Al-Mustaqbal University
Dept. Medical Lab. Techniques, 4th. class
Diagnostic Microbiology 2024-2025
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Lecture-14 & 15: Blood Stream infections

Blood is a combination of plasma and cells that circulate through the entire body. It is a specialized bodily fluid that supplies essential substances around the body, such as sugars, oxygen, and hormones.

In healthy subjects, the blood is sterile

• There are various routes that organisms take to reach the blood.

• **Pneumococcus** colonizing the upper airways could be aspirated into the lungs during sleep and go on to cause a lobar pneumonia; from here it can enter the blood.

The presence of bacteria in the blood requires identification of the likely source. There is the obvious association of *Escherichia coli* in blood and an ascending urinary tract infection (UTI).

The patient with endocarditis caused by a streptococcus of the mouth flora, such as *Streptococcus sanguinis*, can have poor dentition (Poor oral health), and this needs to be addressed as part of the patient's management, usually involving the maxillafacial surgical team and also called periodontal organisms of dental infections.

• **More unusual situations** occur, and one is the identification of *Streptococcus gallolyticus* in blood culture. This organism is a minor member of the normal flora of **the colon.**

• However, it is recognized that there is an association that can develop between it and a large bowel malignancy, likely due to a specific interaction between the organism and these malignant cells.

• The *Streptococcus* gains a selective growth advantage, from where it accesses the blood. Once in the blood it has the potential to initiate infective endocarditis.

• The finding of *Streptococcus gallolyticus* in blood culture, often in the setting of endocarditis, is an alert to investigate this malignancy; if found this is removed before

any valve surgery. Blood is cultured to detect and identify bacteria or other cultivable microorganisms (yeasts, filamentous fungi). The presence of such organisms in the blood is called bacteraemia or fungaemia, and is usually pathological.

bacteraemia defines the presence of bacteria as detected by the culture of blood.

• **Septicemia** also defines the presence of bacteria in blood, but it signals a sense of urgency in the management of the patient.

• **The terms sepsis and septic shock** are also used and, with clinical parameters such as fever, hypotension, tachycardia, multiorgan failure and leucocytosis, alert the clinician to the severity of the situation, and the need for immediate action in the management of the patient.

Bacteremia

1. A transient bacteremia (a single episode lasting less than 30 minutes or so) can arise from **a pneumococcal pneumonia, or pyelonephritis caused by *Escherichia coli.***

2. An intermittent bacteremia manipulation (guidance) of **an extravascular** site, such as a ***Staphylococcus aureus* abscess,** where bacteria enter the lymphatics at irregular intervals, and from there, to the blood.

3. A continuous bacteremia an **intravascular** source, and endocarditis is the most important example.

• Once bacteria enter the blood, they have the potential to settle (become down) in other sites of the body, and set up another focus of infection.

• A ***Staphylococcus aureus*** bacteremia arising from an infected **peripheral venous cannula** (PVC) site can **result in** bacteria attaching to a heart valve to initiate **endocarditis,** or settling in the **spine** and **causing an abscess** there.

• **The bacteria can cross the synovial membrane of a joint to initiate septic arthritis**. These examples underline the critical importance of full clinical assessment of the septic or bacteremic patient.

Blood collection

blood should be taken before antibiotics are administered. It is recommended that two or preferably three blood cultures be obtained.

• **Tryptic soy broth (TSB)** should be able to support growth of all clinically significant bacteria.

• the blood should be mixed with 10 times its volume of broth (5 ml of blood in 50 ml of broth) to **dilute any antibiotic present and to reduce the bactericidal effect of human serum**. **Any medium showing turbidity should not be used**

• If strictly aerobic bacteria **(*Pseudomonas, Neisseria*)** the bottle should be **vented** as soon as it is received in the laboratory, by inserting a sterile cotton-wool-plugged needle through the previously disinfected diaphragm. **The use of a diphasic blood culture bottle, with a broth phase and a solid-slant phase** on one of the flat surfaces of the bottle (Castaneda bottle), is recommended for the cultivation of *Brucella* spp.

• Blood-culture bottles should be incubated at 35–37 ◦C and routinely inspected twice a day (at least for the first 3 days) for signs of microbial growth.

• A sterile culture usually shows a layer of sediment red blood covered by a pale yellow transparent broth.

• Whenever **visible growth appears**, the bottle should be opened aseptically, a small amount of broth removed with a sterile loop or Pasteur pipette, and a Gram stained smear examined for the presence of microorganisms.

Table (3): Summary of bacterial blood infections.

Infection	Most Important Pathogens	Laboratory diagnosis
Endocarditis	*Streptococcus* spp. (60–80%) *Staphylococcus* spp. (20–35%) Gram-negative rods (2–13%) Numerous other bacterial spp. (5%) Fungi (2–4%) Culture negative (5–25%)	**Blood culture**, three sets from three different sites, within 1–2 h, before antimicrobials if possible. 10–20 ml venous blood into one aerobic and one anaerobic bottle, respectively.
Bacteria	***Staphylococcus aureus*** ***Streptococcus pneumoniae*** ***Enterobacteriaceae*** ***Mycobacterium tuberculosis***	Microscopy and culture from punctate DNA test from punctate if required
	Mycoplasma pneumoniae	Serology; culture from punctate
	Neisseria spp. Gram-negative anaerobes *Actinomyces* spp. *Nocardia* spp.	Microscopy and culture from punctate
	Rickettsia spp. *Chlamydia trachomatis*	Serology

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