Beyond *Staff aureus* – getting the most out of residency
(Things I wish I knew During Residency)

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AMMI Canada – CACMID Annual Conference 2016 Trainees' Day
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Objectives

- To share with you some of the best Infectious Diseases and Medical Microbiology references **I wish I knew** about earlier
- To share with you a few pearls on the preparation for the Royal College Exams **I wish I knew** earlier

« Unofficial » objective

- Share with you my ID and Med Micro toolbox that took me 3 years to build
- If I could time travel, this is what I would tell Padawan Philippe when he started his training in med micro/ID

- 10 multiple choice questions

Question 1

- Blood culture contamination can have significant consequences for patient care. What is a reasonable target for blood culture contamination rate in your institution?

a) Less than 1%
b) Less than 3%
c) Less than 5%
d) Less than 10%
e) Less than 20%

Answer

- b) Less than 3%

Reference 1 : CLSI documents…

- A bit messy
  - At least 60 documents that can apply to a med micro lab
  - They do not all start with the letter “M”
- Not all CLSI documents are useful for a medical microbiologist / infectious diseases specialist
- **I wish** someone would have help me find the useful CLSI documents
- New website helpful
  - http://shop.clsi.org/microbiology-documents/

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- Method Evaluation

Documents

Standards Documents for Microbiology

Browse our collection of consensus-based clinical laboratory standards documents for the Microbiology subject area. Choose from print or electronic versions of certain CLSI Microbiology documents.

M02-A12 PK16

Package of Two Documents

M02-A12: *Performance Standards for Antimicrobial Disk Susceptibility Tests; Approved Standard - Twelfth Edition.*

M100-S26: *Performance Standards for Antimicrobial Susceptibility Testing, 26th Edition*

Nonmember Price: $340.00

Price: $340.00

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M02-A12/M07-A10 PK16

M02-A12, M07-A10, M100-S26 Package of 3 Docs.

M02-A12: Performance Standards for Antimicrobial Disk Susceptibility Tests; Approved Standard - Twelfth Edition.

M07-A10: Methods for Dilution Antimicrobial Susceptibility Tests for Bacteria That Grow Aerobically; Approved Standard - Tenth Edition.

M100-S26: Performance Standards for Antimicrobial Susceptibility Testing, 26th Edition

Nonmember Price: $500.00
**Your membership discount will be applied at checkout.*

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“My” CLSI list

- M100-S26 (AST)
- M45-ED3 (AST rare bacteria)
- M35-A2 (Abbreviated identification)
- M29-A4 (Occupationally Acquired Infections)
- M47-A (Blood cultures)
- M36-A (Toxoplasmosis)
- M39-A4 (Cumulative Antimicrobial Susceptibility)
- M53-A (HIV)
- M54-A (Fungi – Direct Examination and Culture)
- M56-A (Anaerobes)
- QMS11-A (Management of Nonconforming Laboratory Events)

Which CLSI documents are the most useful (my opinion)

- **M100-S26** (MM & ID)
  - Performance Standards For Antimicrobial Susceptibility Testing, 26th Edition (2016)
- **M45-ED3** (MM & ID)
  - Methods for Antimicrobial Dilution and Disk Susceptibility Testing of Infrequently Isolated or Fastidious Bacteria, 3rd Edition (2015)
- **M47-A** (MM > ID)
  - Principles and Procedures for Blood Cultures; Approved Guideline (2007)
    - How many bottles? What volume?
    - When to order anaerobic blood culture
    - Limitations of blood cultures for some organisms
    - Lysis-centrifugation blood culture system (when to use and for what)
    - Quality assurance issues

M47-A Quality Assurance of Blood Cultures

Example QA Indicator 1: Blood culture contamination rate. The goal for blood culture contamination rate, whether analyzed overall or stratified by location, phlebotomist, etc., should be less than 3%.

Example QA Indicator 2: Proportion of blood culture bottles inoculated with more or less than the recommended volume of blood. For adults, each blood culture bottle should be inoculated with 10 mL of blood.

Example QA Indicator 3: Proportion of blood cultures submitted that include only a single inoculated bottle.

Example QA Indicator 4: Proportion of blood cultures submitted that must be rejected for any cause.

CLSI M47-A, Vol. 27 No. 17, 2007

Which CLSI documents are the most useful (my opinion)

- **M29-A4** (MM > ID)
  - Protection of Laboratory Workers from Occupationally Acquired Infections; Approved Guideline – Fourth edition (2014)
    - Section 14 : Management of Biological Releases, Exposure Incidents or Accidents
      - Biohazard Spill Clean-up (classic example of TB culture dropped on the floor)
      - Post exposure Actions

Appendix C. General Characteristics to Consider for Early Recognition of Select Agents Associated With Bioterrorism and Potential Laboratory-Acquired Infections

Consult the laboratory director or supervisor immediately whenever any of these microorganisms is suspected.

Characteristic	*Bacillus anthracis*	*Burkholderia mallei*	*Burkholderia pseudomallei*	*Brucella* spp.	*Francisella tularensis*	*Neisseria meningitidis*	*Yersinia pestis*
Colony Morphology on SBA	• Nonhemolytic • Ground glass appearance • Irregular or wavy edges • Tenacious, appear as "beaten egg whites" when touched with loop	• Smooth, gray, translucent • Not pigmented	• 18–48 hours: small, creamy, smooth • >48 hours: dry, wrinkled	• Nonhemolytic • Small, punctate colonies after 48 hours • Grows in blood culture media but may require "blind" subculture to detect	• Usually nonhemolytic • Scant to no growth at 48 hours • Good growth in 48 hours on chocolate agar	• Best growth on chocolate agar in 5% CO_2 • Beige to gray-brown, translucent, smooth colonies (0.5–1 mm diameter) • Grows well on SBA at 18–24 hours	• Nonhemolytic, pinpoint colonies at 24–48 hours • "Fried egg," "hammered copper," or shiny at 48–72 hours

NOTE: Do not place isolate into automated instrument for identification. If a MacConkey agar plate was not inoculated in the original setup, subculture to MacConkey agar plate within a biological safety cabinet (BSC) and incubate at 35°C.

