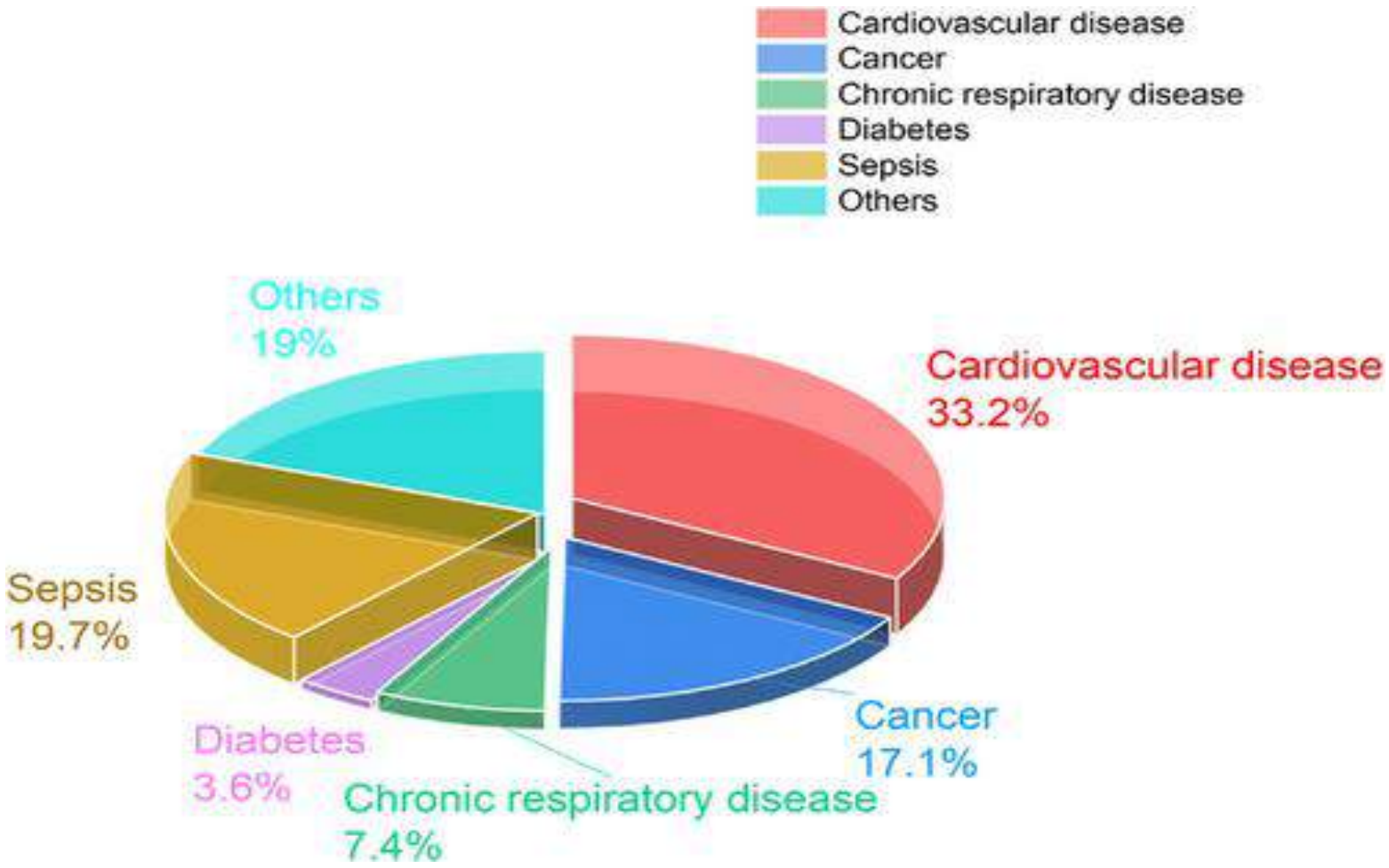
# 2025
# WORLD SEPSIS DAY
# 5 FACTS x 5 ACTIONS

# Deaths due to different causes worldwide
# According to data provided by the World Health Organization




Sepsis deaths exceeding the number of deaths from cancer and becoming the second leading cause of death.

# World Sepsis Day Infographics

stop sepsis save lives

*September 13th – World Sepsis Day*

**Sepsis is the final common pathway to death from most infectious diseases.**

Despite being a medical emergency and having direct ties to all other World Health Days, sepsis is still not getting the attention it deserves.

Awareness saves lives.
Learn about sepsis at
www.worldsepsisday.org

Infographic 20/21

Global Sepsis Alliance

www.worldsepsisday.org

www.global-sepsis-alliance.org

September 13 2020 | World Sepsis Day

# Undrstanding SEPSIS: From Infection to Organ Failure

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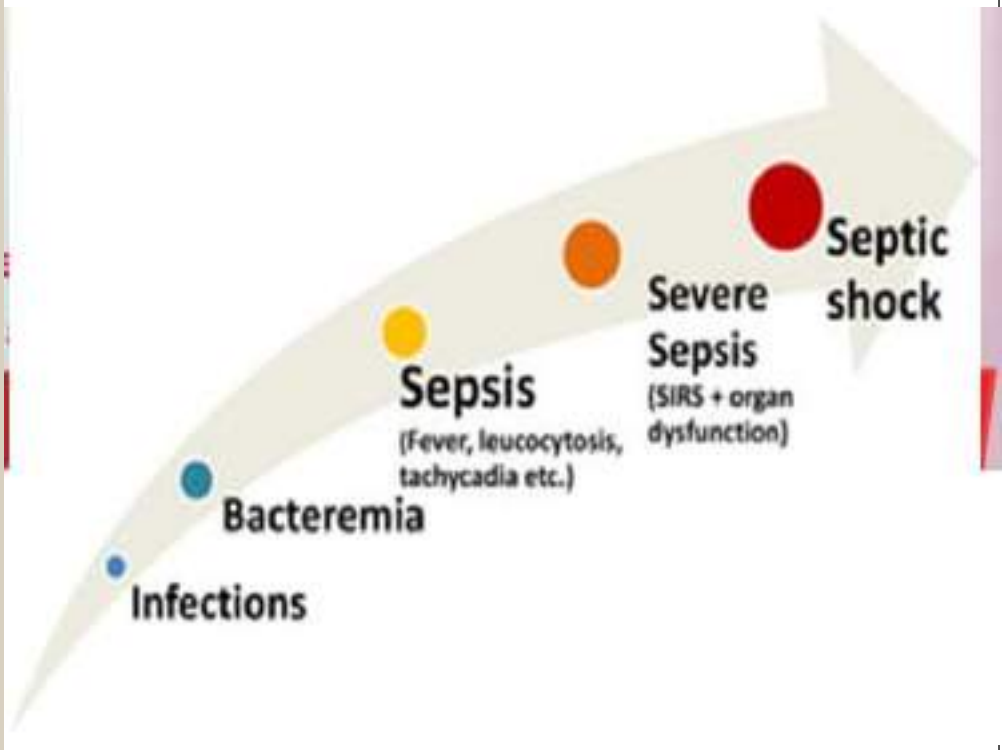
# What is Sepsis?


# S E P S I S

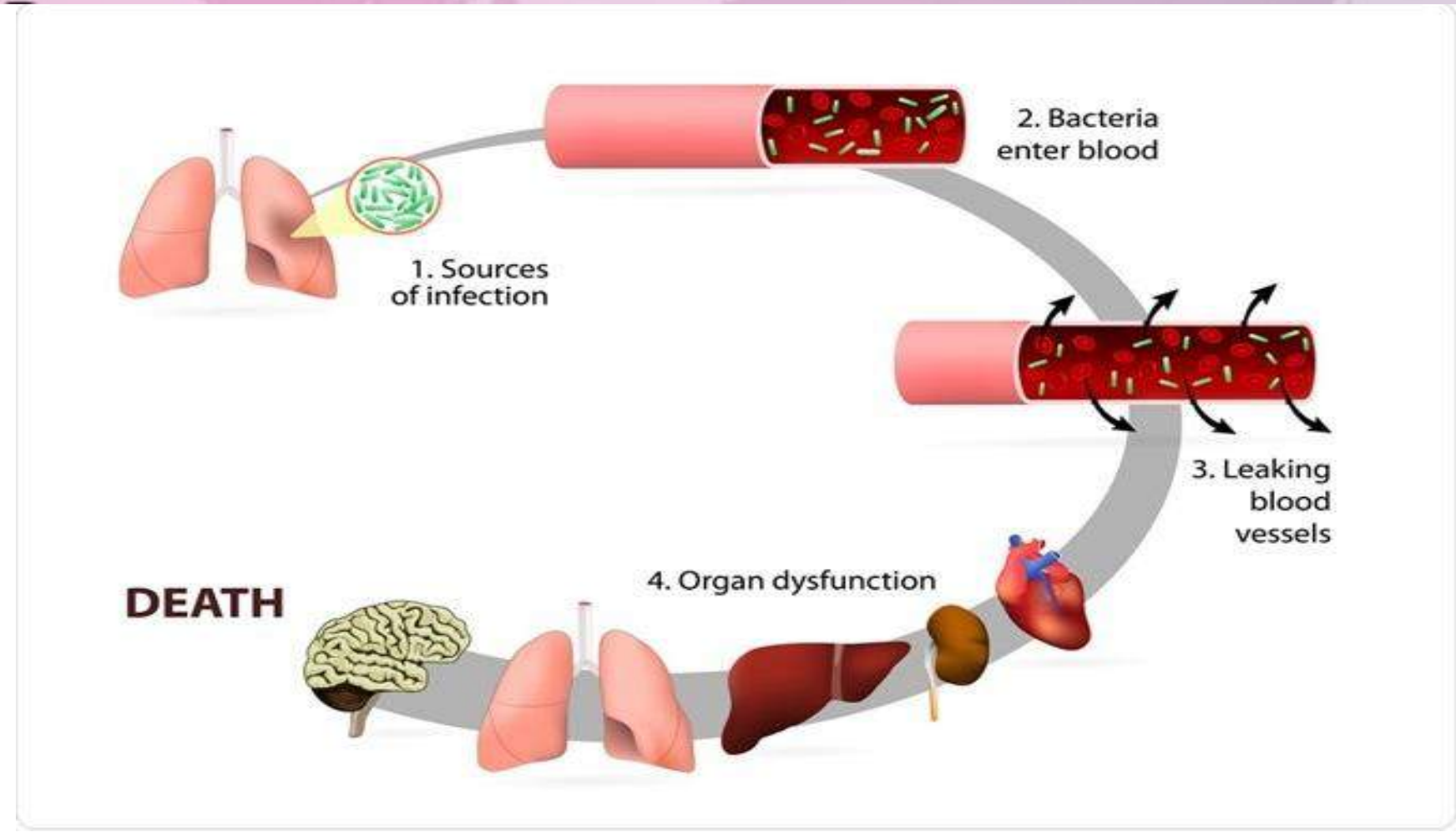
Sepsis is the body's overwhelming immune response to severe infection and can result in damaging its own tissues, cause multi-organ failure and death.

