



M4 - Role of Microbiology Lab

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Learning Objectives

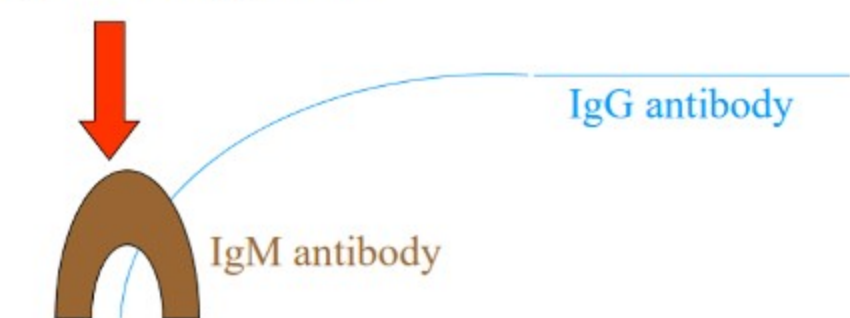
- List the reasons why microbiological laboratory diagnosis is important for good clinical care

Remarks:		
Topic	Anatomical Diagnosis	Microbiological Diagnosis
Disease cause	Based on physical examination and symptoms.	Based on laboratory tests to identify the causative pathogen.
Antibiotic sensitivity test	Empirical antibiotic treatment	specific antimicrobiol therapy R: Having Resistances S: Sensitive (V in treatment)
Monitor effectiveness of therapy	Based on clinical improvement of symptoms.	Based on laboratory tests such as culture and PCR to monitor
Infection control	Based on standard precautions and clinical judgment.	Monitor the concentration of pathogens
Public health and epidemiology	Based on clinical surveillance and reporting of notifiable diseases.	Based on laboratory surveillance and reporting of notifiable diseases.

- Describe the factors that need to be considered in collection and transport of specimens for microbiological laboratory diagnosis
 - Well collected specimen + Transport Medium + Appropriate Storage
 - Date of onset of illness
 - Suspected clinical diagnosis
 - Prior antibiotic therapy
 - Known biological hazards (e.g. HIV positive) clearly stated
- Describe the precautions to be followed when collecting blood for bacteriological culture
- Describe the precautions to be followed when collecting urine for diagnosis of urinary tract infection
- Describe the available options for diagnosis of viral infections
- Describe how serological results are interpreted to arrive at a microbiological diagnosis

Serological Result (IgM & IgG)

IgM antibody positive



- IgM antibodies indicate a recent or ongoing infection.
- IgG antibodies indicate a past or current infection.
- Serological results are interpreted by (antibody titerate) detecting the antibodies in serum
- With a reference range of antibody levels in healthy individuals.
- Antibody levels are higher → Exposed to the pathogen

Microbe Detection

Detection Method

Detection Method	Time Required
Microscopy	minutes
Grow (culture)	days
Microbial antigen detection	hours
Microbial nucleic acid detection (e.g. Polymerase chain reaction) (PCR)	hours, days

Collection & Transport of Blood

When?

With any of these symptoms, a blood culture will be done:

- Unexplained fever
- Sudden relative increase in pulse rate and temperature
- Change in consciousness or confusion
- Onset of chills, prostration, and hypotension
- Prolonged, mild, intermittent fever with or without a heart murmur

This symptoms usually indicate endocarditis and suspected sepsis

Precautions [catheter-related infections]

- Disinfect the exit site of the catheter
- Once the area is dry, remove the catheter
- Aseptically cut off the distal 5 cm segment
- Directly drop the segment into a dry screw-cap container
- Roll the catheter segment over the blood agar plate 4 times
- ≥ 15 colony forming units of a single organism after 48 hours of incubation is associated with an increased risk of catheter-related infections.

Collection of Serum (血清)

Composition of Blood:

- Serum
- Plasma

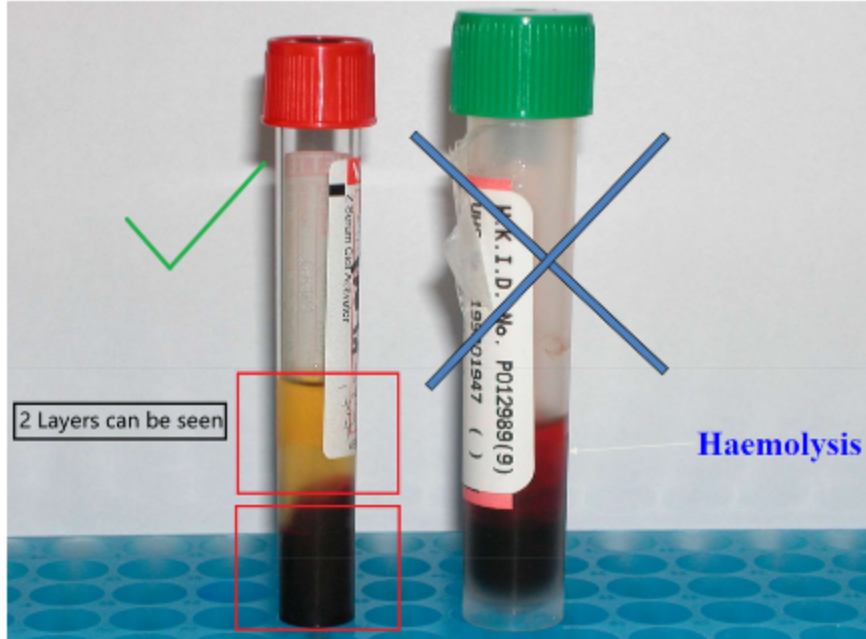
How to prevent Hemolysis:

- Use a sterile needle and syringe to avoid hemolysis during collection and handling of the sample
- Allow the blood to clot at room temperature for 20-30 minutes
- Avoid shaking the tube during centrifugation

Procedures !

- Need 2 cultures
 - Central venous catheter
 - Peripheral venous puncture
- Aseptic technique
- Around 20ml
- Before antibiotic administration
- Store in incubator at 37 C.

- 消毒导管出口部位
- 等待区域干燥后，拿掉导管
- 无菌地取下最末端5厘米的段落
- 直接将该段落滴入干燥的螺旋盖容器中
- 将导管段在血液琼脂板上滚动4次
- 孵育48小时后，单个微生物形成单位≥15个与导管相关感染的风险增加有关。



Collection & Transport of CSF / Sterile Body Fluid

When?

With any of these symptoms, a blood culture will be done:

- Fever
- Headache
- meningeal irritation
- Unexplained febrile illness in an irritable infant who is feeding poorly

This symptoms usually indicate suspected meningitis

Procedures !

- Lumbar puncture → Lab (Immediate)
- Strict Aseptic technique
- Use new sterile glass bottles with labeled (microbiology only)
- Aliquots for sample bottles
 - Dividing collected cerebrospinal fluid (CSF) into smaller portions.
 - Aliquoting makes it easier to handle and distribute samples for analysis or testing.

Collection & Transport of Urine

Sex	Pre-Procedure	Procedure	Precautions	Reason	Remarks
Uncircumcised men	Clean with sterile water.	Retract the foreskin before urination	- Strong urine flow - Bladder is full	- clearing bacteria from the urethral meatus. - least contaminated sample	within an hour of collection unless refrigerated at 4°C.
Women	Clean with sterile water.	Part the labia (把皱褶分开)	- Strong urine flow - Bladder is full	- clearing bacteria from the urethral meatus. - least contaminated sample	within an hour of collection unless refrigerated at 4°C.

Collection & Transport of Specimens from Respiratory Tract

Anatomical Diagnosis	Microbiological Diagnosis	Procedure	Sites	Functions
Upper Respiratory Tract	Bacterial diagnosis	Throat Swab w/ plain cotton wool swab	Tonsils, posterior pharyngeal wall	Microbiological Diagnosis
Upper Respiratory Tract	Virus diagnosis	Nasopharyngeal Swab	A deep nasal swab	Differentiate Healthy pp. & Patient, such as: Bordetella pertussis (百日咳)
Lower Respiratory Tract	Bacterial diagnosis	Expectorated sputum	Lower respiratory tract	Oral-pharyngeal contamination: - High squamous epithelial cell content (from the buccal mucosa) - A low white cell count on gram staining.

Collection & Transport of Sterile Body Fluid

Sterile Body Fluid	Technique	Precaution	Remark
- pleural - peritoneal (dialysis) - pericardial - synovial (joint) fluid	Strict aseptic technique per-cutaneous needle aspiration.	Add citrate or heparin	As some specimen is prone to clotting (e.g. bone marrow).

Collection & Transport of Swab

Type of Swab

- Wound Swab
- Ear & Eye Swab
- Drainage Fluid
- Abscess (Pus) / 脓肿 (Pus)
- Sterile aspirate / Tissue

Precautions

- Use appropriate container (universal bottles) for specimen storage
- For tissue biopsy specimens, use sterile, wide mouth, screw-cap containers
- Remains uncontaminated during transport and storage

Viral Diagnosis

Detection Method	Mechanism	Precaution	Time Required
Grow (virus culture in cell lines) Shell viral cultures	Observing for Virus cytopathic effect	Virus transport medium : - Buffering agent to maintain pH - Protein source to protect the virus - Antimicrobial agent to prevent bacterial growth	days/weeks
Direct electron microscopy			
Viral antigen detection	By immunofluorescence	—	hours
Viral nucleic acid detection (e.g. Polymerase chain reaction) (PCR)	Requires species-specific "primers" Use "polymerase" to amplify Reverse Transcriptase [RT] → RNA	Visualize by hybridization with: complementary DNA probes gel electrophoresis "Real-time" PCR.	hours/days
Inclusion bodies (Proteins)	—	—	days