



1

---

---

---

---

---

---

---

---



2

---

---

---

---

---

---

---

---



3

---

---

---

---

---

---

---

---

**WHAT IS SEPSIS?**

Sepsis is **dysregulated** host response to **infection** that can lead to life-threatening organ dysfunction.

Infection from: virus, bacteria, fungus or parasites.

4

---

---

---

---

---

---

---

---

**SEPSIS**

Sepsis occurs when chemicals released into the bloodstream to fight an infection trigger inflammatory responses throughout the body.

© MAYO CLINIC

[www.mayoclinic.org](http://www.mayoclinic.org) 2017

5

---

---

---

---

---

---

---

---

**WHAT IS SEPTIC SHOCK?**

Septic shock is a subset of sepsis with **circulatory and cellular/metabolic dysfunction** associated with a higher risk of mortality.

If sepsis goes unchecked, it can progress to septic shock

6

---

---

---

---

---

---

---

---

### SEPTIC SHOCK

- If patient **requires vasopressors** to maintain a mean arterial pressure (MAP) of  $\geq 65$  mm Hg (despite adequate fluid resuscitation)
- And **serum lactate is  $\geq 2$  mmol/l** it is defined as *septic shock*
- The term “**severe sepsis**” has been **abandoned** and should not be used
- Concept of **SIRS** can still be used to describe a systemic response to a **sterile hit** (e.g., pancreatitis or trauma)

---

---

---

---

---

---

---

---

7

### SEPSIS STATISTICS

- Estimated **20 million sepsis cases per year** worldwide with **25% mortality**
- Estimated 5 million sepsis-related deaths worldwide in 2017
- At least 1.7 million sepsis cases in the US annually
- At least 350,000 sepsis deaths in the US annually
- Leading cause of hospital deaths, readmissions & treatment costs
- **Almost 50% of hospital deaths** are related to sepsis

Dantes et al, MMWR, 2023

---

---

---

---

---

---

---

---

8

### SEPSIS STATISTICS

- 87% of sepsis cases start in the community
- **Risk of dying from sepsis increases by 8% for every hour treatment is delayed**
- Patients often suffer limb amputations and post sepsis syndrome
- Medicare costs for sepsis admissions & skilled nursing care > \$41.5B annually

Townsend et al, Chest, 2022

---

---

---

---

---






---

---

---

9

### CAUSES OF SEPSIS BY INFECTIOUS ORGANISM

<b>Gram-positive cocci</b>	<b>Gram-negative rods</b>
<ul style="list-style-type: none"><li>• <i>Staphylococcus aureus</i></li></ul> 	<ul style="list-style-type: none"><li>• <i>Klebsiella pneumoniae</i></li></ul> 
<ul style="list-style-type: none"><li>• <i>Streptococcus pyogenes</i></li></ul> 	<ul style="list-style-type: none"><li>• <i>Escherichia coli</i></li></ul> 
	<ul style="list-style-type: none"><li>• <i>Pseudomonas aeruginosa</i></li></ul> 

Khan Academy/Science 2014

10

---

---

---

---

---


---

---

---

### CAUSES OF SEPSIS BY ORGAN SYSTEM

1. Lung
2. Gastrointestinal
3. Urinary
4. Blood
5. Skin & soft tissues



11

---

---

---

---

---

---

---

---

### CAUSES OF SEPSIS BY ORGAN SYSTEM & AGE

- Adults ages 65 and older are 13 times more likely to be hospitalized with sepsis than younger adults
- Particularly in older people, infection starts in **urinary tract** or **lungs**
- **GI tract** and **skin** are other common sources of sepsis
- Higher risk if weakened immune system or chronic conditions such as diabetes, kidney disease or lung disease, or recent surgery or hospitalization

12

---

---

---

---

---

---

---

---

### WHO IS AT HIGH RISK OF SEPSIS?

- **Age** over 60 years or under 1 year
- **Immunocompromised** e.g., post splenectomy
- **Chronic conditions** e.g., COPD or diabetes
- Indwelling **foreign body** e.g., central venous catheter
- Recent **hospitalization** or surgery
- **Malnutrition** or immobility

13

---

---

---

---

---

---

---

---

### SEPSIS WARNING SIGNS

**SEPSIS SYMPTOMS**

- SWEATY SKIN
- DISORIENTATION
- SHIVERING
- HIGH HEART RATE
- EXTREME PAIN
- SHORT OF BREATH

14

---

---

---

---

---

---

---

---

### SEPSIS SCREENING TOOLS / EARLY WARNING

- National Early Warning Score (**NEWS**)
- Modified Early Warning Score (**MEWS**)
- Sequential Organ Failure Assessment (**SOFA**) criteria
  
- Tools have a wide variation in specificity and sensitivity
- Important component of identifying sepsis for early intervention

Tu et al, JAMA, 2021

15

---

---

---

---

---

---

---

---

### SEPSIS SEVERITY SCORING: SOFA SCORE

- Sequential Organ Failure Assessment score
- Measures organ dysfunction
- **Life threatening if increased by  $\geq 2$  points**
- Abdominal sepsis is increase in SOFA of  $\geq 2$  points due to intra-abdominal infection
- **Mortality prediction for ICU patients**
- Score 1-4 in 6 clinical & lab value categories:
  - PaO<sub>2</sub>, GCS, MAP, Billi, Platelets & Creatinine