# Terminologies related to sepsis

- Infection
- Bacteremia
- Septicemia
- Systemic Inflammatory Response Syndrome(SIRS)
- Sepsis
- Severe sepsis
- Septic shock



# Sepsis is the final common pathway to death from most infectious diseases.




**Infection** → **Death**

# SEPSIS STEPS

## SIRS

T: >100.4 F
< 96.8 F
RR: >20
HR: >90
WBC: >12,000
<4,000
>10% bands
PCO2 < 32 mmHg

## SEPSIS

2 SIRS

+

Confirmed **or** suspected infection

## SEVERE SEPSIS

Sepsis +

Signs of End Organ Damage

Hypotension (SBP <90)

Lactate >4 mmol

## SEPTIC SHOCK

Severe Sepsis with persistent:

Signs of End Organ Damage

Hypotension (SBP <90)

Lactate >4 mmol

Slides Courtesy of Curtis Merritt, D.O.

# World Sepsis Day Infographics

stop sepsis save lives

## A Global Health Crisis

47 000 000 - 50 000 000
cases per year


At least 11 000 000 die
- 1 death every 2.8 seconds

Survivors may face
lifelong consequences


1 in every 5 deaths worldwide
is associated with sepsis

Global Sepsis Alliance

www.worldsepsisday.org

www.global-sepsis-alliance.org

September 13 2020 | World Sepsis Day

# Risk Factors

**Remember**

**SEPSIS**

**where every second counts**

Suppressed immune system — **S**

Extreme of Age — **E**

Procured or transplanted organ — **P**

Surgical Procedures — **S**

Indwelling Devices — **I**

Sickness — **S**

# Exciting factors causing Sepsis

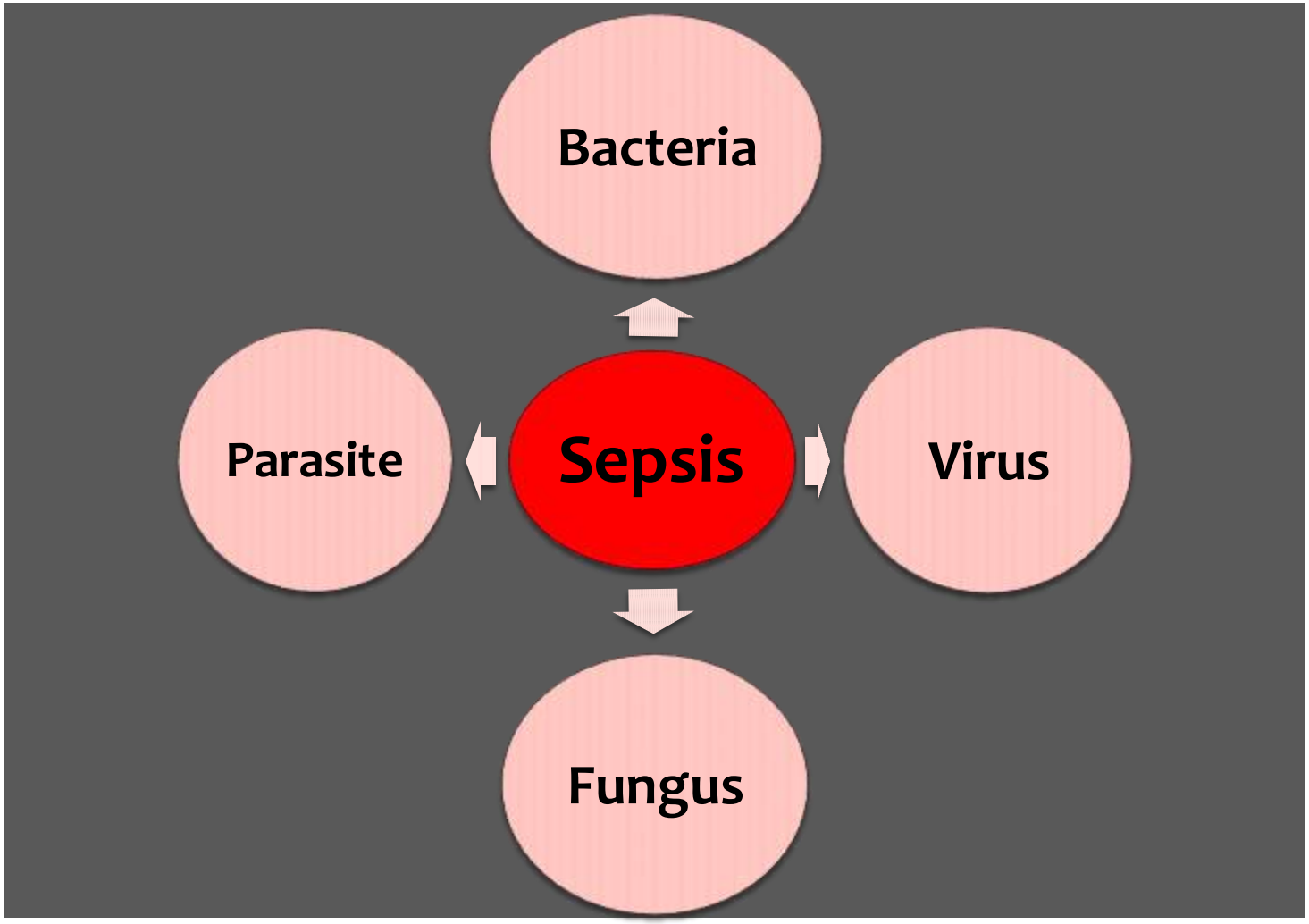
## Infectious cause

- Bacteremia
- Intravascular device associated infections
- Lower respiratory tract infections
- Intra-abdominal infections
- Urinary tract infections
- Endovascular infections
- Skin and soft tissue infections

## Non-infectious cause

- Trauma, surgery or burns
- Acute Coronary Syndrome
- Severe pancreatitis
- Thyroid storm or acute adrenal insufficiency
- Acute leukemia
- Malignant hyperthermia
- Malignant neoplastic syndrome
- Deep vein thrombosis

