Septic Shock

pathophysiology

- Medrockets

Definition of Septic Shock

- Septic shock is a medical condition as a result of severe infection and sepsis, though the microbe may be systemic or localized to a particular site. It can cause multiple organ dysfunction syndrome (formerly known as multiple organ failure) and death. Its most common victims are children, immunocompromised individuals, and the elderly, as their immune systems cannot deal with the infection as effectively as those of healthy adults. Frequently, patients suffering from septic shock are cared for in intensive care units. **The mortality rate from septic shock is approximately 25–50%.**

Shock: Types

- Hypovolemic
- Septic (high CO, low SVRI)
- Cardiogenic (high CVP)
- Neurogenic
- Anaphylactic
- Adrenal insufficiency

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Definitions

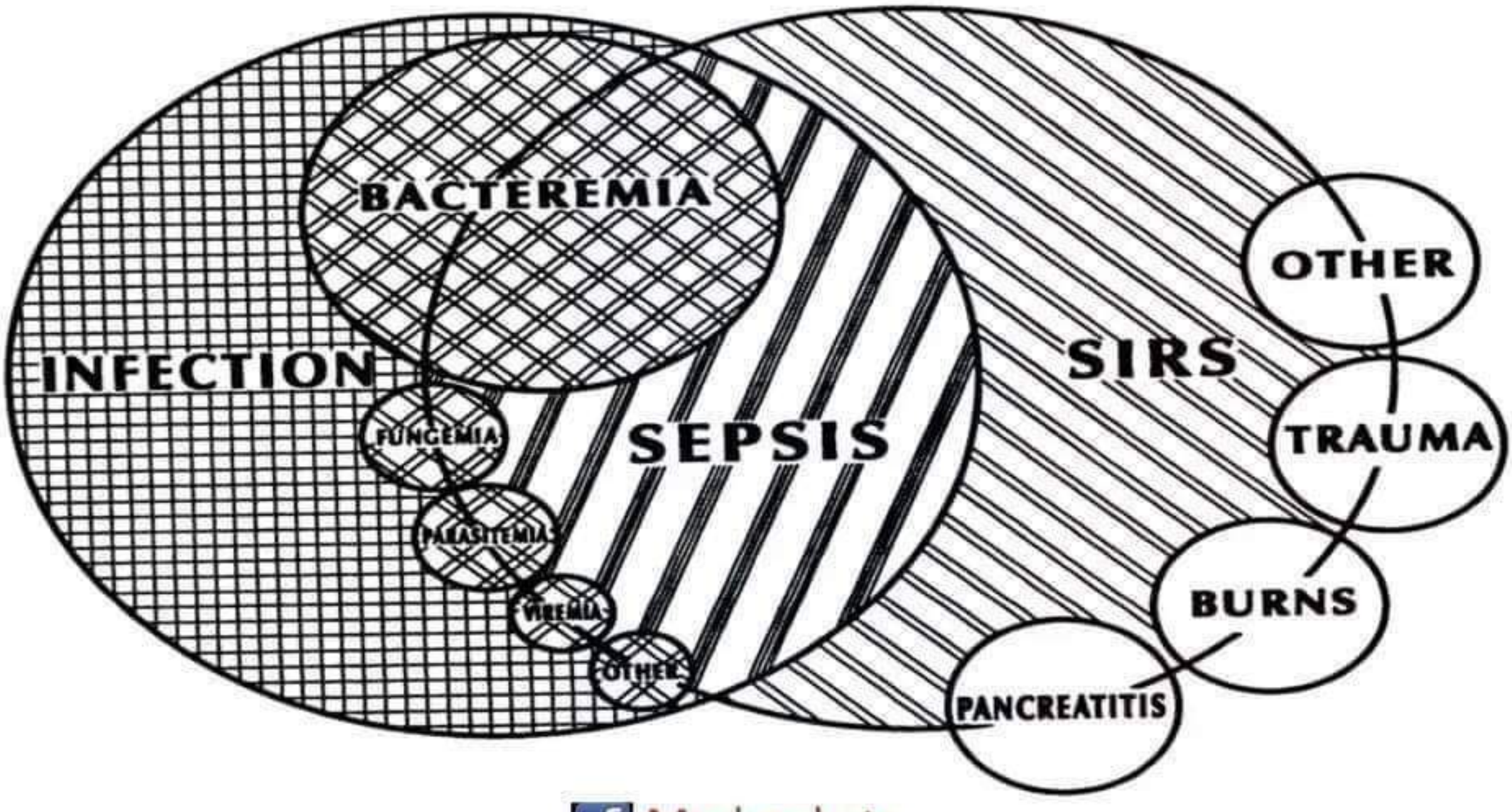
- **Infection:** microbial phenomenon characterised by an inflammatory response to the presence of micro organisms or the invasion of normally sterile host tissue by these organisms
- **Bacteraemia:** the presence of bacteria in the bloodstream
- ***Septicaemia:*** *no longer used*

Definition

- **Shock:-** When the cardiovascular system fails to deliver enough oxygen and nutrients to meet cellular metabolic needs.
- **Sepsis:-** Presence of bacteria in the blood stream.
- **Septic Shock:-** Begins with the development of septicaemia usually from bacterial infections, but can be viral in origin.