Sartelli et al, World Journal of Emergency Surgery, 2021

SOFA score	SOFA score
PaO <sub>2</sub> /FiO <sub>2</sub> (mmHg)	
<400	1
<100	2
<100 and mechanically ventilated	3
<100 and mechanically ventilated	4
Glasgow coma scale	
15-14	1
13-12	2
8-6	3
<6	4
Mean arterial pressure (or administration of vasopressors required)	
MAP < 65 mmHg	1
80p 55 or 60p 50mm	2
80p 55 (or 60p 50) (or 60p 50)	3
80p 55 (or 60p 50) (or 60p 50)	4
Bilirubin (mg/dl)	
1.2-1.9	1
2.0-3.0	2
6.0-11.9	3
>12.0	4
Platelets $\times 10^9/L$	
<100	1
<100	2
<100	3
<29	4
Creatinine (mg/dl)	
1.2-1.9	1
2.0-3.4	2
3.5-4.9	3
>5	4

16

---

---

---

---

---

---

---

---

---

---

### SEPSIS SEVERITY SCORING: QUICK SOFA SCORE

For use **outside the ICU** (e.g., ER or ward)

Three easy to evaluate criteria:

1. **Alteration in mental status** (GCS < 15)
2. **Respiratory rate  $\geq 22$  breaths per minute**
3. **Systolic blood pressure  $\leq 100$  mm Hg**

Presence of **2 or more** is high-risk for sepsis



Sartelli et al, World Journal of Emergency Surgery, 2021

17

---

---

---

---

---

---

---

---

---

---

### SURVIVING SEPSIS CAMPAIGN 2004

- Introduced at 2002 European Society of Intensive Care Medicine (ESICM) annual meeting in Barcelona, with the “**Barcelona Declaration**”
- 3 organizations: ESICM, Society of Critical Care Medicine and International Sepsis Forum committed to **reduce mortality of sepsis by 25% within 5 years**
- International **guidelines and quality improvement** program
- Updated every 4 years and published in Critical Care Medicine
- Worked with Institute for Healthcare improvement to create “**bundles**”

18

---

---

---

---

---

---

---

---

---

---

**SURVIVING SEPSIS CAMPAIGN 2021**

- Endorsed by 20 medical organizations all over the world
- Adults with septic shock on vasopressors, rec. target MAP of  $\geq 65$  mm Hg
- In RCT, higher MAP targets of 80-85 mm Hg were assoc. with A. Fib.
- **Mortality increases when ED to ICU admit time exceeds 6 hours (17 v 13%)**

19

---

---

---

---

---

---

---

---



**SEPSIS TREATMENT**

20

---

---

---

---

---

---

---

---

**SURVIVING SEPSIS CAMPAIGN 2021  
CORNERSTONES OF MANAGEMENT**

- Fluid and electrolyte **resuscitation** (initial 30 ml/kg)
- Obtain **blood cultures** and **serum lactate**
- **Broad spectrum antibiotics within one hour** of recognition for **septic shock** and **within 3 hours** for sepsis without shock
- **Source control** of the infection (e.g., surgery)
- Glycemic control
- Detailed initial assessment & ongoing re-evaluation of treatment response

21

---

---

---

---

---

---

---

---

### SEPSIS IS AN EMERGENCY

- Outcomes are improved with **early recognition & appropriate treatment**
- Every **hour** matters
- Prompt **consultation**
- May include **admission to ICU**

22

---

---

---

---

---

---

---

---

### Figure 1: Sepsis Mortality Rate: Time to Antibiotics

DELAY IN ANTIBIOTICS REDUCES SURVIVAL RATE

Time to antibiotics (hours)	Patient survival rate (%)	Patients with effective antibiotic therapy (%)
0	100	0
1	92	10
2	84	20
3	76	30
4	68	40
5	60	50
6	52	60
9	44	70
12	36	80
24	28	90
36	20	100

• Every hour delay in antibiotics leads to an **8% increase** in mortality

Source: Made for World Sepsis Day by lindgruen-gmbh.com.

23

---

---

---

---

---

---

---

---

### TIME FROM ED PRESENTATION TO FIRST ABX

Legend: Overall (solid line), Septic shock (dashed line), Severe sepsis (dotted line), Sepsis (dash-dot line).

Source: Liu et al. AM and CCM, 2017

24

---

---

---

---

---

---

---

---



### ODDS RATIO FOR HOSPITAL MORTALITY BASED ON TIME OF ANTIBIOTIC ADMINISTRATION

**Table 3.** Odds Ratios for Hospital Mortality Based on the Time of Antibiotic Administration in Unadjusted and Adjusted Logistic Regression Models

Model	Odds Ratio for Hospital Mortality, per Elapsed Hour until Antibiotic Administration	95% CI	P Value
Unadjusted	0.89	0.86-0.91	<0.001
+ Sepsis severity strata	0.96	0.93-0.99	0.013
+ Severity of illness	1.08	1.04-1.12	<0.001
+ Demographics	1.09	1.05-1.13	<0.001
Fully adjusted model, in each subgroup			
Sepsis only	1.09	1.00-1.19	0.046
Severe sepsis only	1.07	1.01-1.24	0.014
Septic shock only	1.14	1.06-1.23	0.001

Lee et al, ABR and CCM, 2017

---

---

---

---

---

---


---

---

---

---

25



### SEPSIS CLINICAL GUIDELINES

---

---

---

---

---

---

---

---

---

---

26

### SOURCE CONTROL FOR GI PERF & SEPTIC SHOCK

- Developed a **protocol for early source control** immediately after admission
- Prospective observational study: 154 patients with GI perforation & septic shock
- Early goal directed therapy in ER for resuscitation
- Survival was 82.5% on day 28 and 77.9% on day 60
- **Survival rate fell as surgery initiation was delayed, 0.29 per hour delay (adjusted OR)**
- **60-day survival 0 for times greater than 6 hours**
- **Time from admission to initiation of surgery for source control** is a critical determinant of mortality risk