# Microbial Agents causing Sepsis



# Bacteria

## Gram negative

*E. coli*

***Klebsiella***

*Pseudomonas spp.*

***Acinetobacter spp.***

*Salmonella spp.*

*Vibrio*

*Y. enterocolitica*

*Neisseria*

*Hemophilus*

## Gram Positive

***S.aureus***

*S. pneumonia*

*S. agalactiae*

*L. monocytogenes*

## Anaerobic

*C. perfringes*

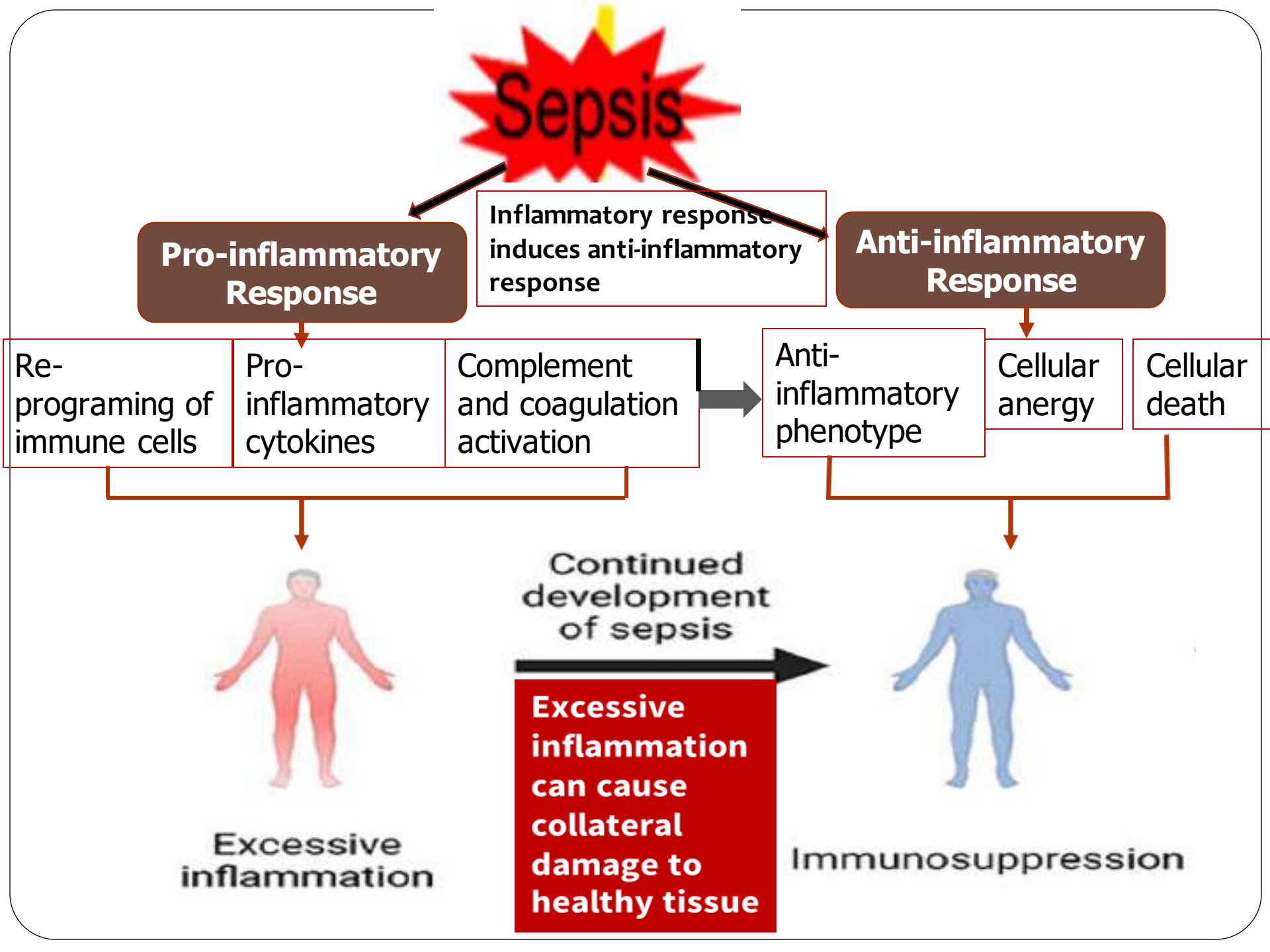
*C. septicum*

*Fusobacterium*

| Viral | Fungal | Parasitic |
|---|---|---|
| CMV | *Candida spp* | Malarial parasite |
| HSV | *Aspergillus spp* | *Strongyloides stercoralis* |
| VZV | *Pneumocystis jirovecii* | *Cryptosporidium parvum* |
| EBV | *Cryptococcus neoformans* | |
| Dengue | *Zygomycetes* | |

# Pathogenesis

**Sepsis is not merely the infection itself, but the body's reaction to it.**


Sepsis
Pro-inflammatory Response
Inflammatory response induces anti-inflammatory response
Anti-inflammatory Response
Re-programing of immune cells
Pro-inflammatory cytokines
Complement and coagulation activation
Anti-inflammatory phenotype
Cellular anergy
Cellular death
Continued development of sepsis
Excessive inflammation
Excessive inflammation can cause collateral damage to healthy tissue
Immunosuppression

**Nidus of infection**

**Enter the IV space**

Exotoxin,, teichoic acid, super Ag & others PAMPs

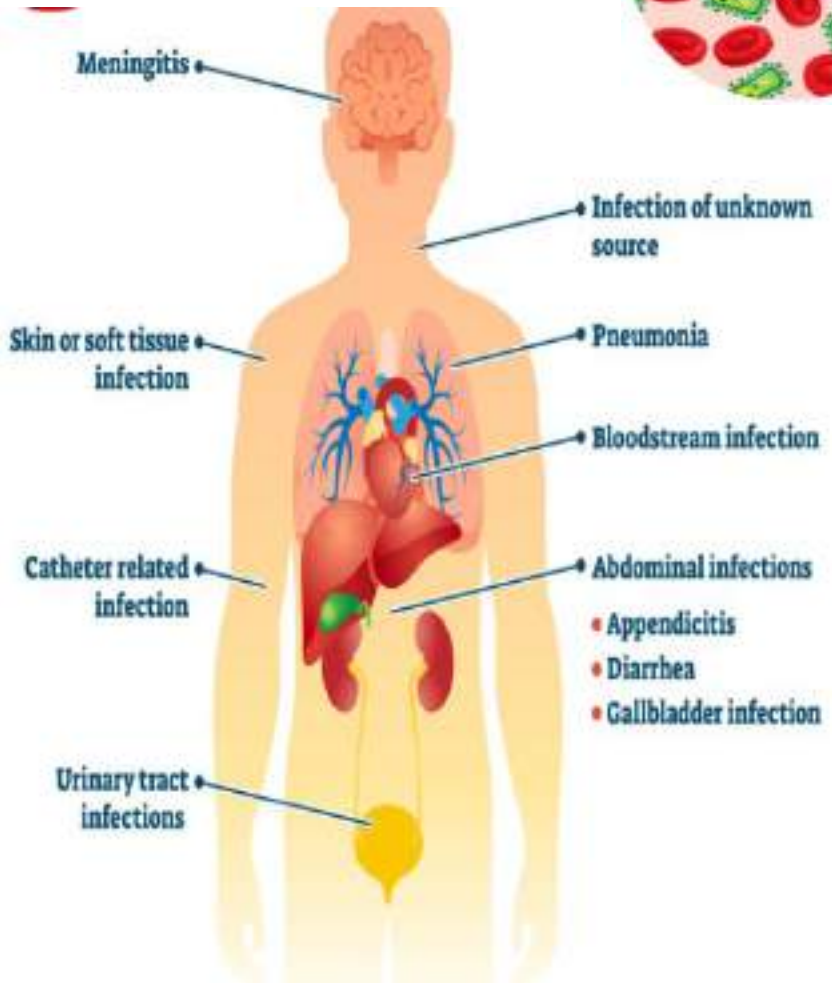
Endotoxin, LPS & others PAMPs

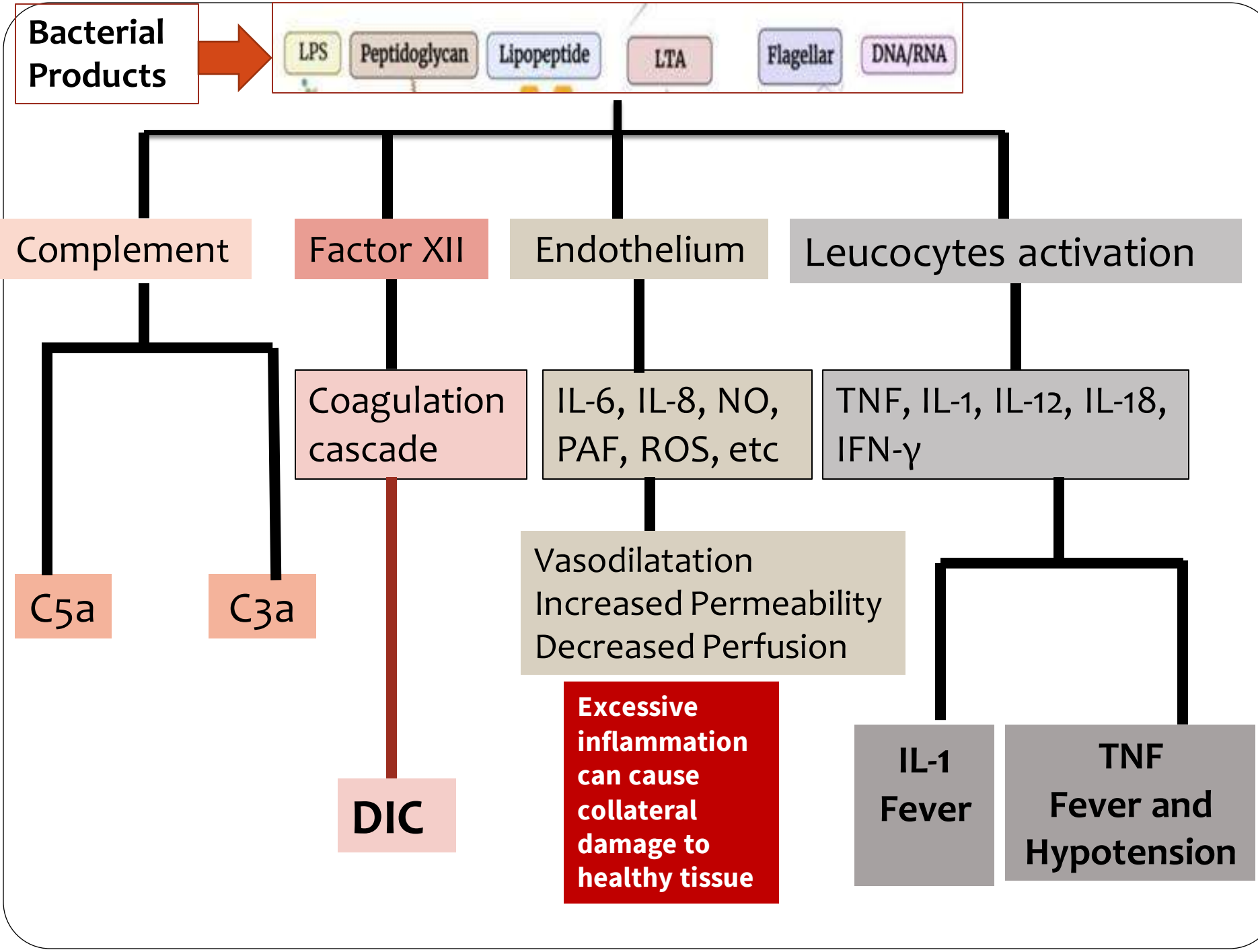
Recognized by PRR on endothelial cells and immune cells