  This is the most common type of Distributive Shock.

Infection, SiRS, Sepsis



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Causes of Septic Shock

- As mentioned any type of bacteria in the bloodstream causes septic shock and this can occur from many infections, for example:

➢ The pope died from septic shock caused by a **urinary infection**

➢ Simon has a **chest infection**

➢ Other common reasons according to Collins (2000) are, **major abdominal surgery** and an **invasive catheter.**

Clinical Spectrum of Infection

Infection

↓

Bacteremia

↓

Sepsis

↓

Severe Sepsis

↓

Septic Shock

Aetiology of Septic shock

- When bacteria or viruses are present in the bloodstream, the condition is known as bacteraemia or Viremia. Sepsis is a constellation of symptoms secondary to infection that manifest as disruptions in heart rate, respiratory rate, temperature and WBC.. Once severe sepsis worsens to the point where blood pressure can no longer be maintained with intravenous fluids alone, then the criteria have been met for septic shock. The precipitating infections which may lead to septic shock if severe enough include **appendicitis, pneumonia, bacteraemia, diverticulitis, pyelonephritis, meningitis, pancreatitis, and necrotizing fasciitis.**

Systemic inflammatory response syndrome (SIRS)

- Systemic inflammatory response syndrome (SIRS) is a term that was developed in an attempt to describe the clinical manifestations that result from the systemic response to infection. Criteria for SIRS are considered to be met if at least 2 of the following 4 clinical findings are present:
- Temperature greater than 38°C (100.4°F) or less than 36°C (96.8°F)
- Heart rate (HR) greater than 90 beats per minute (bpm)
- Respiratory rate (RR) greater than 20 breaths per minute or arterial carbon dioxide tension (PaCO2) lower than 32 mm Hg
- White blood cell (WBC) count higher than 12,000/µL or lower than 4000/µL, or 10% immature (band) forms

Some Characteristics of Septic Shock

- Systemic vasodilation and hypotension
- Tachycardia; depressed contractility
- Vascular leakage and oedema; hypovolemic
- Compromised nutrient blood flow to organs
- Disseminated intravascular coagulation
- Abnormal blood gases and acidosis
- Respiratory distress and multiple organ failure

Terminology

- Systemic Inflammatory Response Syndrome (SIRS)
  - Temp > 38 or < 36
  - HR > 90
  - RR > 20 or PaCO2 < 32
  - WBC > 12 or < 4 or Bands > 10%

TWO out of four criteria
acute change from baseline

- Sepsis
  - The systemic inflammatory response to infection.

- Severe Sepsis
  - Organ dysfunction secondary to Sepsis.
  - e.g. hypoperfusion, hypotension, acute lung injury, encephalopathy, acute kidney injury, coagulopathy.

- Septic Shock
  - Hypotension secondary to Sepsis that is resistant to adequate fluid administration and associated with hypoperfusion.

Changing criteria of sepsis

- With sepsis, at least 1 of the following manifestations of inadequate organ function/perfusion is typically included:
- Alteration in mental state
- Hypoxemia (arterial oxygen tension [PaO2] < 72 mm Hg at fraction of inspired oxygen [FiO2] 0.21; overt pulmonary disease not the direct cause of hypoxemia)
- Elevated plasma lactate level
- Oliguria (urine output < 30 mL or 0.5 mL/kg for at least 1 h)

Pathophysiology

- The nidus of infection:
  - –Localized infections (otitis, pneumonia, meningitis etc.,)
  - –Colonization of mucosal and invasion (Hib, menigococci)
  - –Occult bacteremia (3mo to 3 years)
  - –Nosocomial : 'at risk patients'