Azuhata et al, Critical Care, 2014

---

---

---

---

---

---

---

---

---

---

27

### SOURCE CONTROL FOR GI PERFORATION

- Sites of perforation: small intestine (42.9%), colon (40.9%) and upper GI (9.1%)
- **Upper GI perforation: omental patch, irrigation & drainage**
- If gastric cancer, same with delayed secondary radical operation
- **Lower GI perforation: resection of necrotic piece, irrigation & drainage**
- No primary anastomosis
- 18 patients (11.7%) required a re-laparotomy
- Second factor assoc. with survival was SOFA score (adjusted odds ratio 0.80)

Azuahata et al, Critical Care, 2014

28

---

---

---

---

---

---

---

---

### CORNERSTONES OF TREATMENT OF INTRAABDOMINAL INFECTION (IAI)

- **Early recognition**
- Adequate **source control**
- Broad-spectrum **antimicrobial** therapy initiated within one hour of diagnosis
- Prompt physiological stabilization with **iv fluids**

- Complicated IAIs have an **overall mortality rate of 9.2%**

Sartelli et al, World Journal of Emergency Surgery, 2021

29

---

---

---

---

---

---

---

---

### ABDOMINAL SEPSIS

```

    graph TD
      A[Patients with intra-abdominal infections] --> B[Source control  
(if done, provides an  
initially fit patient)]
      A --> C[Empiric antibiotic  
therapy  
Based on:  
Local epidemiology  
Individual risk factors for IMCI  
Clinical severity]
      A --> D[Fluid support  
(Fluid resuscitation  
and vaso-pressors)]
      B --> E[Microbiological culture  
To identify the pathogen(s)  
To determine susceptibility  
(culture is dependent on site for  
IMCI) and to identify if  
sepsis]
      C --> F[Reassessment of antibiotic  
therapy  
To amend antibiotic regimen  
To de-escalate antibiotic regimen]
      D --> G[Vasopressors  
(If hypotensive patients  
following fluid loading)]
      E --> F
      F --> H[Re-intervention  
(if ongoing infections)]
      style H fill:none,stroke:none
  
```

Sartelli et al, World Journal of Emergency Surgery, 2021

30

---

---

---

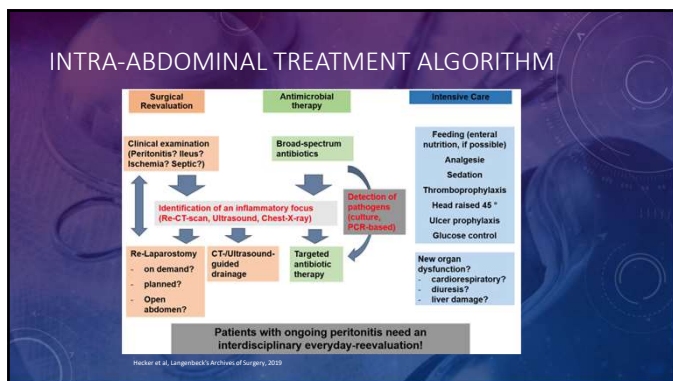
---

---

---

---

---



31

---

---

---

---

---

---

---

---

---

---

---

---

### SOURCE CONTROL IN INTRABDOMINAL SEPSIS

- Source control is based on 4 elements:
  1. Debridement
  2. Removal of infected devices
  3. Drainage of purulent cavities
  4. Decompression of the abdominal cavity
- Inadequate source control increases 28-day mortality from 27% to 43%

Hecker et al., Langenbeck's Archives of Surgery, 2020

32

---

---

---

---

---

---

---

---

---

---

---

---

### CMS MANAGEMENT BUNDLE FOR SEPSIS (SEP-1)

- Severe Sepsis and Septic Shock: **Management Bundle (SEP-1)**
- Emphasized the importance of **early sepsis management in US hospitals**
- Endorsed in 2013 by National Quality Foundation (NQF)
- Implemented by **CMS in October 2015**
- Has faced some criticism for its complexity and breadth
- In **2021, NQF re-endorsed the SEP-1 measure for a third time**
- Infectious Diseases Society of America (ISDA) and American College of Emergency Physicians (ACEP) appealed this in 2022

33

---

---

---

---

---

---

---

---

---

---

---

---

### CMS MANAGEMENT BUNDLE FOR SEPSIS (SEP-1)

7 Basic Elements:

1. Measure the **patient's initial lactate** level.
2. Take a **blood culture** before administering a broad-spectrum antibiotic.
3. Administer a **broad-spectrum antibiotic within 3 hours**.
4. **Administer 30 mL/kg of crystalloid fluid** to patients with low BP or elevated lactate.
5. **Repeat the lactate** if it was elevated initially.
6. Administer a **vasopressor** for patients who remain hypotensive.
7. **Reassess the patient** after a certain period.

