

Microbe of the month

Breaking The Chain of Infection



SEPTEMBER 2023 NEWSLETTER

Compiled by
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Featured
this
month:

SEPSIS AND SEPTIC SHOCK - VASCULAR FOCUS

World Sepsis Day 13th September 2023

15-minute read + QUIZ

Hello readers!

The **Microbe of the Month ('MOM')** newsletter aims to create awareness about topical issues relating to infection, pathogens of clinical importance, as well as recommendations for clinical best practice and antimicrobial stewardship (AMS).

Every issue is laid out in an easy-to-read and understand format, and includes a detailed reference section to assist you in keeping your clinical risk management protocols and Infection Prevention measures up to date.

There is a quick quiz at the end of the newsletter to test your grasp of the content – please use this newsletter as a teaching tool in your workplace and start an 'infectious dialogue' about topical issues in infection control!

It is **World Sepsis Day** on **13th September**, and this issue will cover the aetiology of and risk factors for developing **sepsis** and **septic shock**, as well as the **definitive vascular features** of septic shock.

Sepsis is a clinical syndrome of life-threatening organ dysfunction and a medical emergency, caused by the dysregulated response of the immune system to infection. Severe sepsis leads to **septic shock**, where there is a critical reduction in tissue perfusion, and acute failure of multiple organs occurs - including the lungs, kidneys, brain and liver. Without timely and specific medical intervention, sepsis and septic shock may be fatal.¹⁻⁵

Key words: sepsis, septic shock, clinical syndrome, dysregulated immune response, immunocompromised, reduced tissue perfusion, microthrombi, intravascular coagulation, SIRS, qSOFA score, gangrene, multi-organ failure

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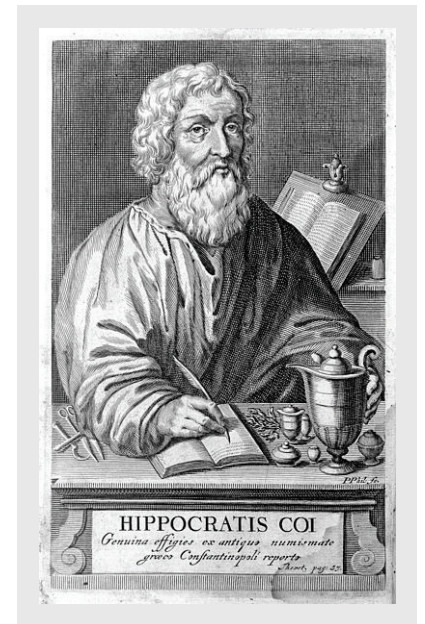
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A BRIEF HISTORY OF SEPSIS ⁶

Sepsis was first mentioned in scriptures in Ancient Greece. The word sepsis comes from the Greek word ‘*sepo*’, which means ‘I rot’, and had its first use in a medical context in Homer’s poems. It is also mentioned in the writings of Hippocrates, a physician and philosopher, +/- 400 BC. Hippocrates viewed sepsis as ‘dangerous biological decay’; however, the principles of disease and infection were not well understood at the time, so sepsis was believed to occur in the colon and release various substances which caused ‘auto-intoxication’. **After Hippocrates, Galen (129-199 AD), a respected Roman physician, pioneering pharmacologist and philosopher, developed theories about pus and wound healing. The Romans believed that the malodour from wound sepsis resulted from invisible creatures that gave off fumes. This created the foundation of the Roman public health system, which emphasised good hygiene practices.**

The 1800s were the start of the golden age of ‘germ theory’, and Ignaz Semmelweis critically observed that the women in his ward who had midwife-assisted deliveries developed puerperal sepsis (sepsis occurring after childbirth) only 2% of the time, whereas those who had help from medical students (who had not washed their hands after performing an autopsy) developed it at least 16% of the time. He instituted a hand-washing policy, whereby the medical students had to wash their hands before seeing a patient, and the rates of puerperal sepsis dropped to below 3%. Ironically, Semmelweis’s policy on basic hygiene was met with heavy criticism and he was fired!



THE AETIOLOGY OF SEPSIS AND SEPTIC SHOCK ^{1,2,5}



Most cases of septic shock are caused by hospital-acquired Gram-positive (e.g., *Staphylococcus aureus*, *Streptococcus pneumoniae*) or Gram-negative bacteria (e.g., *E. coli*, *Pseudomonas aeruginosa*, *Klebsiella* and *Acinetobacter spp.*), tending to affect immunocompromised patients, neonates and those with chronic and debilitating diseases. Rarely, it may be caused by *Candida* species or other fungi in immunocompromised patients, especially if they have invasive lines and devices.

Common sources of infection include the skin, the lungs, and the urinary, biliary and gastrointestinal tracts.

Sepsis arising from surgical procedures accounts for 30% of all sepsis in healthcare facilities; therefore, a surgical site infection (SSI) should always be suspected as the cause of septic shock in patients who have recently had surgery.



