Bloodstream Infections

Laboratory Science

MBS 240

Ms. M. Mwansa

Definitions

- Bacteremia: presence of bacteria in blood
- Transient bacteremia:
  - Occurs spontaneously or with minor events like brushing teeth or chewing food
  - Manipulation of infected tissue, surgery in non-sterile sites or instrumentation of contaminated mucosal surfaces
- Intermittent bacteremia:
  - Undrained abdominal or pelvic abscesses
  - Extravascular infections
- Continuous bacteremia:
  - Endocarditis, intravascular infections
  - Early stages of Typhoid, Brucellosis and Leptospirosis

Definitions cont'd

- Septicemia: presence of microbes or their toxins in blood

- Sepsis: host systemic response to the presence of pathogenic bacteria or their toxins, or both, in the bloodstream resulting in a systemic inflammatory response syndrome (SIRS)

Definitions cont'd

- Severe sepsis/Septic shock: severe immune response to bacteremia or septicemia resulting in multiple organ dysfunction syndrome (MODS)

Introduction

- Bloodstream Infection (BSI):
  - Presence and active multiplication of organisms in blood
- Primary:
  - Point of entry or focus of infection cannot be determined or originates from I/V catheters
- Secondary:
  - Distant site (focus) of infection present

Introduction cont'd

- Community acquired BSI:
  - Those detected within 48 hrs of admission
- Nosocomial BSI:
  - Signs and symptoms detected after 48 hrs of admission

Introduction cont'd

- Factors contributing to initiation of BSI
  - Immunosuppression
  - Widespread use of broad spectrum antibiotics suppress normal flora
  - Invasive surgical procedures

Organisms commonly associated with BSI

- *Staphylococcus aureus*
- *Escherichia coli*
- Coagulase negative *streptococci*
- *Enterococcus spp.*
- *Pseudomonas aeruginosa*
- *Klebsiella pneumonia*
- Viridans *strepococci*
- *Streptococcus pneumoniae*
- *Enterobacter cloacae*
- *Proteus spp.*
- Beta-hemolytic *streptococci*
- Anaerobic bacteria – *Bacteroids* and *Clostridium spp.*

Introduction cont'd

- Intravascular BSI: originate within the cardiovascular system

- Extravascular BSI: originate from bacteria entering the blood circulation through the lymphatic system from another site of infection

Diseases

- Intravascular infections
  - Infective endorcarditis
  - Mycotic aneurysm
  - Suppurative thrombophlebitis
  - Intravenous catheter bacteremia
- Extravascular infections
  - Sepsis
  - Septic shock

Pathogenesis

- Intravascular infections
  - Intracardiac infections (endocarditis) and those primarily involving veins (thrombophlebitis) or arteries (endarteritis) are usually caused by bacteria
  - They commonly produce a constant shedding of organisms into the bloodstream that is often characterized by continuous, low-grade bacteremia in untreated patients

Pathogenesis

- Extravascular infections
  - Most cases of sepsis occur as a result of urinary tract, respiratory tract, skin and soft tissue or central nervous system (CNS) infections
  - Approximately 50% of cases of sepsis are due to gram-negative bacteria, and slightly less than 50% are caused by gram-positive bacteria

Pathogenesis - Extravascular

- Bacteria from the infected area reach the capillary and venous circulation through the lymphatic vessels

- Bloodstream invasion is more common in the acute phases of infection and intermittent at other times

Pathogenesis - Extravascular

- Systemic Inflammatory Response Syndrome (SIRS) or sepsis is indicated when two or more of the following occur:
  - Temperature : > 38C or < 360C
  - Heart Rate: > 90 beats/min
  - Respirations: > 20 breaths/min
  - Leukocytes > 12,000 or < 4,000/mm3 or > 10% immature neutrophils

Pathogenesis - Extravascular

- Sepsis can advance to severe sepsis/septic shock if the signs of sepsis also include the following:
  - Skin lesions
  - Decreased urination
  - Changes in mental ability
  - Unconsciousness
  - Extreme weakness
  - Abnormal heart function
  - Low blood pressure

Bacterial causes of sepsis

Gram-negative bacteria	Common infection(s)
Escherichia coli	UTI; prostatitis
Klebsiella pneumoniae	UTI; pneumonia
Enterobacter	UTI
Pseudomonas aeruginosa	Infected burn wounds and pneumonia in patients with cystic fibrosis
Proteus	UTI
Bacteroides fragilis	Peritonitis

Gram-positive bacteria	Common infection(s)
Streptococcus pneumoniae	Pneumonia; meningitis
Streptococcus pyogenes	Skin and soft tissue
Staphylococcus aureus	Skin and soft tissue
Enterococcus	UTI

Laboratory Diagnosis

- The primary means for establishing a diagnosis of sepsis is by blood culture

- A sample of the patient's blood is obtained by aseptic venipuncture and cultured in an enriched broth or, after special processing, on plates.

Lab diagnosis cont'd

- Blood culture media
  - Tryptone Soy broth- aerobic
  - Thioglycollate broth- anaerobic
- Bottles should be incubated overnight before plating (aerobically and anaerobically)
- Examine bottles macroscopically for hemolysis, turbidity or colonies
- Subculture on Blood and MacConkey agar aerobically and Chocolate agar anaerobically


BACTEC 9550


BACTEC
8-10 mL
BACTEC
MYCO/F LYTIC
1-5 mL
BACTEC
PEDS PLUS/F
1-3 mL
BACTEC
Standard 10
Aerobic/F

Lab diagnosis cont'd

- Growth is detected, and the organisms are isolated, identified, and tested for antimicrobial susceptibility

Treatment

- Immediate stabilization of the patient
  - Airway, breathing, circulation
  - Monitor vital signs
- The blood must be rapidly cleared of microorganisms
  - Administer empiric treatment
- The original focus of infection must be treated
  - Remove foreign bodies e.g catheters