34

---

---

---

---

---

---

---

---

### 7 SEPSIS CORE ELEMENTS CDC HOSPITAL SEPSIS PROGRAM 2023

1. **Hospital Leadership** Commitment: dedicating human, financial & IT services
2. Accountability: **appointing a leader** or co-leader responsible for goals & outcomes
3. Multi-Professional Expertise: **engaging key partners** throughout hospital system
4. Action: **implementing processes** to improve identification, mgmt. & recovery
5. Tracking: **measuring** epidemiology, mgmt. & outcomes to **assess impact of initiatives**
6. **Reporting**: providing info. on sepsis mgmt. & outcomes to relevant partners
7. Education: providing **sepsis education** to healthcare professionals, patients & families

CDC. Hospital Sepsis Program Core Elements. 2023

35

---

---

---

---

---

---

---

---

POLICIES COMPLIANCE  
TRANSPARENCY RULES  
REQUIREMENTS STANDARDS  
LAW  
REGULATIONS

36

---

---

---

---

---

---

---

---

### COMPLIANCE WITH SEP-1 & MORTALITY

- **Effects of compliance** with early management bundle on **30-day mortality**
- Patient-level Medicare data reported by **3,241 hospitals** 10/1/15 to 3/31/17
- Propensity score matched Medicare patients with sepsis
- **Compliance defined as completion of all 7 SEP-1 elements**
- Primary outcome was a change in 30-day mortality
- Secondary outcomes included changes in length of stay

Townsend et al, Chest, 2022

37

---

---

---

---

---

---

---

---

### COMPLIANCE WITH SEP-1 & MORTALITY

- **122,870 patients** whose care was compliant matched to same # noncompliant
- **Compliance was associated with a reduced 30-day mortality: 21.8% v 27.5%**
- Yielding **absolute risk reduction of 4.06%**
- **Compliance was associated with risk-adjusted 30-d mortality (OR 0.82)**
- Median length of stay was shorter with complaint care (5 v 6 days)
- Conclusion: **compliance with SEP-1 was associated with lower 30-d mortality**
- Rendering SEP-1 compliant care *may* reduce the incidence of avoidable deaths

Townsend et al, Chest, 2022

38

---

---

---

---

---

---

---

---

### HOUSTON METHODIST CASE STUDY

- Over **15 years cut sepsis deaths from 35% to 6%**
- Formed a sepsis committee in 2008
- Created a scoring system and sepsis teams in ER, ward and ICU
- Also created a critical care recovery clinic to follow patients & prevent readmits
- Estimated they **saved almost 2,500 lives and \$50M in costs**
- Only hospital recognized by Global Sepsis Alliance for its progress on sepsis

Becker's Clinical Leadership, Carabajal, Sept. 18, 2023

39

---

---

---

---

---

---

---

---

### POST SEPSIS SYNDROME (PSS)

- Over **62% of survivors are readmitted** to hospital within 30 days of discharge
- PSS affects up to **50% of sepsis survivors**
- Some long-term problems:
  - Amputations
  - Anxiety
  - Memory Loss
  - Chronic Fatigue
  - Chronic Pain

Popp, Journal of Healthcare Risk Management, 2016

40

---

---

---

---

---

---

---

---

### POST SEPSIS SYNDROME (PSS)

<u>Physical</u> <ul style="list-style-type: none"><li>• Difficulty sleeping &amp; poor appetite</li><li>• Fatigue</li><li>• Shortness of breath</li><li>• Disabling muscle or joint pain &amp; swelling</li><li>• Repeat infections</li><li>• Reduced organ function (e.g., kidney, liver, heart)</li><li>• Skin rash &amp; hair loss</li></ul>	<u>Psychological</u> <ul style="list-style-type: none"><li>• Hallucinations</li><li>• Panic attacks &amp; flashbacks</li><li>• Nightmares &amp; PTSD</li><li>• Decreased cognitive functioning</li><li>• Depression &amp; mood swings</li><li>• Loss of self-esteem</li><li>• Memory loss &amp; difficulty concentrating</li></ul>
---	--

Sepsis Alliance, www.sepsis.org

41

---

---

---

---

---

---

---

---



### MEDICAL MALPRACTICE AND SEPSIS

42

---

---

---

---

---

---

---

---

### THE "BIG 3" IN MALPRACTICE CLAIMS: VASCULAR, INFECTIONS, & CANCERS

- Misdiagnosis-related harms in malpractice claims
- Analysis of large medical malpractice claims database
- Controlled Risk Insurance Company from 2006-2015
- Analyzed 11,592 diagnostic error cases out of 53,377 closed claims
- Included 7379 high-severity harms (including 53% death)
  - Defined as serious, permanent disability, or death
- Big 3 accounted for 74% of high-severity cases

Newman-Toker et al, Diagnosis, 2019

43

---

---

---

---

---

---

---

---

### SEPSIS AND MEDICAL MALPRACTICE

- Failure to diagnose
- Failure to treat
- Delay or inadequate antibiotics
- Failure to obtain source control
- Failure to reintervene with clinical deterioration or lack of improvement

44

---

---

---

---

---

---

---

---

### SEPSIS CLAIMS REVIEW – CANADA 2023

- Retrospective review of closed claims 2011 to 2020
- Documented peer expert criticism related to sepsis
- 162 patients, mean age 53 years, mortality 49%
- Main outcomes: describe patients and physicians and classify contributing factors (provider, team, system) & diagnostic pitfalls based on peer expert criticisms.