What is Sepsis? (90 secs)

<https://www.youtube.com/watch?v=6NdLnHbLZMU>









SEPSIS AND SEPTIC SHOCK IN POSTOPERATIVE VASCULAR PATIENTS ^{1,2,5,7}

Surgical site infection (SSI) is a frequent complication of vascular procedures; however, the true rate of SSI is difficult to ascertain since many SSIs go unreported because they are only detected after the patient has left the hospital setting.

Several factors play a role in the risk profile of these patients – given their high prevalence of diabetes mellitus, ischaemic heart disease, obesity, smoking, advanced age and overall frailty.

Groin incisions are the most frequently performed surgical exposures in vascular surgery. The proximity to skin folds, external genitalia and the abundance of local flora makes local intra-operative skin disinfection difficult.

The risk of post-operative sepsis following the insertion of a prosthetic graft is further heightened by:

-  Prolonged pre-operative hospitalisation (the patient may become colonised with drug-resistant pathogens)
-  Infection at another body site (e.g., urinary or chest infection, a chronic wound, pressure ulcer, leg or diabetic foot ulcers)
-  Recent arterial puncture at the operative site (e.g., angiogram)
-  A break in intraoperative aseptic technique
-  Emergency vascular surgery
-  Prolonged duration of surgery
-  Performing a concomitant GI or urological procedure (e.g., urinary catheterisation)
-  Post-operative haematoma, wound infection, lymphatic complications

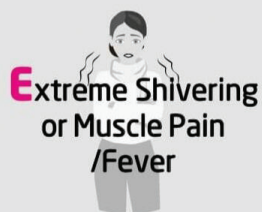
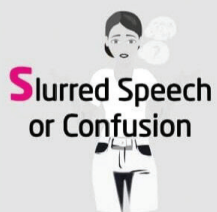


THE PATHOPHYSIOLOGY OF SEPSIS AND SEPTIC SHOCK^{1,2,4}

To be able to appreciate the devastating consequences of septic shock, it is important to understand the following physiological precursors to the development of sepsis:

- An inflammatory stimulus (e.g., a bacterial toxin) triggers the production of pro-inflammatory mediators, including tumour necrosis factor (TNF) and interleukin (IL-1). These powerful cytokines cause neutrophil-endothelial cell adhesion, which activates the clotting mechanism, and generates microthrombi (microscopic clumps of fibrin, platelets and red blood cells).
- Numerous other pro-inflammatory molecules are also released (e.g., leukotrienes, lipoxigenase, histamine, bradykinin, serotonin and IL-2), which are opposed by anti-inflammatory mediators, resulting in a negative feedback mechanism.
- Initially, arteries and arterioles dilate, and cardiac output typically increases - this stage has been referred to as 'warm shock'.
- Later on, cardiac output may decrease, and the blood pressure falls.
- Poor capillary flow, as well as vascular obstruction by microthrombi, decrease the delivery of oxygen and impair the removal of carbon dioxide and waste products.
- Decreased perfusion results in the dysfunction and failure of one or more organs - for example, the kidneys, lungs, liver, brain and heart.
- Systemic coagulopathy may also develop because of intravascular coagulation and the consumption of major clotting factors.

These signs may indicate sepsis:

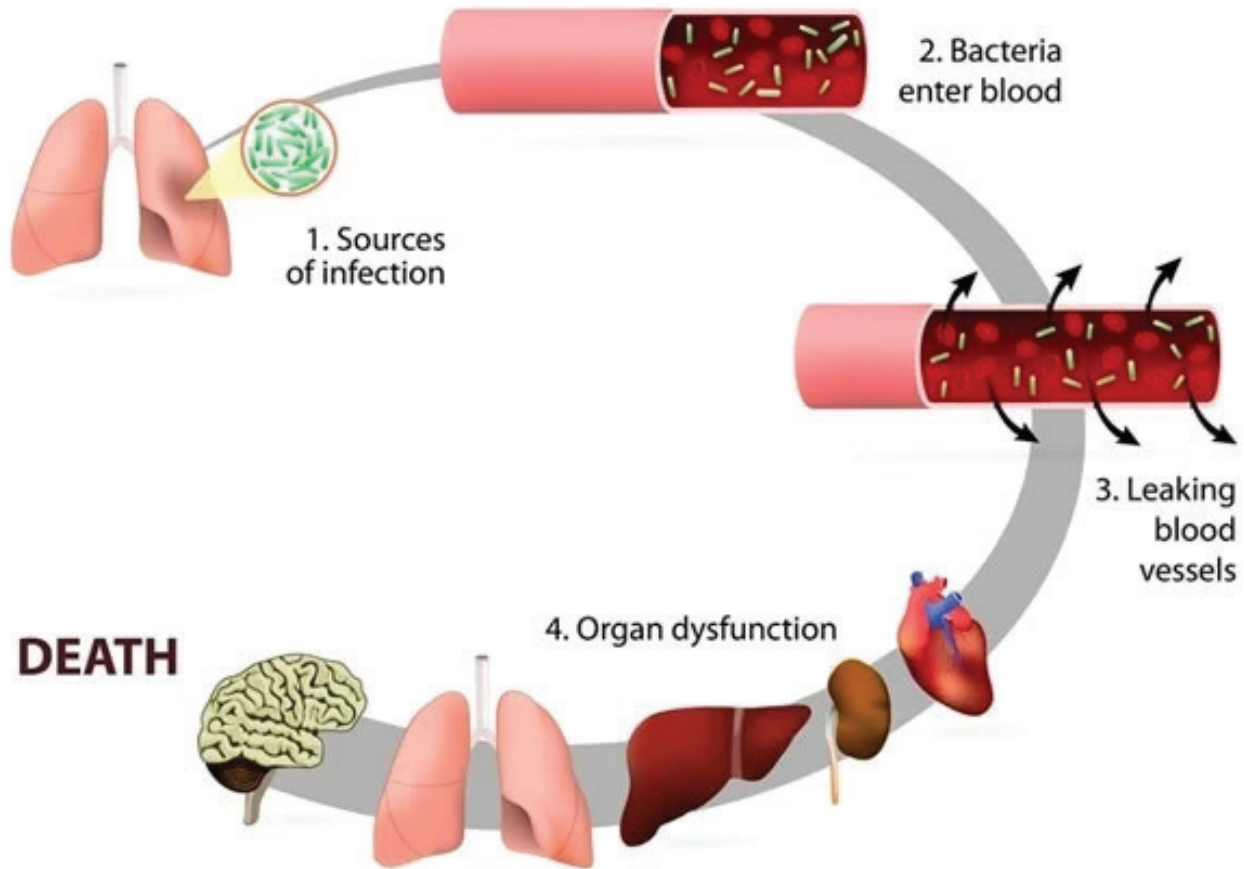




THE DIAGNOSIS OF SEPSIS AND SEPTIC SHOCK ²

- Clinical manifestations – shivering, generalised body pain, dyspnoea, mental confusion, etc.
- Blood pressure (BP), heart rate and oxygen monitoring.
- Full blood count (FBC) with differential, electrolyte panel, creatinine and lactate levels.
- Invasive central venous pressure (CVP) monitoring, arterial and central venous oxygen saturation readings.
- Cultures of blood, urine and other potential sites of infection, including wounds in surgical patients.
- Blood levels of C-reactive protein (CRP) and procalcitonin (PCT) are often elevated in severe sepsis and may facilitate diagnosis, but they are not specific.
- Ultrasound, CT or MRI may be required, depending on the suspected source of infection.
- **It is important to detect organ dysfunction as early as possible.** A number of scoring systems have been devised, but the 'sequential organ failure assessment score' (SOFA score) and the 'quick SOFA score' (qSOFA) are relatively simple to use, and do not require waiting for laboratory results.
- The qSOFA score is based on:
 - > Respiratory rate ≥ 22 breaths/min
 - > Altered mental status (Glasgow Coma Scale <13)
 - > Systolic blood pressure ≤ 100 mm Hg
 - > **A qSOFA score ≥ 2 is suggestive of sepsis.**
- Patients with ≥ 2 of the following meet the criteria for **Systemic Inflammatory Response Syndrome (SIRS)** and require further clinical investigation:
 - > Temperature $> 38^{\circ}\text{C}$ or $< 36^{\circ}\text{C}$
 - > Heart rate > 90 beats per minute
 - > Respiratory rate > 20 breaths per minute or $\text{PaCO}_2 < 32$ mm Hg
 - > White blood cell count $> 12 \times 10^9/\text{L}$, $4 \times 10^9/\text{L}$
- **Septic shock is defined as a subset of sepsis in which the underlying circulatory shock and metabolic abnormalities are serious enough to substantially increase mortality.** ⁴

The Sepsis Cascade



Symmetrical peripheral gangrene (SPG) is a condition in which symmetrical ischaemia and dry gangrene of the toes, hands, nose or earlobes may occur, increasing the risk of amputation.

The cause has been linked to the use of vasopressors (drugs used to raise the systolic blood pressure) in the treatment of septic shock.



This short **VIDEO** (4 mins) features case studies of patients and families who have survived sepsis.¹

'The Faces of Sepsis'

<https://www.sepsis.org/education/patients-family/faces-of-sepsis/>





Supply the correct answer!

Question 1. Most cases of hospital-acquired sepsis are caused by both Gram-positive and Gram-negative bacteria. **True/False**

Question 2. Sepsis arising from _____ procedures accounts for 30% of all sepsis in healthcare facilities.

Question 3. Incisions in the _____ area are prone to developing wound infection after vascular surgery.

Question 4. In septic shock, poor capillary flow and vascular obstruction by microthrombi decrease the delivery of oxygen to the hands and feet, and may result in _____.

Question 5. The early recognition and treatment of sepsis should include the intravenous (IV) administration of antimicrobial agents within the first hour. **True/False**

ANSWERS: 1. True. 2. Surgical. 3. Groin. 4. Gangrene. 5. True



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