Abbreviation: SBA, sheep blood agar.

Characteristic	*B. anthracis*	*B. mallei*	*B. pseudomallei*	*Brucella spp.*	*F. tularensis*	*N. meningitidis*	*Y. pestis*
Growth requirement and colony morphology on MacConkey agar	• No growth	• 35 to 37°C with ambient or increased CO_2 • Lactose (−) or no growth	• 35 to 37°C with ambient or increased CO_2 • Lactose (−)	• Poor to no growth	• No growth under standard conditions • Very slight growth after > 2 days	• No growth	• Optimal growth at 28°C • Slower growth at 35 to 37°C • Lactose (−)

NOTE: Do not place isolate into automated instrument for identification. Perform identification procedures **only** within a BSC.

CLSI M29-A4, Vol. 34 No.8, 2014

Characteristic	*B. anthracis*	*B. mallei*	*B. pseudomallei*	*Brucella spp.*	*F. tularensis*	*N. meningitidis*	*Y. pestis*
Gram stain morphology	• Large GPR • Smears from SBA: no apparent capsule and central to subterminal spores, which do not swell cell • Smears from blood culture: prominent capsule and usually no spores	• Small GNCB	• Small GNR • Bipolar staining (+/−)	• Tiny GNCB • Faintly staining, resembles "pink sand"	• Poorly staining, pleomorphic, minute GNCB (smaller than *Haemophilus influenzae*)	• Coffee bean–shaped GNDC	• Plump GNR • Bipolar staining (+/−) with "safety pin" appearance • Bipolar staining best with Wright-Giemsa stain
Tests	• Catalase (+) (**Caution:** Perform catalase in a BSC **only**) • Motility (−)	• Catalase (+) • Indole (−) • Resistant to colistin (10-µg disk) and polymyxin B (300-unit disk) • Motility (−) • Oxidase (+/−)	• Catalase (+) • Indole (−) • Resistant to colistin (10-µg disk) and polymyxin B (300-unit disk) • Motility (+) • Oxidase (+)	• Catalase (+) • Motility (−) • Urease (+) (rapid) • Usually oxidase (+)	• Weakly catalase (+) • Motility (−) • Urease (−) • Oxidase (−) (**Hint:** does not produce satellite colonies)	• Oxidase (+) catalase (+) • Deoxyribonuclease (−)	• Catalase (+) • Motility (−) • Urease (−) • Oxidase (−) • Indole (−)

Abbreviations: BSC, biological safety cabinet; GNCB, gram-negative coccobacilli; GNDC, gram-negative diplococci; GNR, gram-negative rods; GPR, gram-positive rods; SBA, sheep blood ag

CLSI M29-A4, Vol. 34 No.8, 2014

Which CLSI documents are the most usefull (my opinion)

- **M35-A2** (MM & ID)
  - Abbreviated Identification of Bacteria and Yeast; Approved Guideline – Second Edition (2008)

Table 2. (Continued)

Organism	Presumptive Identification	Additional Tests for Definitive Identification	Additional Notations
Streptococcus anginosus group (*"S. milleri"*)	1. Gram-positive cocci in pairs and chains 2. Catalase negative 3. Colonies <0.5 mm diameter on BAP with variable hemolysis	1. Odor of butterscotch or vanilla; or 2. Lancefield group F by latex agglutination	May be Lancefield group A, C, F, or G by latex agglutination.
Streptococcus pneumoniae	1. Gram-positive lancet-shaped cocci in pairs 2. Catalase negative 3. Alpha-hemolytic on BAP	Bile solubility positive	Some strains have lost solubility to bile.
Streptococcus pyogenes (Group A)	1. Gram-positive cocci in pairs and chains 2. Catalase negative 3. Sharp zone of beta hemolysis on BAP; colony >0.5 mm diameter	1. PYR positive; or 2. Lancefield group A by latex agglutination	Carefully look at size and hemolysis, since enterococci can be hemolytic.
Streptococcus, viridans group	1. Gram-positive cocci in pairs and chains 2. Catalase negative 3. Alpha hemolytic or nonhemolytic	1. PYR negative 2. LAP positive 3. Bile solubility negative if alpha hemolytic	If not in chains, *Pediococcus* is vancomycin resistant and *Aerococcus urinae* is a urinary pathogen in tetrads.

CLSI M35-A2, Vol. 28 No. 29, 2008

Question 2

- A 10 weeks pregnant patient is found to have the following toxoplasmosis serology result (routine screening)
    - IgM: positive
    - IgG: positive
    - Result of avidity IgG testing: Presence of high avidity IgG

When did the patient acquire toxoplasmosis?

a) More than 12 to 16 weeks ago
b) Less than 12 weeks ago
c) Likely false positive serology since patient is asymptomatic
d) Time of infection cannot be determined with these tests