Neilson et al, Critical Care Explorations, 2023

45

---

---

---

---

---

---

---

---

### SEPSIS CLAIMS REVIEW – CANADA 2023

- 218 implicated physicians (1.3 MDs/patient)
- 169 (78%) were family medicine, emergency medicine or surgeons
- 49% of patients made multiple outpatient visits leading up to admission
- 39% of patients were admitted to the ICU
- Only 25% presented with fever
- 30% had severe harm such as limb amputation or brain damage
- Deficient assessments, such as failing to consider sepsis or not reassess the patient prior to discharge, contributed to 81% of cases

Neilson et al, Critical Care Explorations, 2023

46

---

---

---


---

---

---

---

---



### SEPSIS CASES

DISCLAIMER:  
THESE ARE FICTITIOUS AND NOT  
REAL CASES

47

---

---

---

---

---

---

---

---

### POSSIBLE CASES/IMAGES

- Line infection – sent home with CVC
- New case for RMAP – bypass, presented w sepsis, no surgery until septic shock, death
- Or Ashley cases for Colin – colon injury
- Or the Southern Oregon case – Blommer – admit to medicine
- Balloon aspiration/ ARDS case

48

---

---

---

---

---

---

---

---



### SEPSIS CASE #1: HYSTERECTOMY

- 40-year-old female has laparoscopic hysterectomy for fibroids
- Postop day one has tachycardia to 115 bpm (HR on admission was 79)
- Rates pain as 7/10, narcotics changed from Oxycodone to Dilaudid
- EKG shows sinus tachycardia with HR 119
- Metoprolol ordered by senior gynecology resident on postop day 2
- Discharged home on Dilaudid & metoprolol on postop day 3, with HR of 101
- Advised to follow up with PCP in one week regarding the tachycardia

49

---

---

---

---

---

---

---

---

### SEPSIS CASE #1: ED PRESENTATION

- Presents to the ED on postop day 4 with shortness of breath and abdo pain
- On exam she is pale, diaphoretic, abdo is tender with guarding
- HR 120, BP 80/50, RR 24, O2 saturation 89% on room air
- Upright chest x-ray ordered
- Labs ordered: lactate, CBC, CMP, amylase, troponin

50

---

---

---

---

---

---

---

---

### UPRIGHT CHEST X-RAY



www.radiopaedia.org

51

---

---

---

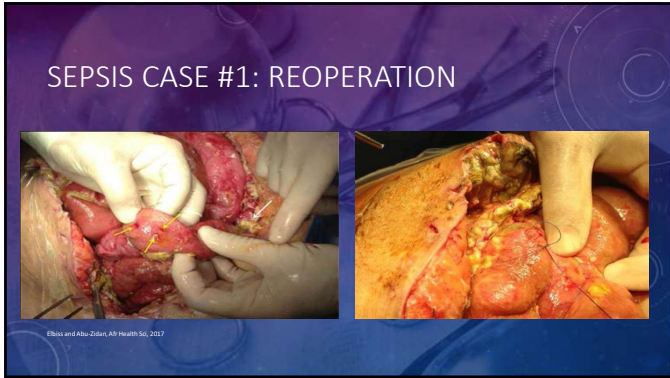
---

---

---

---

---



52

---

---

---

---

---

---

---

---



53

---

---

---

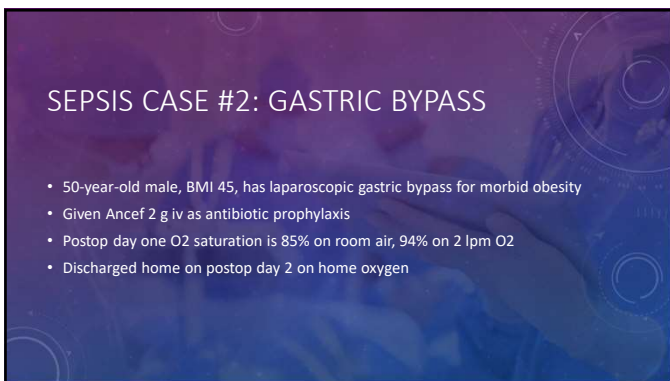
---

---

---

---

---



54

---

---

---

---

---

---

---

---

### SEPSIS CASE #2: ED PRESENTATION

- Presents to ED on postop 3 with abdo pain, distention & vomiting
- Has not kept anything down for 24 hours
- BP 140/100, HR 95, RR 22, O2 Sat 79% on RA, 94% on O2 5 lpm
- ED MD says patient is in moderate distress, tender, concern for leak
- Bariatric surgeon called and labs and CT AP ordered with oral & iv contrast

55

---

---

---

---


---

---

---

---

### SEPSIS CASE #2: CT ABDOMEN/PELVIS



56

---

---

---

---

---

---

---

---

### SEPSIS CASE #2: SURGEON EVALUATION

- Seen next am by bariatric surgeon, notes abdo distention & pedal edema
- Orders chest x-ray (which is normal) and Lasix for possible fluid overload
- States that CT scan is negative and wbc stable at 12
- Is called in the afternoon regarding tachycardia and orders metoprolol

57

---

---

---

---

---

---

---

---

### SEPSIS CASE #2: RAPID RESPONSE

- Rapid response called next evening (POD#5) for tachycardia & tachypnea
- Patient is diaphoretic & complains of 10/10 abdo pain
- Hospitalist transfers patient to ICU for higher level of care
- Surgeon is called and suggests CT chest to rule out PE

58

---

---

---

---


---

---

---

---

### SEPSIS CASE #2: CT CHEST ABDOMEN PELVIS



CT Scan Details:  
CONTRAST Definition  
EX: 20000  
SC: 200  
SC: 200 CT Head Ch Abdom Pelvis Soft Tissue 3 mm - Venous  
IN: 20000  
AX: 1.00 00  
Map: 16  
000000

100 kVp  
200 mA  
10.0 s  
TI: 23.00  
DPR: 0.90

Aug 14, 12:29 PM  
100 kVp  
200 mA

59

---

---

---

---

---

---

---

---

### SEPSIS CASE #2: REOPERATION

- Taken to surgery later that morning (POD#6) for suspected leak
- Given 2 g of Ancef and 500 mg Flagyl intraoperatively
- Is on a NRB and several pressors, no urine output noted last 24 hours
- Surgeon finds leak at gastrojejunal anastomosis and oversews & drains
- Patient is transferred back to ICU in critical condition
- Broad-spectrum antibiotics ordered by Intensivist
- Patient develops multi system organ failure and dies the next day