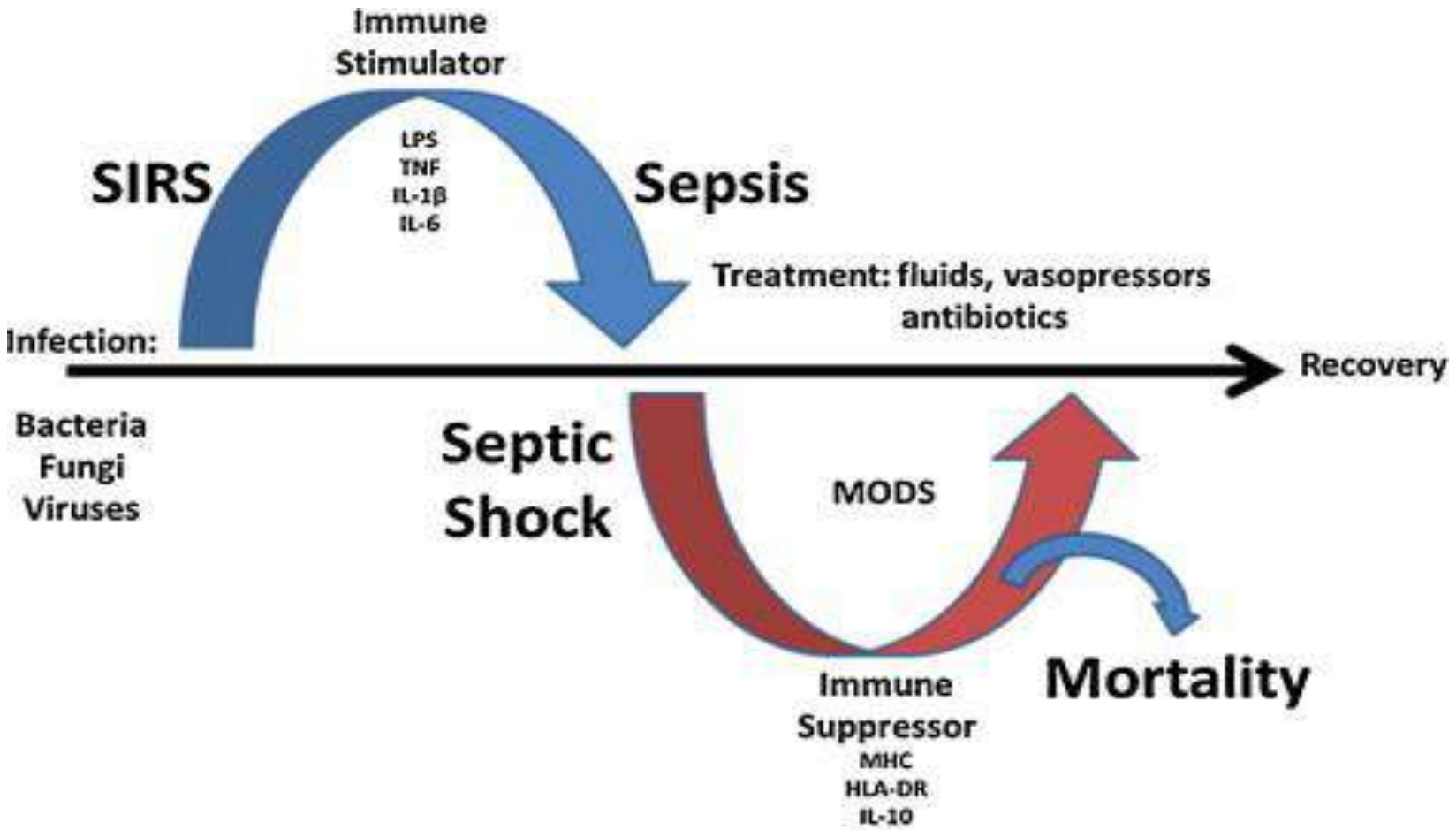
Activation of nuclear factor κβ and nuclear translocation

Expression of genes encoding inflammatory mediators

Release of large amount of proinflammatory cytokines




Bacterial Products
LPS
Peptidoglycan
Lipopeptide
LTA
Flagellar
DNA/RNA
Complement
Factor XII
Endothelium
Leucocytes activation
C5a
C3a
Coagulation cascade
IL-6, IL-8, NO, PAF, ROS, etc
TNF, IL-1, IL-12, IL-18, IFN-γ
DIC
Vasodilatation
Increased Permeability
Decreased Perfusion
Excessive inflammation can cause collateral damage to healthy tissue
IL-1
Fever
TNF
Fever and Hypotension




LPS=lipopolysaccharide, TNF=tumor necrosis factor, IL-1β=interleukin 1, IL-6=interleukin 6, MODS=multi-organ dysfunction syndrome, MHC=major histocompatibility complex, HLA-DR=histocompatibility proteins, HLA=human leukocyte antigen

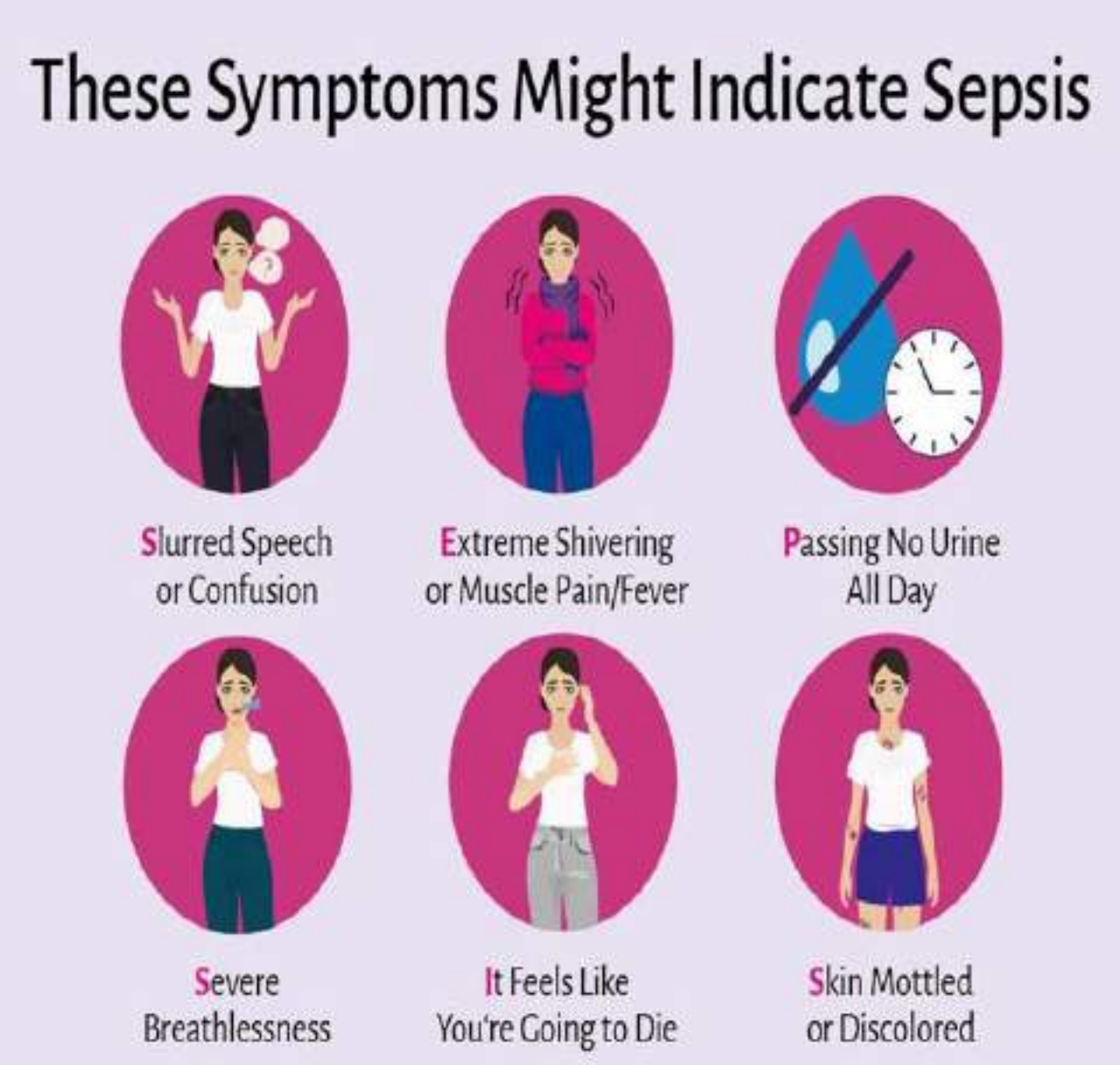
# Symptoms

Foci of Infection

+

REMEMBER

**SEPSIS**



# Sepsis Screening Tools

SIRS criteria

Quick Sequential Organ Failure Score (qSOFA)