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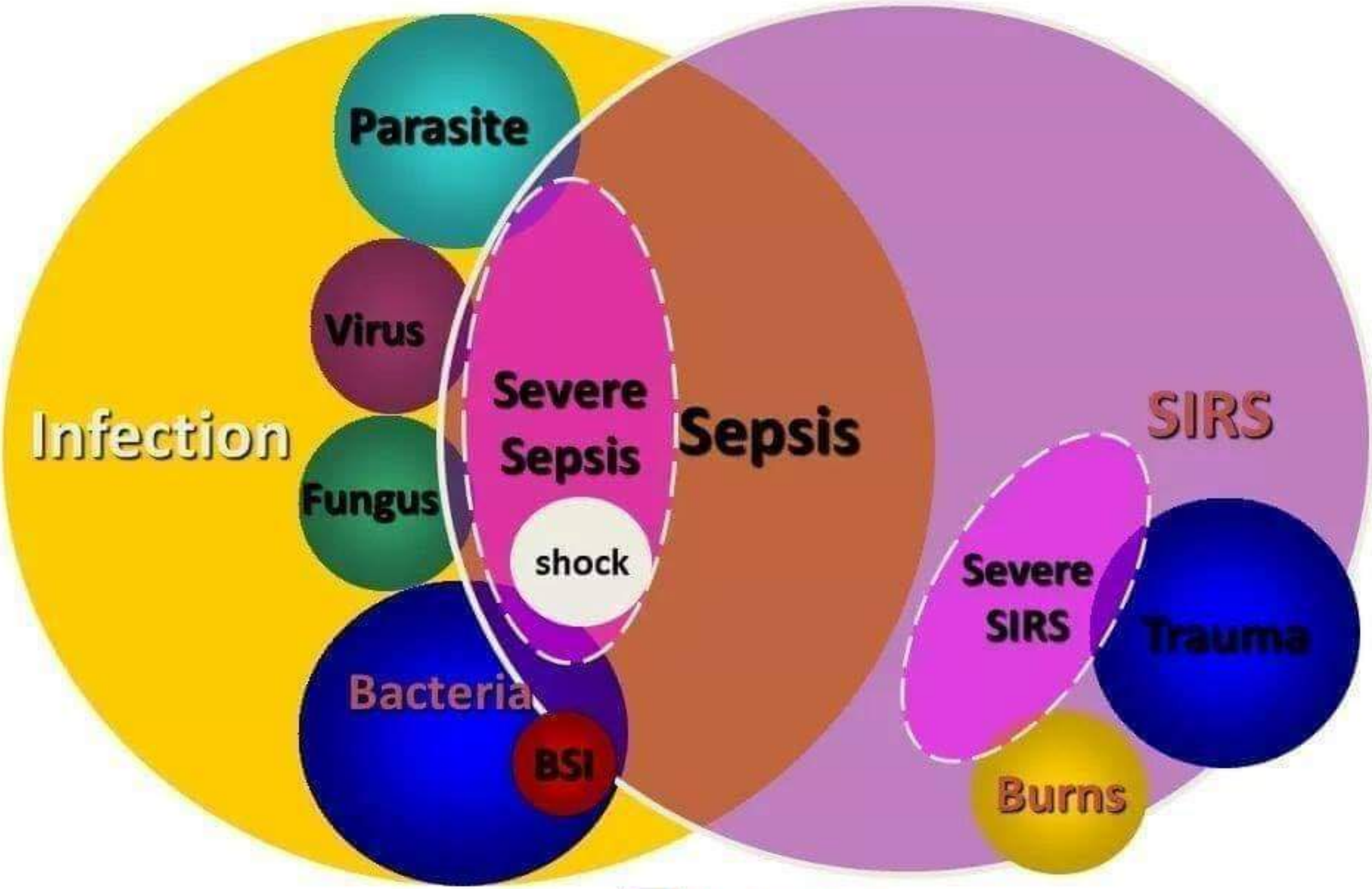
Parasite
Virus
Infection
Fungus
Bacteria
BSI
Severe
Sepsis
shock
Sepsis
SIRS
Severe
SIRS
Trauma
Burns

Septic Shock

- Septic shock- once a uniformly fatal condition with 100% mortality.
- Present recovery rates are up to 50%.
- Significance: Frequent occurrence and high mortality.

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Sepsis and septic shock

Bacterial infection

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Excessive host response

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Host factors lead to cellular damage