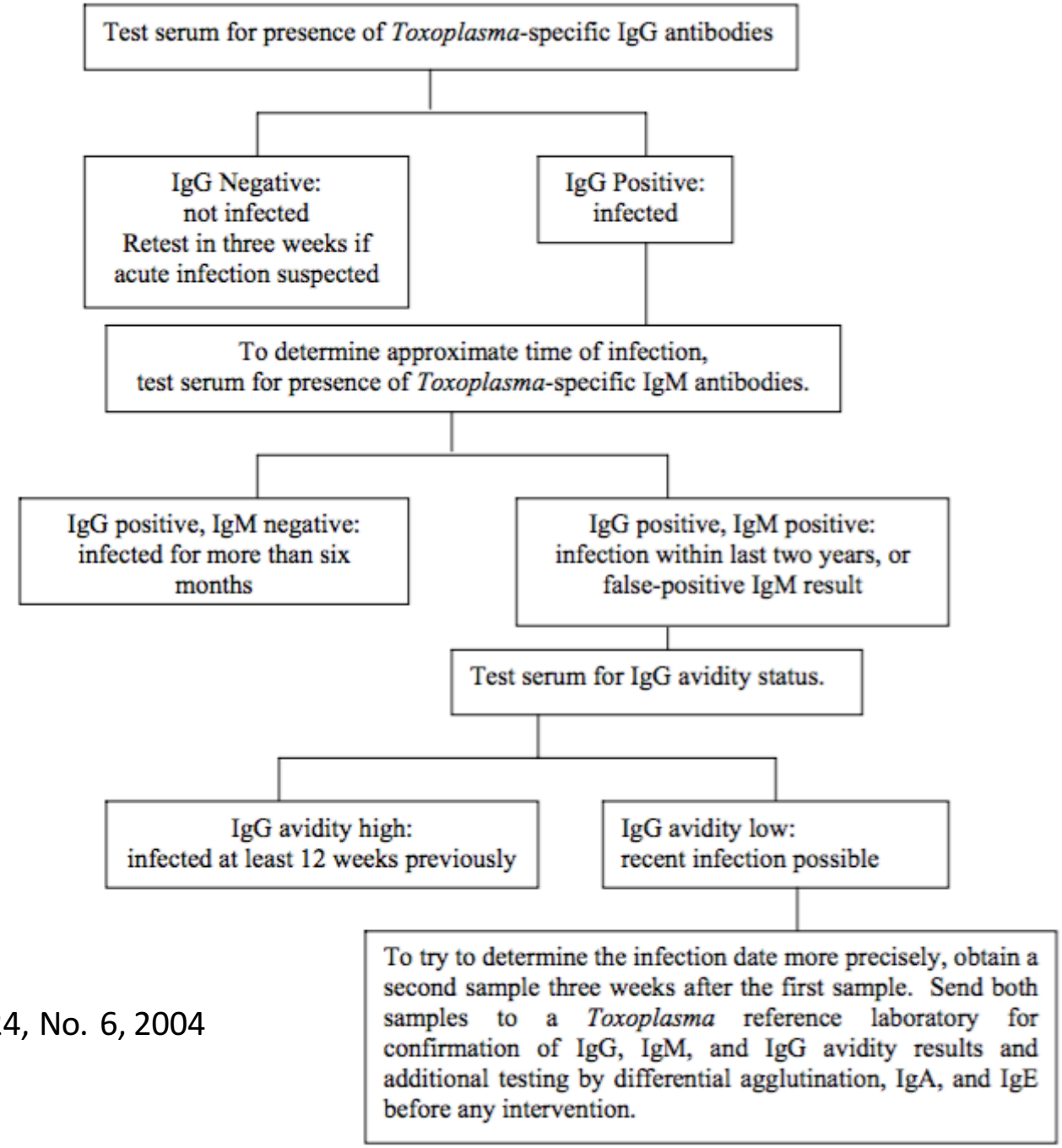
Answer

a) More than 12 to 16 weeks ago

- The presence of high avidity IgG suggest that the infection occurred at least 12 to 16 weeks prior to the test

Which CLSI documents are the most usefull (my opinion)

- **M36-A** (MM & ID)
  - Clinical Use and Interpretation of Serologic Tests for *Toxoplasma gondii*; Approved Guideline (2004)
  - Makes toxoplasmosis diagnosis simple!
    - Great document to understand all the tests for toxoplasmosis
      - IgG – IgM – IgA – IgE
      - Avidity testing
      - PCR
    - Helps to interpret tests in multiple settings :
      - Acute acquired infection
      - Congenital infection
      - Newborn infection
      - Ocular infection
      - Immunocompromised host



CLSI M36-A, Vol. 24, No. 6, 2004

Figure 1. General Algorithm for Serological Testing of People Older Than One Year of Age

Question 3

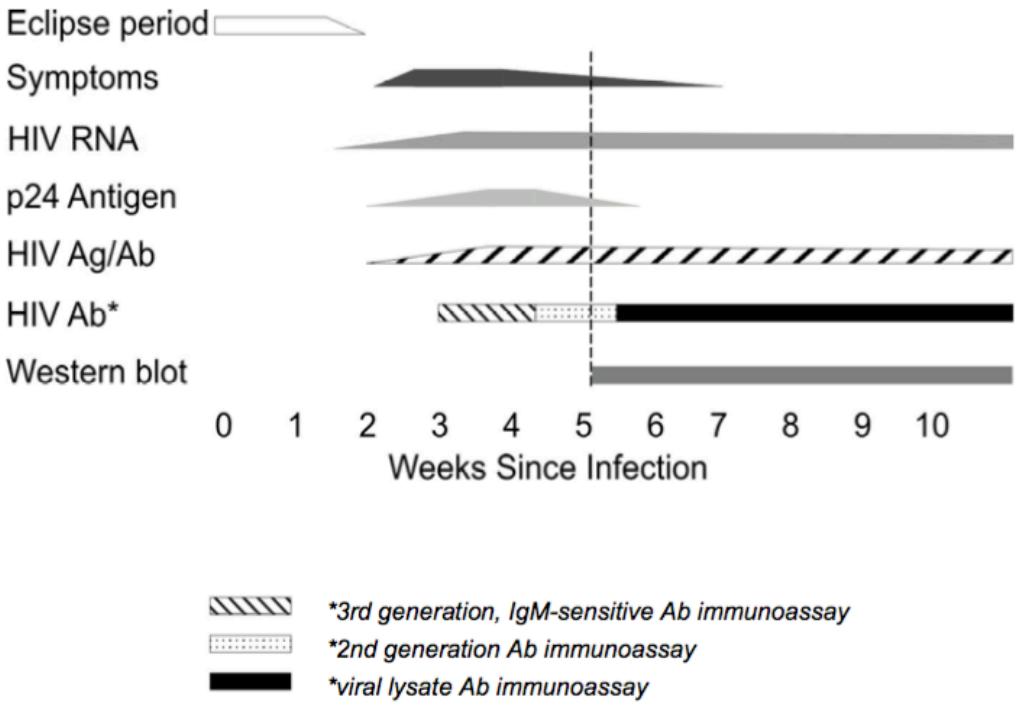
- A 26 M from Cameroun presents with fever and bilateral cervical lymphadenopathy. An HIV test (4th generation) is reactive. The specimen is sent for a HIV-1 Western Blot.
  - HIV-1 WB result: indeterminate
- Which of the following could explain this situation?