60

---

---

---

---

---

---

---

---

### EXPERT OPINIONS – CASE #2

- Bariatric surgeon is negligent (not for the leak)
- Inadequate prophylactic antibiotics at time of gastric bypass
- Delay in diagnosis of leak, sepsis and septic shock leading to death
- 3-day delay in diagnosis and treatment of sepsis
  - with antibiotics & source control

61

---

---

---

---

---

---

---

---



### EXPERT TIPS FOR SEPSIS CASES

62

---

---

---

---

---

---

---

---

### EXPERT TIPS FOR REVIEWING SEPSIS CASES

- Timing is everything:
  - Appropriate prophylactic antibiotics for surgery?
  - Vitals, fluid resuscitation, antibiotics and source control
  - Check the MAR for actual time of 1st dose of antibiotics and were they broad enough?
  - Sepsis protocol: close monitoring, serial serum lactate and clinical reassessment
  - Any unnecessary delays or prolonged surgery?
- Source control is not necessarily one and done

63

---

---

---

---

---

---

---

---

### EXPERT TIPS FOR REVIEWING SEPSIS CASES

- Review all radiology imaging and/or have a radiology expert
- Make a table or graph of the vitals and urine output and labs e.g. lactate, wbc
- Can calculate SOFA or other sepsis scores yourself even if not in the record
- Review the audit trail to see who saw early warning scores and when

64

---

---

---

---

---

---

---

---

### MD CALC PHONE APP

The screenshot shows two screens of the MD Calc app. The left screen lists various calculators such as Sepsis-Induced Coagulopathy, SIRS & Sepsis Criteria, Pediatric SOFA, qSOFA, APACHE II Score, MASCC Risk Index, ATLAS Score for C. Diff Culture, and Urine Output. The right screen shows the results for a 'Sepsis' calculation, including metrics like SOFA, qSOFA, Pediatric SOFA, and SOFA Score.

65

---

---

---

---

---

---

---

---

### QUIZ

The graphic features several white question marks on a teal background, with the word 'QUIZ' in white text on a dark blue background to the right.

66

---

---

---

---

---

---

---

---

## QUESTION #1

Sepsis is currently defined as: (choose the best answer)

- A Hypotension or tachycardia due to bacteria in the bloodstream.
- B A dysregulated host response to infection that can cause organ dysfunction.
- C An infection that is severe and requires hospitalization.
- D Metabolic dysfunction due to infection.
- E Systemic dysregulation that requires vasopressor blood pressure support.

67

---

---

---

---

---

---

---

---

## QUESTION #2

Septic shock is currently defined as: (choose all correct answers)

- A Hypotension or tachycardia due to bacteria in the bloodstream.
- B A dysregulated host response to infection that can cause organ dysfunction.
- C A subset of sepsis with circulatory and cellular/metabolic dysfunction.
- D A patient requires vasopressors to maintain a mean arterial pressure (MAP) of  $\geq 65$  mm Hg despite adequate fluid resuscitation.
- E A patient has a serum lactate of  $\geq 2$  mmol/l despite fluid resuscitation.

68

---

---

---

---

---

---

---

---

## QUESTION #3

The mortality rate of sepsis is: (choose the best answer)

- A 5%
- B 10%
- C 25%
- D 50%
- E 70%

69

---

---

---

---

---

---

---

---

## QUESTION #4

Every **hour delay in antibiotics** for sepsis results in: (choose the best answer)

- A An 8% increase in mortality.
- B An 8% increase in septic shock.
- C A 1% increase in mortality.
- D A 1% increase in septic shock.
- E A 5% increase in risk of being sued for medical negligence.

70

---

---

---

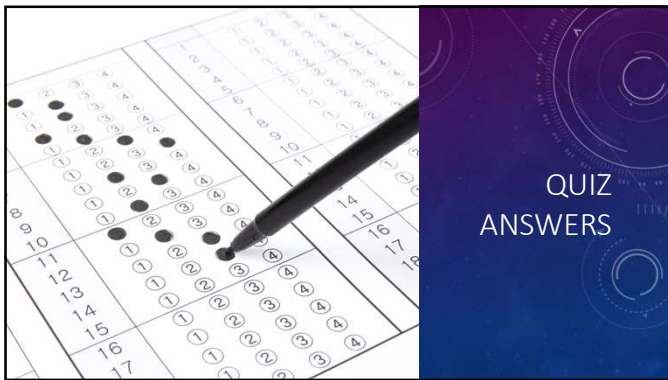
---

---

---

---

---



71

---

---

---

---

---

---

---

---

## ANSWER TO QUESTION #1

**Sepsis** is currently defined as:

- A Hypotension or tachycardia due to bacteria in the bloodstream.
- B **A dysregulated host response to infection that can cause organ dysfunction.**
- C An infection that is severe and requires hospitalization.
- D Metabolic dysfunction due to infection.
- E Systemic dysregulation that requires vasopressor blood pressure support.

72

---

---

---

---

---

---

---

---



## ANSWER TO QUESTION #2

Septic shock is currently defined as: (choose all correct answers)

- A Hypotension or tachycardia due to bacteria in the bloodstream.
- B A dysregulated host response to infection that can cause organ dysfunction.
- C A subset of sepsis with circulatory and cellular/metabolic dysfunction.
- D A patient requires vasopressors to maintain a mean arterial pressure (MAP) of  $\geq 65$  mm Hg despite adequate fluid resuscitation.
- E A patient has a serum lactate of  $\geq 2$  mmol/l despite fluid resuscitation.