↘

Organ damage

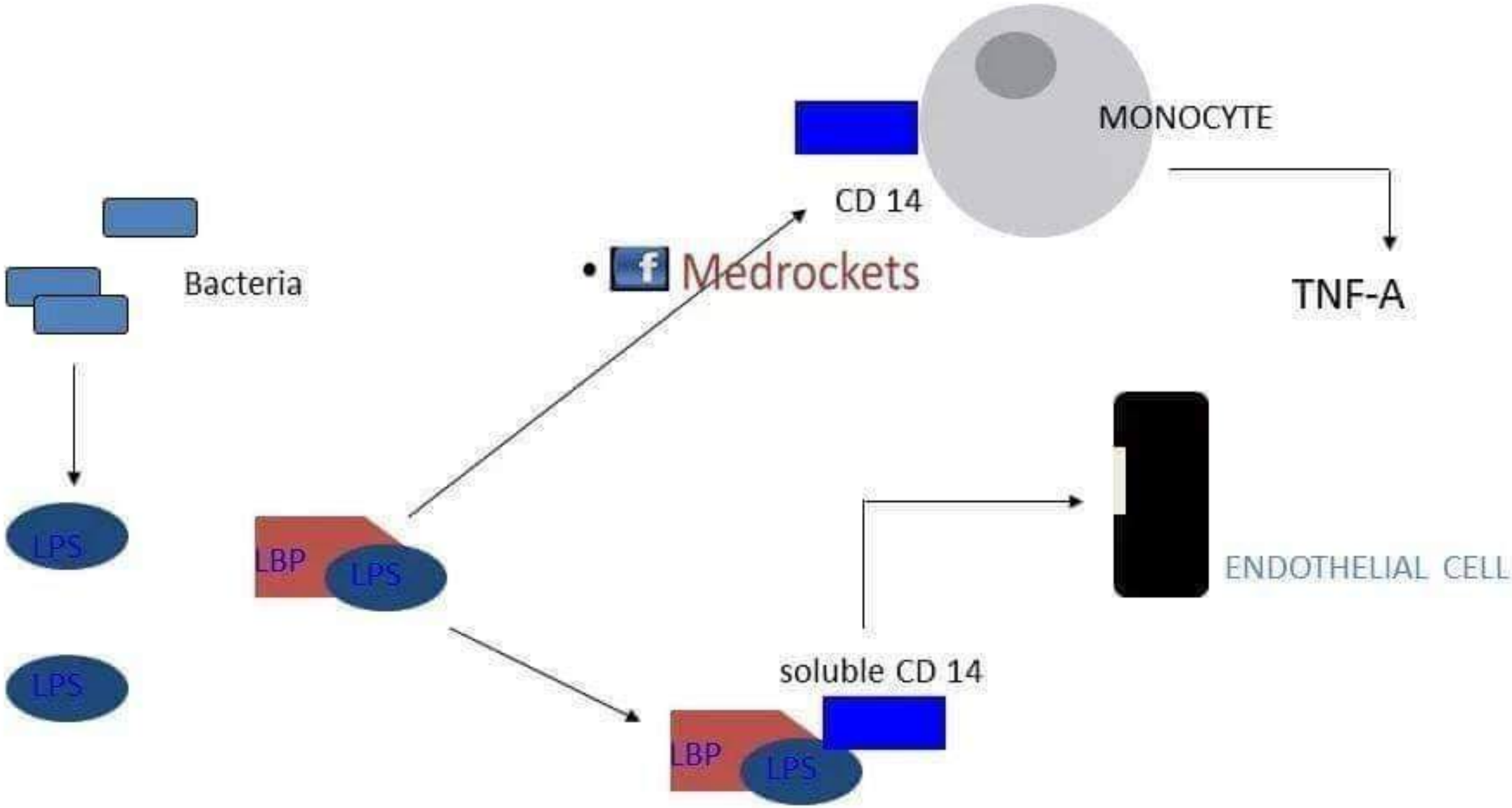
↘

Death

Microbial Triggers

- Gram-negative bacteria:
- lipopolysaccharide
- Gram-positive bacteria Lipoteichoic
- acid/cell wall muramyl
- peptides
- – Superatigens Staphylococcal Toxic Shock Syndrome Toxin,
- TSST
- Streptococcal pyrogenic exotoxin
- , SPE

Pathogenesis of Septic Shock



Management of Sepsis

- Recognition
- Supportive care
- Source control
- Antibiotics
- Specific (adjunctive) therapy

Issues in the rational choice of antibiotics

EFFICACY

- Spectrum of activity
- Pharmacokinetics & pharmacodynamics
- Patterns of resistance

TOXICITY

COST

Choosing antibiotics in sepsis

- There is no, single, "best" regimen
- Consider the **site** of the infection
- Consider **which organisms** most often cause infection at that site
- Choose antibiotic(s) with the appropriate **spectrum**
- After obtaining cultures, give antibiotics quickly and **empirically** at **appropriate dose**

"Non-antibiotic" therapy for sepsis

- Low dose steroids
- Intensive insulin therapy
  - tight glycaemic control
- Activated protein C
- Goal directed therapy

Shock: Realize the Facts

- Shock = inadequate tissue perfusion
- Types of shock: hypovolemic, septic, cardiogenic, neurogenic, anaphylactic
- Signs of shock: altered MS, tachycardia, hypotension, tachypnea, low UOP
- Always start with ABCs
- Resuscitation begins with fluid