Sequential Organ Failure Assessment Score (SOFA)

National early warning score (NEWS)

Modified National early warning score (MEWS)

Blood lactate level and blood culture

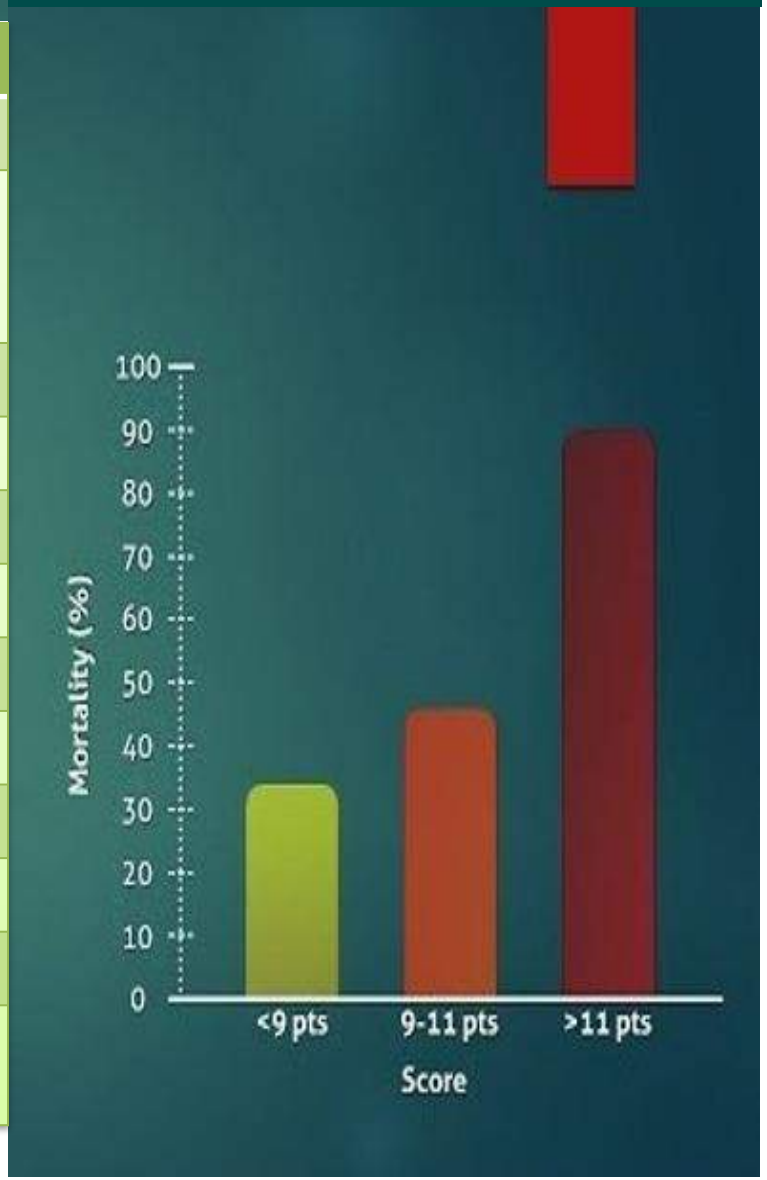
# SEPSIS: SIRS Criteria

**SIRS= Systemic Inflammatory Response Syndrome**

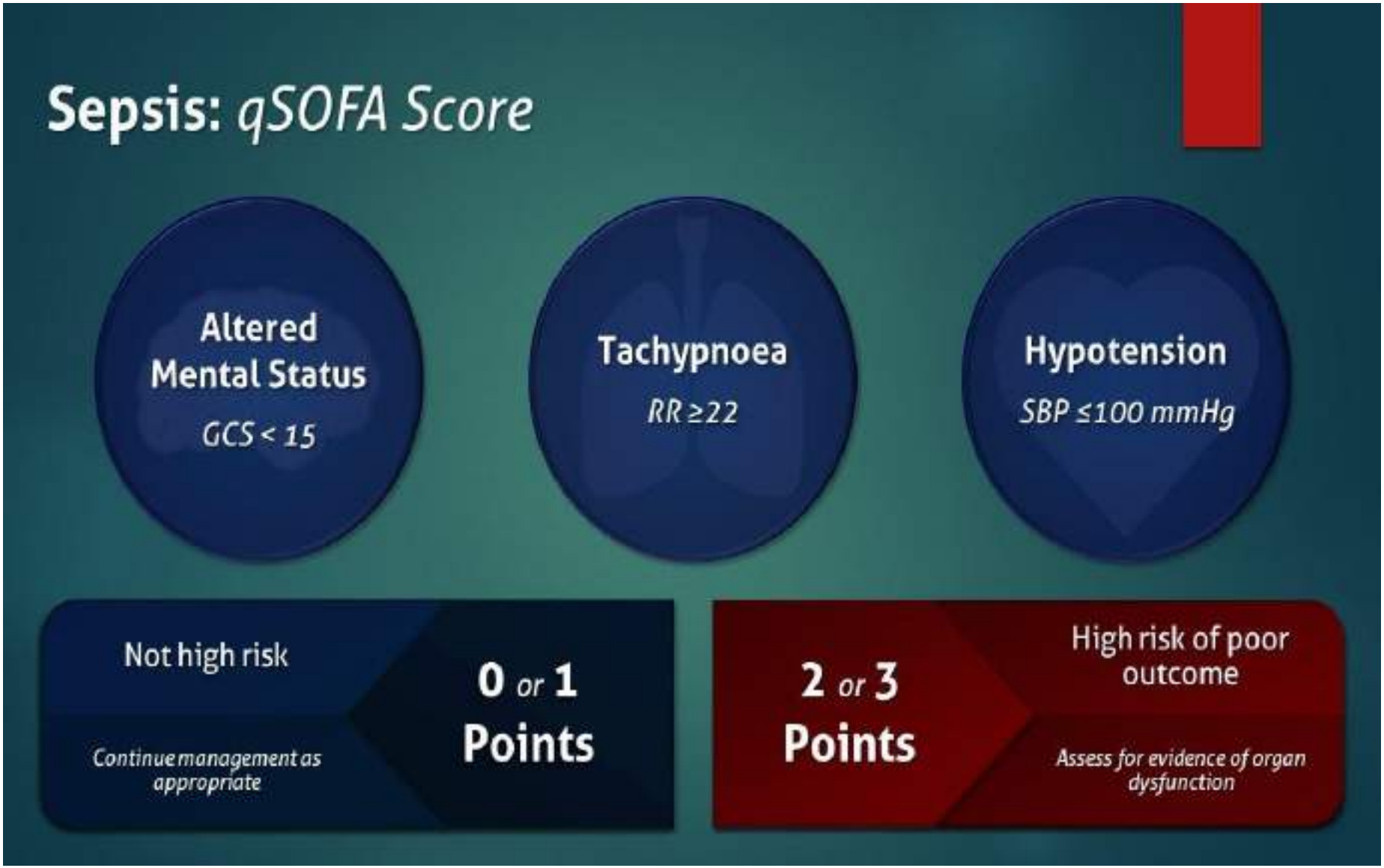
| | |
|---|---|
| Temperature | >38°C or <36°C |
| Heart Rate | >90 bpm |
| Respitatory Rate<br>$PaCO_2$ | >22/min<br><32 mmHg |
| WBC | >12000/mm3 or <4000/mm3 or presence of >10% immature neutrophil |

# Sepsis: *SOFA Score*

| 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Cardiovascular System ( Blood Pressure) | | | | |
| No hypotension | MAP<70m mHg | Vasopressors | Vasopressors | Vasopressors |
| Central Nervous System (Glasgow Coma Scale) | | | | |
| 15 | 13-14 | 10-12 | 6-9 | <6 |
| Respiratory System ($PaO_2/FiO_2$) | | | | |
| >400 | 301-400 | ≤300 | 101-200 | ≤100 |
| Coagulation (Platelets X 103/$mm^3$) | | | | |
| >150 | 101-150 | 51-100 | 21-50 | ≤20 |
| Liver (Billirubin mcmol/L) | | | | |
| <20 | 20-32 | 33-101 | 102-204 | >204 |
| Kidney (Creatinine mcmol/L) | | | | |
| 110 | 110-170 | 171-299 | 300-440 | >440 |



# SEPSIS: qSOFA score



# Laboratory Diagnosis

**Routine blood test:**

- Complete Blood Count
- Arterial Blood Gas Analysis
- Liver function test
- Renal function test
- Blood glucose
- Bleeding profile
- D-dimer

# Laboratory Diagnosis

**Microbiological tests:**

- Microscopy
- Culture:
  - -Blood culture
  - -Urine culture
  - -CSF culture
  - -Culture from infective sources
- Sepsis biomarkers
- Rapid molecular diagnostic methods:
  - -Multiplex PCR

Antisepsis the skin at the venipuncture site to prevent contamination and reduce false-positive results.