73

---

---

---

---

---

---

---

---

## ANSWER TO QUESTION #3

The mortality rate of sepsis is:

- A 5%
- B 10%
- C 25%
- D 50%
- E 70%

74

---

---

---

---

---

---

---

---

## ANSWER TO QUESTION #4

Every hour delay in antibiotics for sepsis results in: (choose the best answer)

- A An 8% increase in mortality.
- B An 8% increase in septic shock.
- C A 1% increase in mortality.
- D A 1% increase in septic shock.
- E A 5% increase in risk of being sued for medical negligence.

75

---

---

---

---

---

---

---

---

### SEPSIS SUMMARY

- The longer sepsis progresses, the higher risk of septic shock and mortality.
- If treatment is started within the first few hours, mortality is reduced.
- Each hour of delay in antibiotics +/- surgical source control increases mortality.
- Early and aggressive treatment of sepsis is crucial.

76

---

---

---

---

---

---

---

---



EMMA J. PATTERSON MD  
FACS FRCS FASMBS

503 939 3369  
[emmajpatterson@gmail.com](mailto:emmajpatterson@gmail.com)

77

---

---

---

---

---

---

---

---



### SURVIVING SEPSIS

EMMA J. PATTERSON MD  
FACS FRCS FASMBS

78

---

---

---

---

---

---

---

---

INTERNET RESOURCES

- The Sepsis Alliance [www.sepsis.org](http://www.sepsis.org)
- Global Sepsis Alliance [www.global-sepsis-alliance.org](http://www.global-sepsis-alliance.org)
- World Sepsis Day [www.worldsepsisday.org](http://www.worldsepsisday.org)

• NELA project 2019 : 1 in 5 patients do not receive antibiotics on time

---

---

---

---

---

---

---

---

79

REFERENCES

- Azuhata T, Kinoshita K, Kawano D et al. Time from admission to initiation of surgery for source control is a critical determinant of survival in patients with gastrointestinal perforation with associated septic shock. *Critical Care*. 2014; 18:R87.
- Carbajal E. Inside Houston Methodist's 15-year journey to cut sepsis deaths. *Becker's Clinical Leadership*. Sept. 18<sup>th</sup>, 2023.
- CDC. Hospital Services Program Core Elements. Atlanta, GA: US Department of Health and Human Services, CDC; 2023. Available at <https://www.cdc.gov/sepsis/core-elements.html>

---

---

---

---

---

---

---

---

80

REFERENCES

- Dellinger RP, Rhodes A, Evans L et al. Surviving sepsis campaign. CCM 50<sup>th</sup> Anniversary article. *Critical Care Medicine*. 2023; 51(4) 431-444.
- Dantes RB, Kaur H, Bouwkamp BA et al. Sepsis program activities in acute care hospitals – National Healthcare Safety Network, United States, 2022. *MMWR Morb Mortal Wkly Rep*. 2023; 72:907-911.
- Elbiss H and Abu-Zidan F. Bowel injury following gynecologic laparoscopic surgery. *Afr Health Sci*. 2017; 17(4) 1237-1245.
- Evans L, Rhodes A, Alhazzani W et al. Surviving sepsis campaign: International guidelines for management of sepsis and septic shock: 2021. *Intensive Care Medicine*. 2021; 47; 1181-1247.

---

---

---

---

---

---

---

---

81

REFERENCES

- Hecker A, Reichert M, Reub CJ et al. Intra-abdominal sepsis: new definitions and current clinical standards. *Langenbecks' Archives of Surgery*. 2019; 404: 257-271.
- Liu V, Fielding-Singh V, Greene J et al. The timing of early antibiotics and hospital mortality in sepsis. *American Journal of Respiratory and Critical Care Medicine*. 2017;196(7): 856-863.
- Neilson H, Fortier J, Ogilby C et al. Diagnostic delays in sepsis: Lessons learned from a retrospective study of Canadian medico-legal claims. *Critical Care Explorations*. 2023; 5(2) 1-9.
- Newman-Toker DE, Schaffer AC, Yu-Moe CW et al. Serious misdiagnosis-related harms in malpractice claims: The "Big Three" – vascular events, infections and cancers. *Diagnosis*. 2019; 6(3): 227-240.

82

---

---

---

---

---

---

---

---

REFERENCES

- Popp P. Hiding in plain sight: Why are we worried about Ebola and not sepsis? *Journal of Healthcare Risk Management*. 2016; 35(4) 22-27.
- Ramachandran G. Gram-positive and gram-negative bacterial toxins in sepsis. *Virulence*. 2014; 5(1) 213-218.
- Rhodes A, Evans L, Alhazzani W et al. Surviving sepsis campaign: International guidelines for management of sepsis and septic shock: 2016. *Critical Care Medicine*. 2016; 45(3) 486-552.

83

---

---

---

---

---

---

---

---

REFERENCES

- Townsend SR, Phillips GS, Duseja R et al. Effects of compliance with the early management bundle (SEP-1) on mortality changes among Medicare beneficiaries with sepsis: a propensity score matched cohort study. *Chest*. 2022; 161(2) 392-406.
- Yu S, Shivakumar N, Betthausen K et al. Comparison of early warning score for sepsis early identification and prediction in the general ward setting. *JAMIA Open*. 2021; 4(3) 1-6.