a) The patient has acute HIV infection (Seroconversion)
b) The patient has non group M HIV-1 infection
c) The patient has HIV-2 infection
d) The patient is not infected with HIV and the result is a false positive
e) All of the above

Answer

e) All of the above

- CLSI M53-A helps you understand the not so clear cut situations and the limits of HIV testing



CLSI M53-A, Vol. 31 No. 13, 2011

Table 3. Capability of Commercial HIV Assays to Detect HIV Non-B Infections

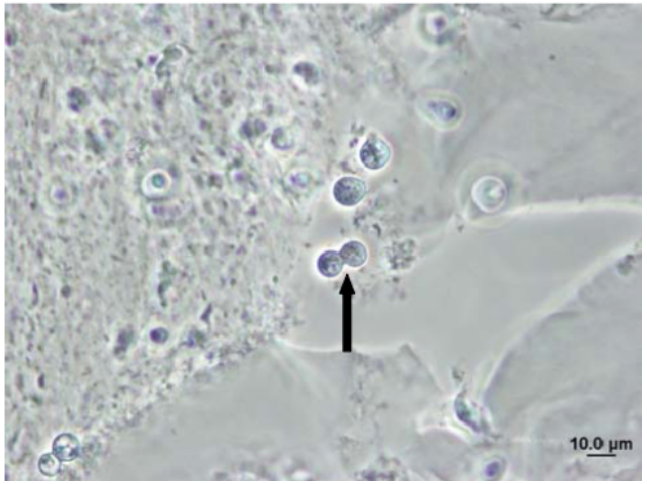
	HIV Non-B Infection		
Assay Type	**HIV-1 Group M, Non-B**	**HIV-1 Group O**	**HIV-2**
HIV-1 Ab (first/second generation)	Detected	Partial detection dependent on cross-reactivity	Partial detection dependent on cross-reactivity
HIV-2 Ab (first generation)	No data available	No data available	Detected
HIV-1/HIV-2 Ab (second/third generation)	Detected	Partial detection dependent on cross-reactivity	Detected
HIV-1/HIV-2/O Ab (third generation)	Detected	Detected	Detected
HIV-1/HIV-2/O Ag/Ab (fourth generation)	Ab detected Ag sensitivity is assay dependent	Ab detected Ag sensitivity is assay dependent	Ab detected Ag detection dependent on cross-reactivity; sensitivity is assay dependent
HIV-1 p24 Ag	Sensitivity is assay dependent	Sensitivity is assay dependent	Ag detection dependent on cross-reactivity; sensitivity is assay dependent
HIV-1 WB	Detected	Can get negative and indeterminate results	Can get negative and indeterminate results
HIV-2 WB	Can get negative and indeterminate results	No data available	Detected
HIV-1 RNA NAT (qualitative)	Detected	Detected	Not detected
HIV-1 RNA NAT (quantitative)	Detected; quantification is assay dependent	Detection and quantification are assay dependent	Not detected
HIV-1 RNA NAT (genotyping)	Detected	Not detected	Not detected

CLSI M53-A, Vol. 31 No. 13, 2011

Question 4

- The buds of the yeast form of *B. dermatitidis* are usually single and attached by a broad base. Which yeast can also share this broad base budding characteristic?

a) *Sprorothrix schenckii*
b) *Cryptococcus neoformans*
c) *Malassezia spp.*
d) *Histoplasma duboisii*



CLSI M54-A

Answer

c) *Malassezia* spp.

- The Larone and the St. Germain are great books for identifying fungi in the lab but the CLSI M54-A presents the information in a more clinical approach

Table 4. Characterization of Yeast and Yeast-like Fungi in Clinical Specimens

Organism Name	Size (μm)	Uniform or Variable Size	Pseudohyphae or True Hyphae Produced	Special Features/Comments
Small-sized Yeasts				
Candida glabrata	2.5–4	Uniform	Absent	This fungus is the smallest of the *Candida* genus; it does not produce hyphae or pseudohyphae in clinical specimens.
H. capsulatum	2–5	Usually uniform	Usually absent	In histological sections, a clear space or pseudocapsule surrounds the yeasts. The yeasts are small, oval-to-round budding cells that are often found clustered within histiocytes in disseminated disease. They are within areas of necrosis in old, inactive histoplasmomas. They may be difficult to detect when present in small numbers. They are best visualized in histological sections using histochemical stains, in most instances.
Malassezia spp.	3–8 (yeast forms in tinea versicolor) ≤ 2.0–4.0 (yeast in fungemia or commensal state)	Uniform, except in tinea versicolor wherein slight variability is seen	Yes, in tinea versicolor	Short, curved hyphal elements are present in conjunction with round yeast cells (ie, spaghetti and meatball appearance) in skin scrapings from patients with tinea versicolor. When found in skin or blood smears of fungemic patients, the yeasts exhibit monopolar budding—the buds have a broad base at the point of attachment and a collarette may be seen.
Pneumocystis jirovecii	4–6	Uniform	Absent	Intracystic bodies that resemble parentheses facing one another are pathognomonic and are seen on histological stains. Often cysts are found in clusters. This organism does not bud. In most instances, it is best visualized in histological sections using histochemical stains or in a DFA stain.
Sporothrix schenckii species complex	2–6	Variable; spherical and elongate	Absent	The elongated cells (cigar bodies) are highly suggestive of *S. schenckii*. This infection commonly evokes a pyogranulomatous response. Yeast forms may be difficult to detect in clinical specimens. They are best visualized in histological sections using histochemical stains, in most instances.

