rate, these should be done quickly!

SUPPORTIVE CARE



IV FLUIDS

All septic patients should get a **bolus of crystalloid fluids** (Normal saline or Lactated Ringers). It's recommended that septic patients get **30ml/kg bolus** – so a 70kg patient would get 2,100 mL of roughly 2 liters.

This should be **run wide open**, and if the patient is hypotensive, you should use pressure bags.

This bolus should be finished infusing within the first 3 hours after the patient presents to the ER.



ANTIPYRETICS

Patients who are septic in the hospital often have fevers. Administering antipyretics can help reduce their fluid losses and improve their symptoms overall. Options include:

- **Tylenol** 650mg every 4-6 hours (or 1000mg every 8 hours)
- **Ibuprofen** 600-800mg every 4-6 hours (or other NSAIDs)

WHAT ABOUT CHF?

Even patients with CHF or renal failure need **fluids** during sepsis, although *may* require less. The nurse and Provider should continuously assess for signs of pulmonary edema, such as increased SOB, tachypnea, hypoxemia, and/or pulmonary crackles/rales. If this develops - stop the fluids, notify the provider, and expect to give diuretics and/or **INTUBATE THE PATIENT**.

MEDICAL THERAPIES



ANTIBIOTICS

Antibiotics are crucial in treating sepsis, as we need to fight the underlying bacteria that are trying to kill our patients. These should be **given within the FIRST hour** after the patient gets to the ER.

The choice of antibiotics should depend on multiple factors including the patient's history, risk factors, as well as the suspected source of infection. In practice, you will commonly see an agent that covers MRSA (Vanco), plus a broad-spectrum antibiotic. Common regimens include:

- Vancomycin + Zosyn
- Vanco + Cefepime
- Vanco + Imipenem

WHAT ABOUT FUNGUS?

Sometimes fungal infections can cause severe sepsis, and should be considered in *some* cases. If the patient is **neutropenic** or has risk factors for a severe fungal infection, the provider *may* order antifungal medications. This is likely best decided by Infectious Disease.



VASOPRESSORS

Vasopressors or “pressors” are medications that increase blood pressure through various means, usually by causing **vasoconstriction** of the blood vessels. This **improves perfusion to important organs** like the brain and the heart. However, these are also high-risk medications and only ordered when absolutely necessary.

In sepsis, the vasopressor of choice is often **Norepinephrine** - **also** known as Levophed).

THE MAP

The MAP stands for Mean Arterial Pressure. This is the average pressure in the arteries from one cardiac cycle (systolic + diastolic). This gives a better idea of the perfusion of the organs. To read more about this, check out [HERE](#).



Vasopressors can *usually* be started peripherally in a pinch but eventually will require a central line to be placed. This is primarily because vasopressors can damage tissue if there is extravasation.

All vasopressors need to be **closely titrated by a critical care nurse**, and the goal is usually **related to the MAP**, not the systolic blood pressure.

NOREPINEPHRINE (LEVOPHED)

VASOPRESSOR

MECHANISM OF ACTION

Stimulates Beta-1 and alpha-adrenergic receptors to increase the strength of contractions, the heart rate, and causes vasoconstriction – all of which increases systemic BP and coronary blood flow.

SEPSIS DOSING

0.05 – 0.15 mcg/kg/min; titrate to MAP \geq 65 mmHg.

** Always follow facility protocol and orders**

MAX DOSE

1 – 3.3 mcg/kg/min

SIDE EFFECTS

Hypertension, tachycardia, palpitations, headache, nausea/vomiting, peripheral vasoconstriction



GLUCOCORTICOIDS

In general, steroids like Solu-Medrol are not recommended during sepsis. However, it *may* sometimes be ordered by the critical care physician **if the patient does not respond well to fluids and vasopressors**.

MONITORING & COMPLICATIONS OF SEPSIS



LACTIC ACID

The **lactic acid should be trended** if it is elevated from the start. This is generally checked every 4-6 hours until it falls below 2 mmol/L



WBC & BANDS

WBCs should be trended as well, at least daily until resolution. This will usually immediately decrease with fluids and antibiotic administration.



URINE OUTPUT

A foley is often placed to track this closely, and it a strong indicator of kidney perfusion. The goal is often to have a urine output \geq 0.5 mL/kg per hour.



CARDIAC MONITOR

Septic patients are usually tachycardic, and they are at increased risk for [arrhythmias](#) as well as [myocardial infarctions](#). Close monitoring per department protocol is warranted.



BLOOD CULTURES & SENSITIVITIES

Gram staining will be performed of the blood cultures usually within 24 hours, and cultures will grow bacteria if present in about 48-72 hours. This will depend on your hospital's lab. The antibiotics may be changed depending on sensitivities.



HEMODYNAMICS

[Blood pressure and MAP](#) should be monitored for hypotension and improvement with interventions like fluids and vasopressors. Goal is usually a MAP ≥ 65 mmHg



ASSESSMENT

The patient will need to be assessed per department protocol. You should be assessing for signs of worsening perfusion such as:

- Pallor and sweating
- Confusion
- Worsening vital signs



IV & EXTREMITIES

Assess the IV sites and/or central line sites per protocol. Remember vasopressors can cause vasoconstriction of the extremities, so monitor for **signs of decreased circulation** such as:

- Delayed capillary refill
- Distal pallor or cyanosis
- Necrosis of the fingertips



S/S OF FLUID OVERLOAD

Patients who are septic are receiving plenty of fluids and are under a lot of stress overall. This can put a lot of strain on the heart, especially when the patient has a history of cardiac disease. Watch for s/s of fluid overload including:

- Increased shortness of breath
- Increased JVD
- Respiratory Crackles/rales

If the patient is on vasopressors, make sure you are assessing their extremities pulses and capillary refill. Vasopressors can cause necrosis of the extremities like fingers or toes if they are clamping down too much.

Early recognition and treatment of sepsis are crucial for improving patient outcomes. The mortality rate for sepsis can be high, but **quick action by nurses** and doctors can make a significant difference in the patient's outcome. It is important for nurses to be aware of the signs and symptoms of sepsis and to know how to recognize and manage it. By recognizing and treating sepsis early, nurses can help improve patient outcomes and save lives.

Also check out:

- [Six Steps for Sepsis Management](#)
- [The Ultimate ABGs Blood Gas Guide you Need to Calm Your Nerves](#)
- [Intravenous Fluids: Types of IV Fluids](#)
- [VTACH + VFIB | A Nurse's Guide to Ventricular Arrhythmias](#)
- [How to Read an EKG Rhythm Strip](#)

REFERENCES



UPTODATE ARTICLES:

[Evaluation and management of suspected sepsis and septic shock in adults](#)

[Norepinephrine: Drug information](#)

[Sepsis syndromes in adults: Epidemiology, definitions, clinical presentation, diagnosis, and prognosis](#)

OTHER RESOURCES

[CDC: "Sepsis"](#)

Tintanilli's Emergency manual (8th edition): Chapter 89