84

---

---

---

---

---

---

---

---



85

---

---

---

---

---

---

---

---



86

---

---

---

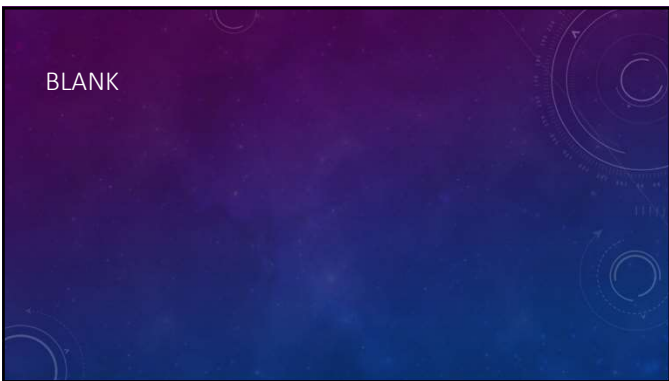
---

---

---

---

---



87

---

---

---

---

---

---

---

---



88

---

---

---

---

---

---

---

---



89

---

---

---

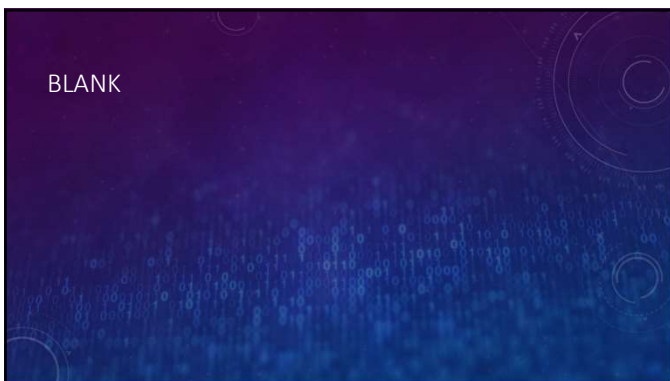
---

---

---

---

---



90

---

---

---

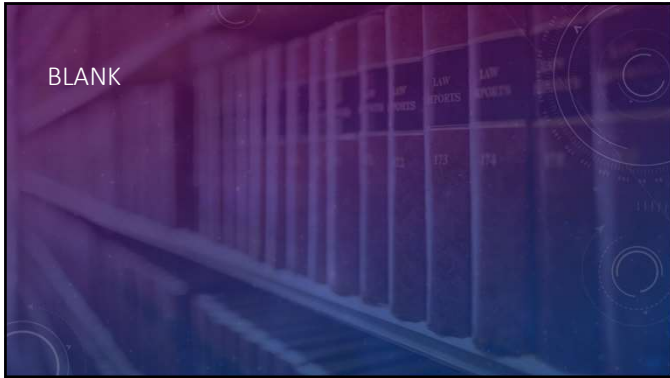
---

---

---

---

---



91

---

---

---

---

---

---

---

---



92

---

---

---

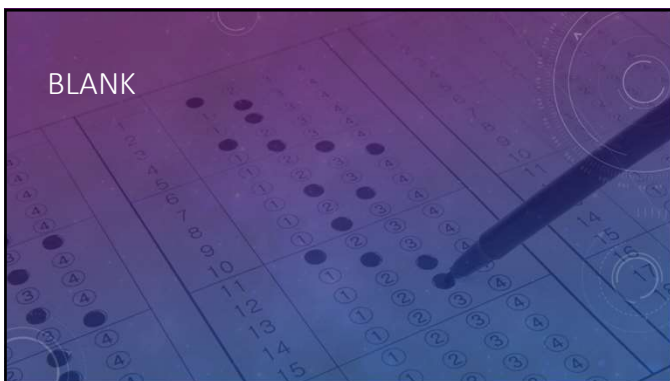
---

---

---

---

---



93

---

---

---

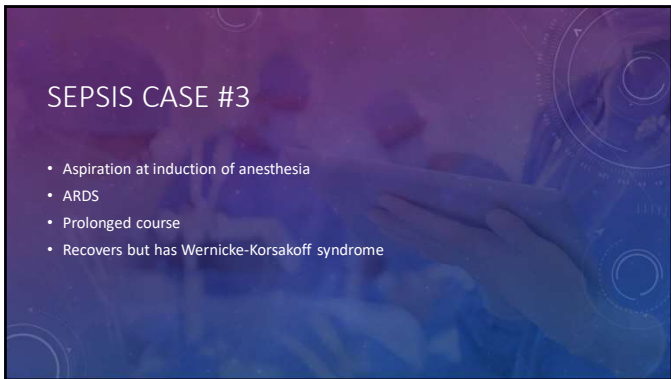
---

---

---

---

---



94

---

---

---

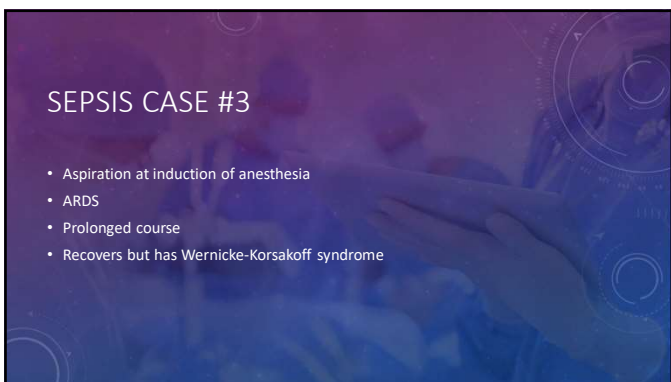
---

---

---

---

---



95

---

---

---

---

---

---

---

---



96

---

---

---

---

---

---

---

---