CLSI M54-A, Vol. 32, No. 14, 2012

Question 5

- A 22 F gives birth to a 3 kg boy. She did not receive any prenatal care. Screening tests ordered on admission show the following results for the mother:
  - HBsAg +
  - Anti-HBs –
  - Anti-HBc +

What treatment should be given to the baby ?

a) Hepatitis B vaccine
b) Hepatitis B Immune Globulin (HBIG)
c) No therapy at this point. Order Hep B PCR for mother.
d) Hep B vaccine and Hepatitis B Immune Globulin

Answer

d) Hep B vaccine and hepatitis B Immune Globulin

- All infants born to infected mother should be given an IM dose of 0.5ml HBIG as soon as possible after birth in addition to the first of a three dose series of Hepatitis B vaccine

Reference 2 : Canadian Immunization Guide

- Essential document for your exams, your residency and your practice
- http://www.phac-aspc.gc.ca/publicat/cig-gci/index-eng.php
- Five parts :
  - Immunization in Canada (General Information)
  - Vaccine safety
  - **Immunization of adults**
  - Specific vaccines
  - **Passive immunizing agents**

Part 3 Immunization of adults

- Everything you want to know about vaccination in healthy individuals, patients with comorbidities and pregnancy/breastfeeding
- Search by type of vaccine or type of population
- Examples:

Vaccine	Recommendations for risk situations
	• non-immune travellers - 1 dose • non-immune students - consider 1 dose Recommended for early post-exposure management of measles

Meningococcal quadrivalent conjugate	Recommended for adults:
	• with occupational risk for exposure (i.e., laboratory workers and the military)
	• who are travellers for whom meningococcal vaccine is recommended or required, including travellers to sub-Saharan African and pilgrims to the Hajj in Mecca, Saudi Arabia
	• at high risk of meningococcal disease due to medical conditions:
	  ○ anatomic or functional asplenia (including sickle cell disease)
	  ○ congenital complement, properdin, factor D or primary antibody deficiencies
	  ○ acquired complement deficiency due to receipt of the terminal complement inhibitor eculizumab consider use for HIV-infected adults
	• who are close contacts of a case of invasive meningococcal disease caused by a vaccine preventable serogroup
	• for management of an outbreak caused by a vaccine preventable serogroup
	
	Booster doses every 5 years if risk is ongoing

Pneumococcal 23-valent polysaccharide (Pneu-P-23)	Recommended for adults:
	• who are residents of long-term care facilities
	• who are at increased risk of invasive pneumococcal disease (IPD) due to lifestyle factors:
	  ○ persons with alcoholism
	  ○ smokers
	  ○ persons who are homeless
	• who are at high risk of IPD but without immunosuppression. Persons with:
	  ○ asthma requiring regular medical care
	  ○ chronic cerebral spinal fluid (CSF) leak
	  ○ chronic neurologic condition that may impair clearance of oral secretions
	  ○ cochlear implants (including those who are to receive implants)
	  ○ chronic cardiac or pulmonary disease
	  ○ diabetes mellitus
	  ○ chronic kidney disease, including nephrotic syndrome
	  ○ chronic liver disease (including hepatic cirrhosis due to any cause)
	• who are at high risk of IPD AND are immunosuppressed. These persons should receive Pneu-C-13 vaccine followed by Pneu-P-23 vaccine eight weeks later. Persons with:
	  ○ asplenia (functional or anatomic)

PHAC, Canadian Immunization Guide, part 3, 2014

Pregnancy and breastfeeding

VACCINE	USE IN PREGNANCY	USE IN BREASTFEEDING	COMMENTS
INACTIVATED VACCINES			
Cholera and travellers' diarrhea	Use if indicated in high risk situations[1]	Use if indicated	• No data on use during pregnancy or breastfeeding
Hepatitis A	Use if indicated in high risk situations[1]	Use if indicated	• No data on efficacy and safety during pregnancy Hep A vaccine should be considered for pregnant women when potential benefits outweigh risks such as for post-exposure prophylaxis or for travel to high risk endemic area
Hepatitis B	Use if indicated[1]	Use if indicated	• HB vaccine can be used safely in pregnancy and during breastfeeding
Human papillomavirus (HPV)	Currently not recommended	Use if indicated	• Limited data on use during pregnancy and breastfeeding
Influenza (inactivated)	Recommended	Recommended	
Japanese encephalitis	Use if indicated in high risk situations[1]	Use if indicated in high risk situations[1]	• No data on safety or efficacy during pregnancy or breastfeeding
Meningococcal conjugate	Use if indicated[1]	Use if indicated	• No data on use during pregnancy. Should be considered for pregnant women in circumstances such as travel to a high -risk area; post-exposure prophylaxis against a vaccine preventable strain; or during an outbreak. • Refer to *Meningococcal Vaccine* in Part 4 for a listing of high risk conditions.

PHAC, Canadian Immunization Guide, part 3, 2014

Vaccine	Chronic disease								
	Asplenia/ hyposplenia	Renal diseases/ dialysis	Neurologic disorders	Lung disease	Liver disease	Endocrine /metabolic diseases	Heart disease	Chronic inflammatory diseases	Non-malignant hematologic disorders[1]
Inactivated vaccines									
Cholera and travellers' diarrhea	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated
Diphtheria	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use
***Haemophilus influenzae* type b (Hib)**	Recommended for all ages	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use
Hepatitis A	Use if indicated[2]	Use if indicated	Use if indicated	Use if indicated	Recommended	Use if indicated	Use if indicated	Use if indicated	Recommended for hemophiliacs and people receiving repeated infusions of blood or blood products
Hepatitis B	Routine use[2]	Recommended[3]	Routine use	Routine use	Recommended[4]	Routine use	Routine use	Routine use	Recommended for hemophiliacs and people receiving repeated infusions of blood or blood products
HPV	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use	Routine use
Influenza (TIV)	Recommended annually	Recommended annually	Recommended annually[5, 6]	Recommended annually	Routine use	Recommended annually	Recommended annually	Recommended annually if immune suppressed	Recommended annually for people with anemias or hemoglobinopathies
Japanese encephalitis	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated	Use if indicated