# Blood Culture

- Two sets of cultures in 4 bottles, 2 aerobic and 2 anaerobic bottles, are recommended
- Total volume 30-40 mL, collected from different sites
- Each bottle should contain 8 to 10 mL of blood in case of an adult; in case of children, 1-3 mL


**aerobic and anaerobic set**
8-10 ml blood volume

**paediatric bottle**
1-3 ml blood volume

- Blood should be collected before antibiotic start
- Administration of the antibiotic before blood culture specimen collection resulted in a significantly lower positivity rate (50%) than those receiving it afterward

# Number of Blood Cultures

| Terminologies | Definition | No. of bottles | Volume |
|---|---|---|---|
| BC set | 2 BC bottles collected from same site | 2 | 20 ml |
| BC pair | 2 BC sets, collected from separate sites within 15 minutes | 4 | 40 ml |
| BC series | All BC sets collected within 24 hours | 4-6 | 40-60 ml |

# Types of Bottles Included in BC Set

1 set : 1 Aerobic bottle + 1 Anaerobic bottle

Role of Anaerobic bottle

- Suspected anaerobic bacteremia
- Promotes growth of facultative anaerobes like *Staphylococcus aureus*, *Enterobacterales*

If <20 ml collected: 10 ml in aerobic and rest in anaerobic bottle is preferred over equally divide

Lytic Anaerobic bottle: contains detergents like Tween 80 which facilitates the yield of intracellular pathogens

# Urine Culture

- Urine samples may be obtained via spontaneous voiding or catheterization in patients who cannot provide a spontaneous sample
- A volume of 15 to 30 ml is sufficient for accurate analysis
- Specimens should not be obtained from the collection bag in patients with indwelling urinary catheters, as this area is considered contaminated

# Other Samples to find the foci

- **Respiratory sample culture**
  - Sputum
  - Endotracheal aspirate
  - Bronchoalveolar lavage
  - Fiber optic bronchoscopy aspirate

- **Other sample culture**
  - Peritoneal fluid
  - Wound swab
  - Pus
  - Tissue biopsy
  - Bone biopsy

# Sepsis Marker

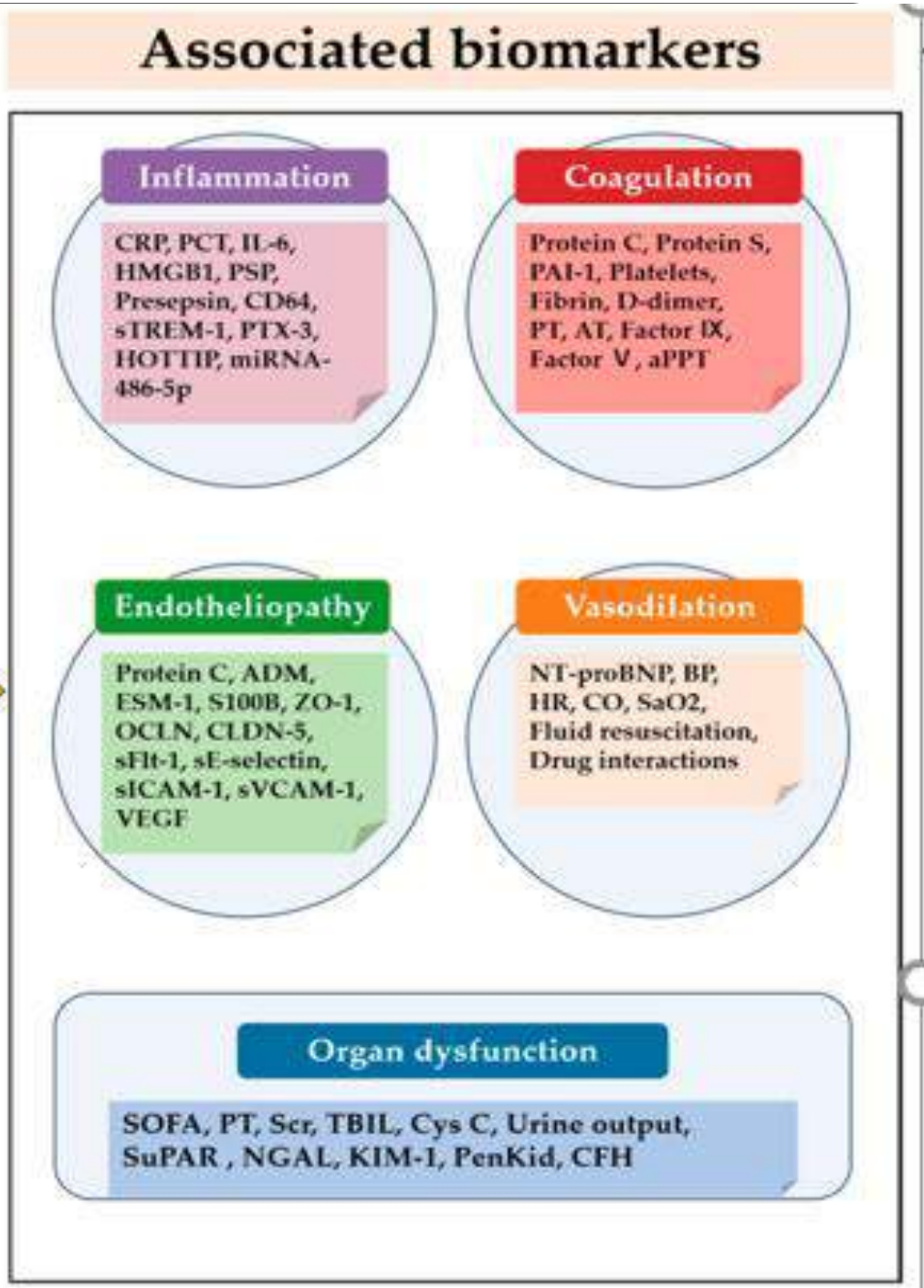
- Sepsis markers or biomarkers of sepsis are the substances produced by different cells of body in response to an infection

- Sepsis markers can be used as:

  -Diagnostic tool

  -Assessing the response to therapy

  -Prognostic tool



# Sepsis Markers (BM)

- **BM of Organ dysfunction:**

  -Lactate

  -D-dimer

- **Pro-calcitonin and CRP**
- BM of activated neutrophils and monocytes

  -Heparin binding protein

  -CD64, CD14
- Pro-inflammatory cytokines as markers of the hyper-inflammatory phase of sepsis

  -TNF, IL-10, IL-6
- Pan-fungal marker

  - 1,3-β-D-Glucan

**Lactate:**

- It can be raised in:
  - -Severe sepsis and Septic shock
  - -Hypo-perfusion
  - -Cellular metabolic failure
- A **high lactate** (≥ 2 mmol/L, especially ≥ 4 mmol/L) is a marker of **severe sepsis and worse prognosis**
- It can be used in:

**-Monitoring response to septic patients to resuscitation:**

- **Response of Lactate to Resuscitation**
  - **Effective resuscitation:**

    A decrease of ≥ 10–20% within the first 2–6 hours is a good sign
  - **Poor or inadequate resuscitation:**

    Lactate remains persistently elevated or continues to rise

    Associated with high mortality

**D-dimer:** Fibrin degradation product

- D-dimer level is elevated in:

  -Deep Vein Thrombosis

  - DIC

  -Pulmonary Embolism

- In DIC (complication of septic shock), D-dimer level is **used for scoring to predict sepsis severity and survival**

**CRP:** Acute phase protein synthesized by liver

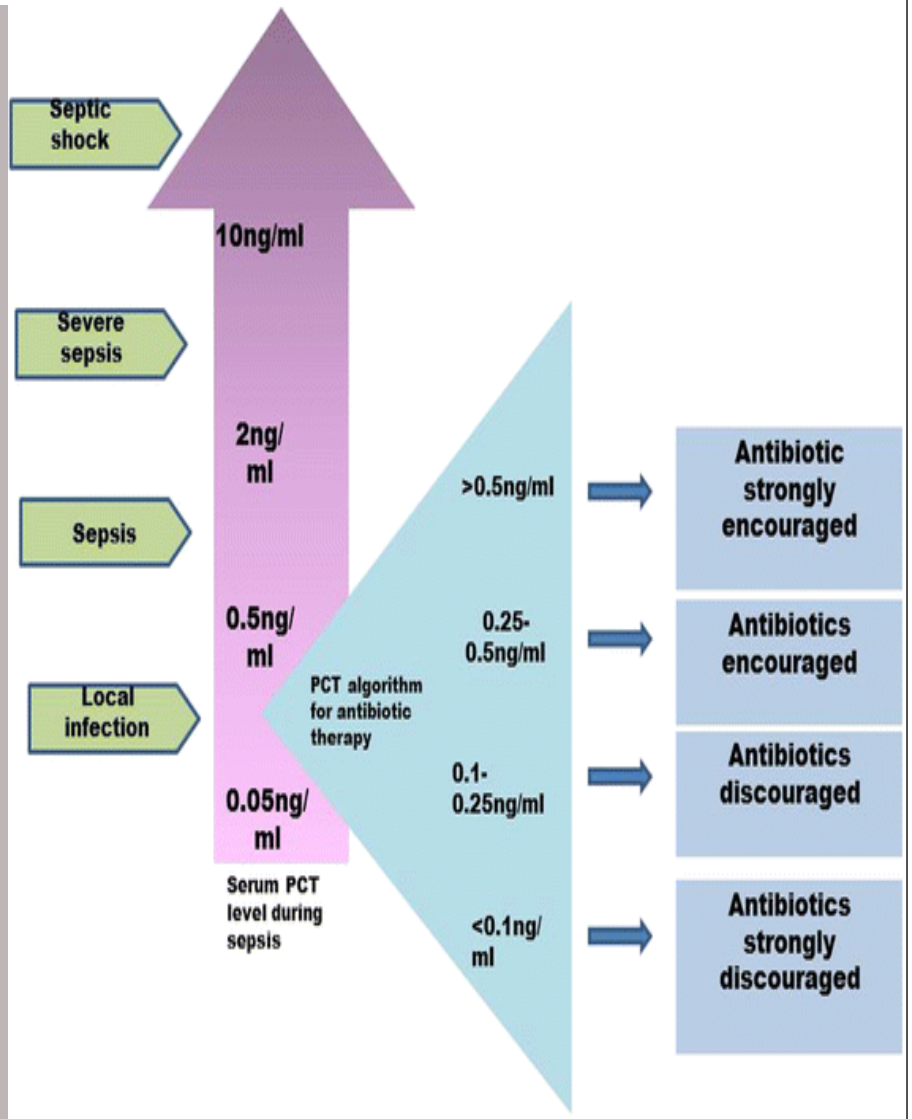
- CRP level begins within 4-6 hours of infection, doubles every 8 hours, peaks at 36-50 hours
- Use:

  -A sensitive marker of inflammation and tissue damage

  -It is commonly used to screen for early onset sepsis

# Pro-calcitonin (PCT)

- It is a marker that distinguish patients who have SIRS from those who have sepsis and can distinguish bacterial from non bacterial sepsis
- **High and persistent elevations in PCT levels have been associated with poor outcomes for ICU patients**
- Can help guide antibiotic therapy, save on cost of antibiotic use and drug resistance



# Patient scenario-1

**Name:** Mr. Rahman
**Age:** 62 years
**Past Medical History:** Type 2 Diabetes Mellitus, Hypertension

**Presentation:**
The patient arrives at the Emergency Department with complaints of:

- **Fever** (39.5°C) for the past 2 days
- **Confusion and drowsiness Increased shortness of breath**

**Other histories:**

- Burning sensation during urination a week ago, which he ignored

**On Examination:**

- **General appearance:** Ill-looking, confused, sweating

- **Vitals:**
  - Temperature: 39.5°C
  - Heart rate: 122 bpm (tachycardia)
  - Blood pressure: 84/52 mmHg (hypotension)
  - Respiratory rate: 28/min (tachypnea)
  - Oxygen saturation: 90% on room air

- **Physical exam:**
  - Dry mucous membranes (dehydrated)
  - Capillary refill > 3 seconds (poor perfusion)
  - Reduced urine output reported by family

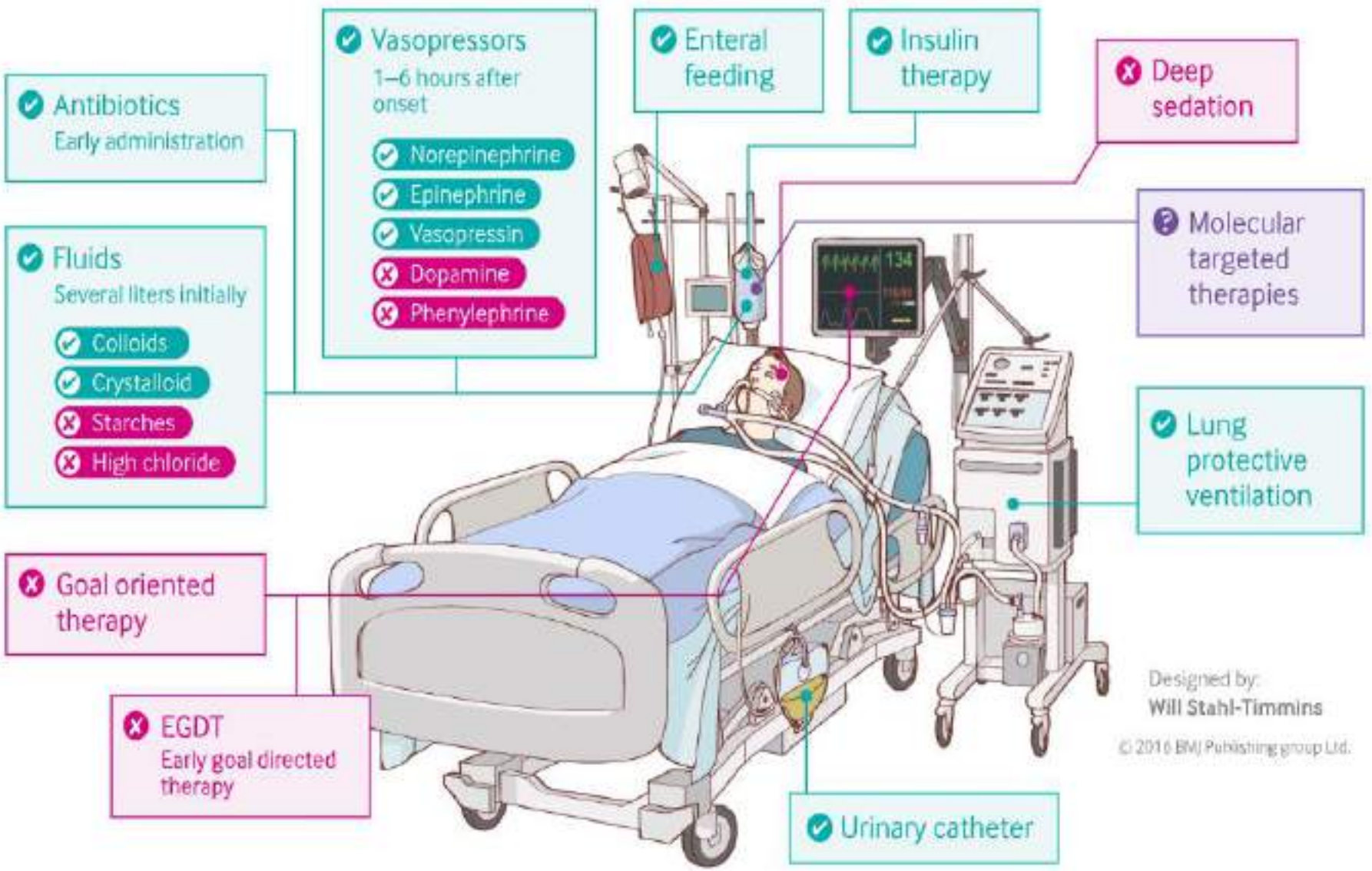
**Investigations:**

- **CBC:** WBC 18,000/$mm^3$ (elevated)
- **Serum lactate:** 4.2 mmol/L (high → tissue hypoperfusion)
- **Blood cultures:** Pending
- **Urine culture:** Pending
- **Chest X-ray:** Clear (no pneumonia)
- **Urinalysis:** Pyuria and bacteriuria