PHAC, Canadian Immunization Guide, part 3, 2014

Part 5 Passive immunizing agents

- Only 16 pages
- Read at least one time and keep close

Table 2: Hepatitis B post-exposure prophylaxis, recommendations for use of HBIg

Post-exposure prophylaxis circumstance	Recommendations
Infant born to a mother with acute or chronic hepatitis B infection	• All infants born to infected mothers should be given an IM dose of 0.5 mL HBIg as soon as possible after birth (preferably within 12 hours) in addition to the first of a three dose series of HB vaccine (premature infants weighing less than 2,000 grams at birth require four doses of vaccine). The efficacy of HBIg decreases significantly after 48 hours, but HBIg may be given up to 7 days after birth.
Percutaneous or mucosal exposure to blood or body fluids potentially containing hepatitis B virus	• HBIg should be given to susceptible individuals (based on their immunization and antibody status, and the infectious status, if known, of the source) within 48 hours after exposure[1]. Efficacy of HBIg decreases significantly after 48 hours, but HBIg may be given up to 7 days after exposure. • Dose of HBIg for older infants, children and adults is 0.06 mL/kg of body weight IM.
Sexual contacts of an acute case or chronic carrier of hepatitis B	• A single[1] IM dose of HBIg (0.06 mL/kg of body weight) should be given within 48 hours after exposure. • Efficacy of HBIg decreases significantly after 48 hours, but may be given up to 14 days from the last sexual contact.

[1] If known HB vaccine non-responder, or if HB vaccine contraindicated, give second dose of HBIg 4 weeks after the first dose

PHAC, Canadian Immunization Guide, part 5, 2014

Question 6

- Which of the following is not a criteria to perform CSF examination in a patient with syphilis?

a) Presence of neurologic or ophthalmic symptoms or signs
b) Previously treated patients who fail to achieve an adequate serologic response to treatment
c) Tertiary syphilis
d) Plan to treat with Doxycycline

Answer

d) Plan to treat with Doxycycline

Reference 3 : Canadian Guidelines on Sexually Transmitted Infections

- http://www.phac-aspc.gc.ca/std-mts/sti-its/cgsti-ldcits/index-eng.php
- Everything you need to know about STIs

Question 7

- You receive a call from the ICU staff. He is concerned that one of his patient might have pneumonic plague (trip to southwest USA, dead rodents, fleas…). He is concerned about possible transmission. How should you manage this patient regarding infection prevention?

a) I have no idea
b) Droplet precautions until 48h of appropriate antimicrobial therapy received
c) No need for additional precautions unless patient intubated/bronchoscopy
d) Airborne precautions until 48h of appropriate antimicrobial therapy received

Answer

b) Droplet precautions until 48h of appropriate antimicrobial therapy received

- Hard to remember all this information

Reference 4 : Routine Practices and Additional Precautions for Preventing the transmission of Infection in Healthcare Settings (PHAC)

- Download this file and keep in in your smart phone (especially the tables in Part C)
- You will look smart…
- http://publications.gc.ca/site/eng/440707/publication.html

Microorganism	Clinical presentation	Precautions	Infective material	Route of transmission	Incubation period	Period of communicability	Duration of precautions	Comments
Pertussis (*Bordetella pertussis*, *Bordetella parapertussis*)	Whooping cough, non-specific respiratory tract infection in infants, adolescents and adults	**Droplet**	Respiratory secretions	Large droplets	Average 9–10 days; range 6–20 days	To 3 weeks after onset of paroxysms if not treated	To 3 weeks after onset of paroxysms if not treated; or until 5 days of appropriate antimicrobial therapy received	Close contacts (household and HCWs) may need chemoprophylaxis and/or immunization If HCWs immunization not up to date, refer to OH and/or delegate Refer to Canadian Immunization Guide 7th Ed., 2006 for specific information available at: http://www.phac-aspc.gc.ca/publicat/cig-gci/index-eng.php
Pinworms **See Enterobius**								
Plague (*Yersinia pestis*)	Bubonic (lymphadenitis)	**Routine**	Rodents and their fleas		1–7 days			
	Pneumonic (cough, fever, hemoptysis)	**Droplet**	Respiratory secretions	Large droplets	1–4 days	Until 48 hours of appropriate antimicrobial therapy received	Until 48 hours of appropriate antimicrobial therapy received	Close contacts and exposed HCWs may need prophylaxis

PHAC, Routine practices and additional precautions for preventing the transmission of infection in healthcare settings, 2012

Reference 5: Pathquestions.com

- http://pathquestions.com/
- Free
- 3 new questions / week
- Great for the board exam but I still do the questions each week
- Does not only give answer but also detailed explanation with references / tables
- Example:

Topic: Diagnosis
Difficulty: Moderate

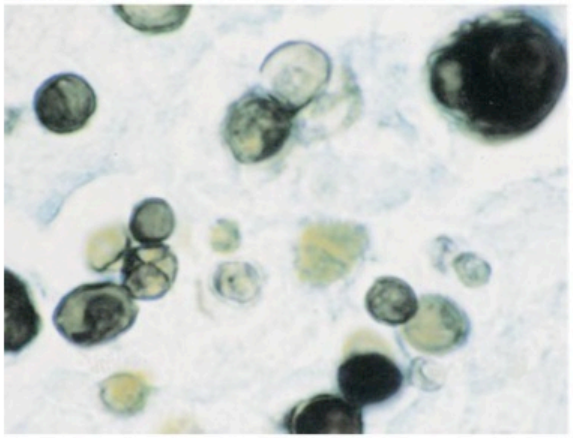
Author: Carey-Ann Burnham

Question Type: Single Best Answer - Please select the single BEST answer choice. 2016-02-19

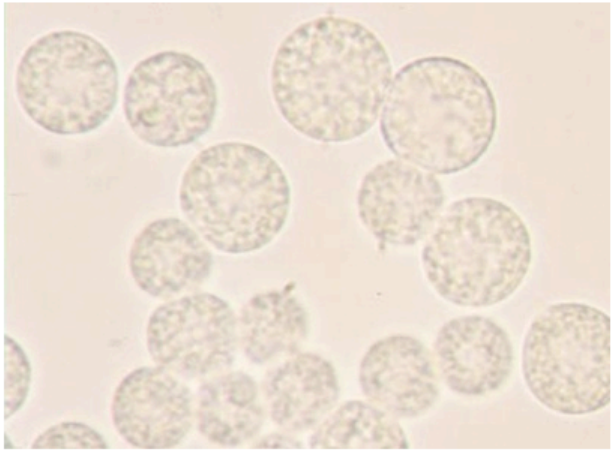
A 42 year old man presents to his physician with elbow pain. He has a past medical history significant for diabetes, hypertension and end-stage renal disease, and received a kidney transplant in 2003. The man works in the Midwest fixing up old houses and thinks he might have injured himself by scraping his arm while performing this work.

He is admitted to the hospital for a left elbow olecranon bursa sac excision, and sent home on antibiotics. However, in a few days the swelling in his elbow returns, and continues to wax and wane for about two months. At that time, he is seen by orthopedic surgery, who takes the man to surgery for a left olecranon bursectomy. Tissue samples were submitted for histopathology and culture.

Findings in the GMS stain were helpful in diagnosing this man's infection (see below).



The organism was also recovered in culture. A wet-mount of the organism growing on solid media is shown below:



What is the etiologic agent of this man's infection?

- A. ***Cyanobacterium* spp.**
- B. ***Prototheca* spp.**
- C. ***Blastomyces* spp.**
- D. ***Coccidioides* spp.**
- E. ***Cryptococcus* spp.**

Submit Answer

Sorry, but that answer is Wrong.
The correct answer(s) are highlighted in green.
Checkmarks indicate correct answer choices and 'X's indicate incorrect choices.

	Answers	Responses
	Cyanobacterium spp.	15 / 368 = 4%
	Prototheca spp.	94 / 368 = 26%
✗	*Blastomyces* spp.	176 / 368 = 48%
	Coccidioides spp.	58 / 368 = 16%
	Cryptococcus spp.	25 / 368 = 7%

Note: Your answer choice has been recorded in the above table. You will not be able to answer this question again. However you can revisit this page at any time to see an updated version of the % Responses.

Explanation:
Prototheca species are an achlorophyllic algae (i.e. they do not have chloroplast, and they have a two-layered rather than a three layered cell wall), but they can cause a mycosis-like infection. Cutaneous protothecosis exhibits similar clinical and histopathologic characteristics to deep tissue mycoses. Infection typically arises secondary to traumatic inoculation into subcutaneous tissue. However, protothecosis is seldom suspected clinically, and therefore patients may be subjected to various treatments for extended periods of time without resolution of illness. A chart is attached from Arch Path Lab Med 2011:135:941 describing some of the key features that can be used to differentiate Protothecosis from other mimics.

Differential Diagnosis of Organisms Causing Soft Tissue Fungal Infections[a]

Fungal Species	Size, μm	Histological Appearance	Clinical Forms	US Geographic Distribution
Prototheca wickerhamii	3–30	Spherical; nonbudding; sporangia with thick, double-layer wall; morula-like appearance; filled with multiple endospores	Achlorophyllic algae	Southeast
Coccidioides immitis	10–200	Spherules vary in size; some contain nonbudding endospores	Spherules, endospores	Southwest
Blastomyces dermatitidis	8–15	Large, double-refractile cells; buds are single, connected by a broad base	Yeast	South-central; Midwest
Paracoccidioides brasiliensis	5–60	Cells have a mariners-wheel appearance (large cells with peripheral buds)	Yeast	Not typical in USA; Central and Latin America
Cryptococcus neoformans	2–15	Cells are spherical to football shaped; polysaccharide capsule	Yeast	West

Protothecosis can be broadly divided into 3 major clinical manifestations. The first is cutaneous lesions; these are typically secondary to traumatic inoculation with an incubation time of several weeks. The lesions are typically ulcerative with purulent discharge and crusting. The lesions typically develop slowly, and remain localized but do not spontaneously resolve.

The second manifestation is olecranon bursitis, which occurs in both immunocompetent and immunocompromised individuals, but is typically a contamination of a wound or injury obtained by grazing the elbow. It is not clear why *Prototheca* has a predilection for olecranon bursa. Symptoms develop over several weeks and include induration, tenderness, erythema and production of serosanguinous fluid.

The third manifestation is disseminated infection, which usually only occurs in immunocompromised individuals, such as cancer patients, solid organ transplants patients, or those with AIDS. Some cases of catheter associated infection have been reported. Recovery of the organism from the blood is common in disseminated infection.

Prototheca spp. grow relatively rapidly, typically maturing on solid medium in approximately 3 days, with optimal growth at 30 degrees C. The colony morphology is typically dull white to cream-colored, with a yeast-like consistency. Microscopically, sporangia of variable sizes can be observed (7-25 um) containing endospores/sporangiospores. No hyphae are produced and the sporangia do not bud.

For treatment of Protothecosis, antifungal agents are most commonly used; these target the *Prototheca* cell wall, which is estimated to be composed of 4% ergosterol. Disseminated and severe infections are usually treated with amphotericin B, and azole agents such as itraconazole and fluconazole are frequently used for more localized infections. It is though that amphotericin B is the most effective agent against *Prototheca* spp.

References/Further Reading:
Todd et al. Med Mycol. 2012 May 9. Protothecosis: report of a case with 20-year follow-up, and review of previously published cases.

Hillesheim and Bahrami. Arch Pathol Lab Med. 2011;135:941–944. Cutaneous Protothecosis.

Zhang et al. Mycopathologia. 2012 Mar;173(2-3):163-71. Cutaneous protothecosis in patient with diabetes mellitus and review of published case reports.