**Diagnosis: ?**

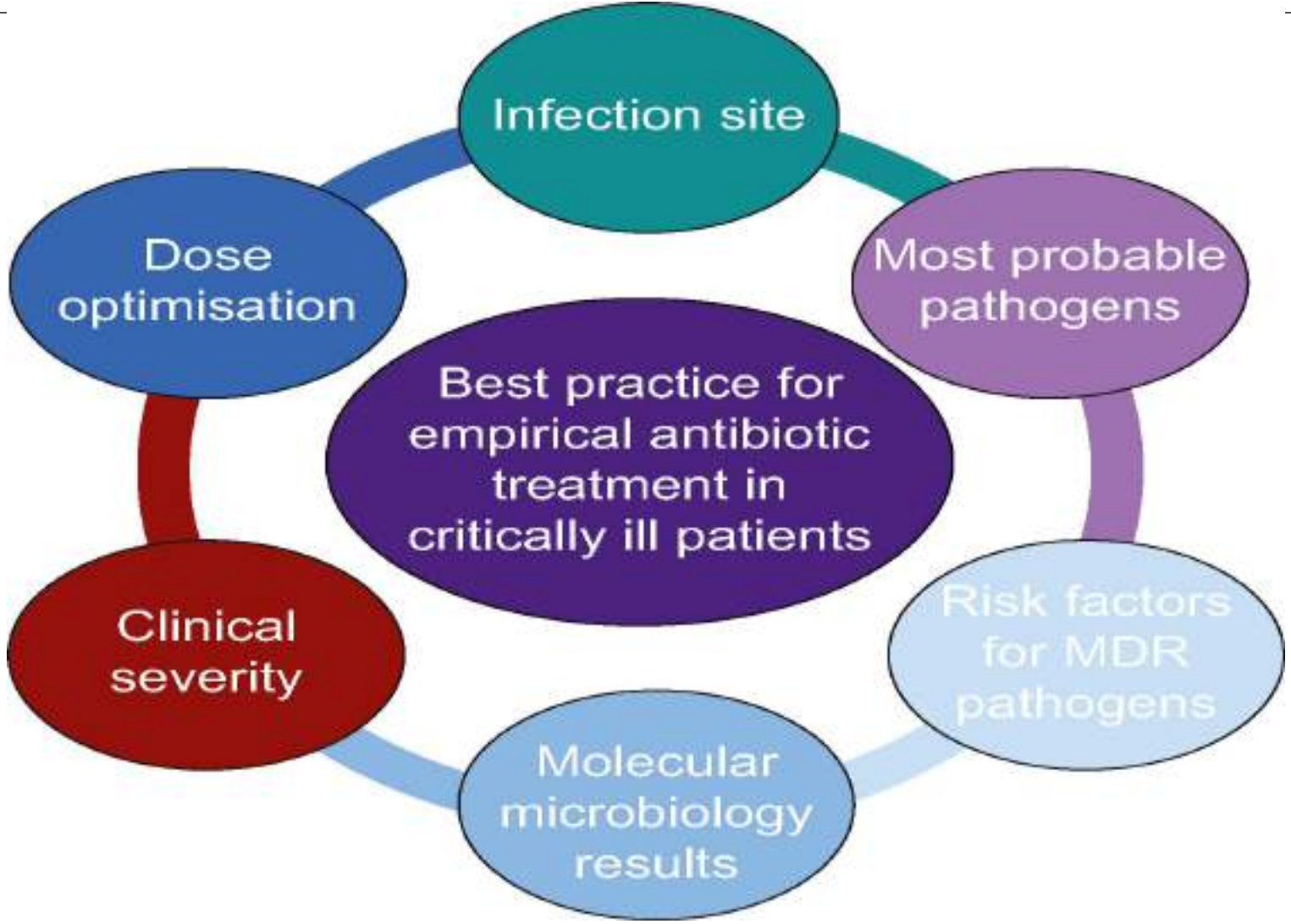
# Management of Sepsis

# Treating sepsis: the latest evidence





# Other Managements




**Based on information about patterns of antimicrobial susceptibility among bacteria isolated from the community, hospital and the patient**

# For how antibiotics should be continued?

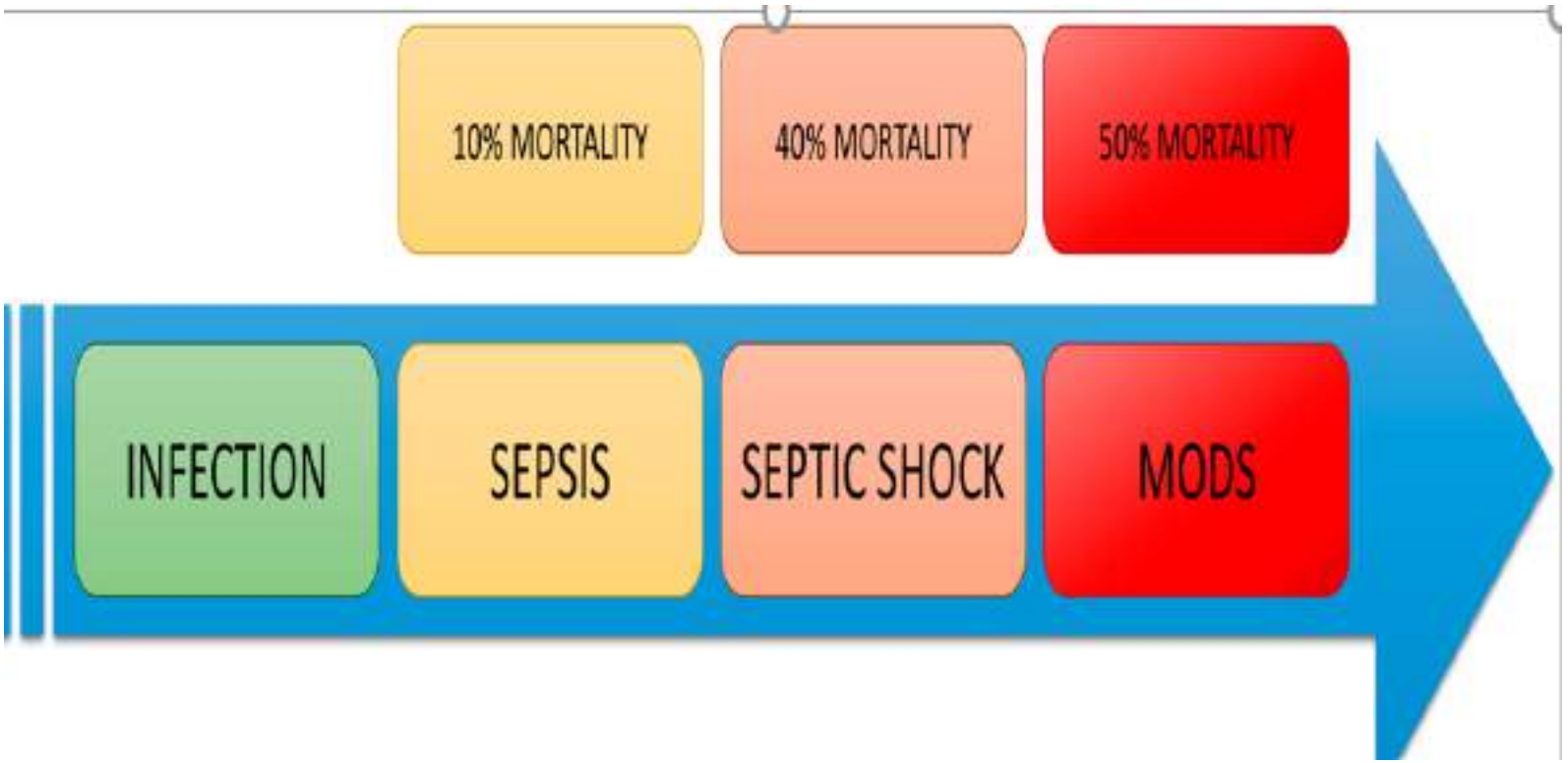
- Total treatment duration should be 7-10 days for infections with sepsis or septic shock.
- Shorter antibiotic courses are indicated in patients whose sepsis resolves rapidly
- Daily assessment for potential de-escalation of antimicrobials
- Failure to normalize procalcitonin levels is a significant predictor of mortality
- Blood cultures can be negative in up to one-third of all patients suffering from sepsis

## C. Fungal Sepsis

Empirical antifungal therapy should be started if-

I. The septic patient is already receiving broad spectrum antibiotics
II. Neutropenic for 5 days
III. Has a long term central venous line in place
IV. Hospitalized in and ICU for a prolonged period

# Prognosis of untreated infection




**Cognitive impairment may be significant in elderly survivors**


2025
WORLD SEPSIS DAY
5 FACTS x 5 ACTIONS

# 5 FACTS

**Fact 1:**
- Leading cause of death globally

**Fact 2:**
- Hits the most vulnerable the hardest- globally

**Fact 3:**
- Most deaths are preventable

**Fact 4:**
- Only 15 of 194 countries invest in sepsis

**Fact 5:**
- A stronger Sepsis response is essential for Global Health

# 5 ACTIONS

| | |
|---|---|
| **Action 1:** | • Every country should prioritize and fund sepsis response |
| **Action 2:** | • Every country should develop protocols and train health care providers |
| **Action 3:** | • Global health actors should prioritize and fund Sepsis response |
| **Action 4:** | • Media can play a leading role in saving lives from Sepsis |
| **Action 5:** | • Prioritize Sepsis in Pandemic and Emergency Response |

World Health Organization

# How do we prevent sepsis?

## Sepsis can be prevented by

preventing infection

preventing the evolution of infection to sepsis

# Prevention Saves Lives

Prevent Infection – Prevent Sepsis – Save Lives

Vaccination

Clean Water

Hand Hygiene

Prevent HAIs
(Hospital-Acquired Infections)

Safe Childbirth

Awareness

# Prevention of evolution of sepsis from Infection

## INFECTION

### Recognize infection early

- Identify symptoms promptly
  (fever, pain, redness, swelling, pus, dysuria, cough, foul-smelling discharge, etc.)
- Seek care early if symptoms worsen (especially in high-risk groups)

## INTERVENTION

### Treat infection quickly

- Appropriate antibiotics
  - Use narrow-spectrum antibiotics where possible
  - Avoid misuse or overuse to prevent resistance
- Adequate source control
  - Drain abscesses, debride necrotic fissue, remove infected catheters or devices

## AVOID SEPSIS

### Maintain physiological stability

- Hydration
- Nutrition
- Monitor vitals
  (fever, heart rate, blood pressure, urine output)

# Take Home Message

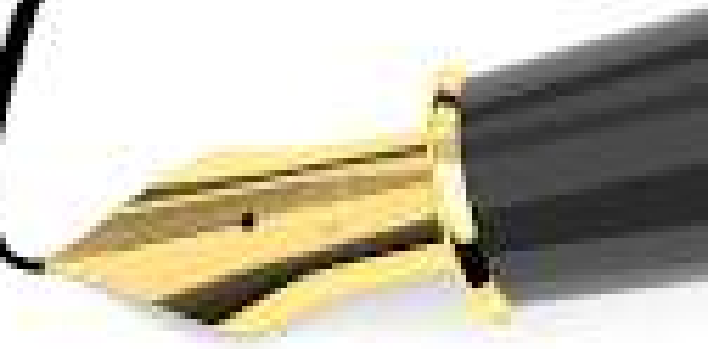
## SEPSIS SIX

**EVERY MINUTE COUNTS !**

- The Sepsis Six consists of three diagnostic and three therapeutic steps- all to be delivered within **one hour of the initial diagnosis of sepsis**

1) Deliver high flow oxygen
2) Take blood cultures
3) Administer empiric intravenous antibiotics
4) Measure serum lactate and complete blood count
5) Start IV fluid resuscitation
6) Commence accurate urine output measurement

Thank you



# QUESTIONS