Summary : references I wish I knew about earlier

- « My » CLSI list
- Canadian Immunization guide
  - Part 3 and 5
- Canadian Guidelines on STIs
- Routine Practices and Additional Precautions for Preventing the transmission of Infection in Healthcare Settings (PHAC)
- Pathquestions.com

Part 2 : My tips on preparation for the Royal College exams (I wish I knew earlier)

- Each individual is different
- I hope these few slides will help you prepare for Infectious Diseases and Medical Microbiology boards (and more)

Tip #1

- Keep the references I shared with you in a nice central file on your computer
  - I think at least 50% of the answers are in these documents
- Download the most recent IDSA guidelines
- Always look for a Canadian guideline first

Question 8

- You are called by OBGYN regarding the potential exposition of a 20 weeks pregnant woman to varicella. Two days ago, she spent a few hours at her sister's house for a birthday party. Yesterday, she got a call from her sister: her 3-year-old son had fever and multiple vesicular skin lesions and was diagnosed with presumed **varicella**. The pregnant woman was born in Columbia and she doesn't recall any history of varicella. A varicella IgG serology was ordered but you won't get any result for at least 4 days. What is your suggestion to OBGYN?

Question 8

a) Do nothing. The exposition wasn't significant
b) Vaccinate the patient for varicella
c) Give varicella zoster immune globulin (VarIg)
d) Start Valacyclovir immunoprophylaxis now

Answer

c) Give varicella zoster immune globulin (VarIg)

- Source : Canadian Immunization Guide part 5

Tip #2

- I suggest that you take the time to create summary tables on some high yield topics
  - Post exposure prophylaxis to classic pathogens and infection prevention
  - Infections in pregnancy
  - Expositions to high risk pathogens in the lab
- These tables will be very useful during your practice as well

Disease	When is source contagious ?	Significant exposition ?	Max delay for intervention after contact with source	Who is immune ?	What to give ?
Measles	4 days pre rash to 4 days post rash (or total duration of disease if immunocompromised) Incubation 7-21 days	Household Daycare / same class Same room without protection	Vaccination : 3 days Ig : 6 days	Born before 1970 (except HCW, military, college) Proof of vaccination Proof of disease Positive serology	Vaccination if no contra-indication Ig for high risk : Pregnancy Immunocompromised HIV-HSCT Not high-risk but more than 3 days after contact
Neisseria meningitidis infection (meningitis, pneumonia, conjunctivitis)	7 days pre-symptoms to 24h post effective treatment	Household Shared same bed All saliva exchange (cigarette, cutlery) Daycare Sitting next to a case in an airplane for more than 8h HCW only if extensive contact without PPE (eg intubation)	Chemoprophylaxis : the sooner the better but 10 days to give after contact Vaccination : When serotype available		Chemoprophylaxis : Ciprofloxacin 500mg x 1 OR Rifampin 600mg BID x 2 days Ceftriaxone 250mg IM x 1 dose (pregnancy) Vaccination : Vaccinate with appropriate vaccine if more than 1 year since last dose (earlier if less than 1 year or risk factors)

Post exposure prophylaxis/intervention

- My post exposure prophylaxis table includes the following :
  - Hepatitis A & B
  - Herpes B
  - Rabies
  - Measles
  - Varicella
  - Rubella
  - Mumps virus
  - *Neisseria meningitidis*
  - *Heamophilus influenzae* type B
  - Group A strep
  - Diphtheria
  - Pertussis

Infection in pregnancy

- You want to have your algorithm / table ready for the infections in pregnancy :
  - STDs (Syphilis)
  - HIV
  - HSV
  - Hepatitis B
  - Varicella
  - Parvovirus B19
  - CMV
  - Toxoplasmosis

Question 9

- A *Brucella* spp. is grown from a synovial fluid sent without any clinical information. A gram stain, a catalase and an oxidase test were performed on the open bench during the weekend by the same technician. What intervention(s) do you recommend for this technician?

Question 9

a) Doxycycline + Rifampin for 3 weeks (if no CI)
b) Sequential serologic testing at 0, 6, 12, 18 and 24 weeks post exposure
c) Symptom watch and daily self fever check for 24 weeks
d) All of the above
e) No intervention necessary because only low risk exposure

Question 9

- Answer: d) all of the above
  - Source: CDC guidelines (http://www.cdc.gov/brucellosis/laboratories/risk-level.html)

High risk expositions in the lab (ID & Med Micro)

- I suggest you create a table for the pathogens that have relatively clear recommendations:
  - *Brucella* spp. (CDC)
  - *Burkholderia mallei / pseudomallei* (CDC & MMWR)
  - *Coccidioides* spp. (CID 2009)
  - *Neisseria meningitidis* (NACI & CDC)
  - *Mycobacterium tuberculosis* (Canadian TB standards)

Agent	Significant exposition	Post-exposure prophylaxis	Medical follow-up (high and low-risk)
Brucella spp.	High Risk : Person performing activity and any person within 5 ft. without using BSL-3 precautions or all persons present in the laboratory room if occurrence of widespread aerosol generating procedures. Low Risk : All persons present in laboratory room at distance greater than 5 ft. from activity	High-risk exposition : Chemoprophylaxis for 21 days (Doxycycline + Rifampin) Low risk exposition : No chemoprophylaxis (discuss with HCW) but consider if pregnant or immunocompromised	Follow for 6 months Symptom watch and daily self fever check for 24 weeks Serology at 0,6,12,18,24 weeks (if not B. canis)

Tip #3

- Review hot (but not too hot) topics
- I would probably spend a few minutes on Zika virus this year

Summary of part 2 (preparation for Royal College)

- Keep the references I shared with you in part 1 & the major guidelines in a nice central file on your computer
- Take the time to create your own tables for frequent/high yield topics
  - Post-exposure prophylaxis
  - Infections in pregnancy
  - Expositions in the lab
- Review hot (but not too hot) topics

Last question

- You receive an unusual call at 3:00 am. A 28 male suffered severe injuries after hitting a moose with his car. The antler of the animal perforated his pericardium. The ICU staff wants to know if he should give any antibiotic (what and for how long). What would you recommend?

a) No antibiotic
b) Piperacillin-tazobactam for 48h
c) Meropenem for 72h
d) Something else?

Answer

- I don’t know !
- One thing I learned is that our specialities (ID & Med Micro) allow us to take the time to look at the literature / ask colleagues
- There is absolutely no shame in saying : “I don’t know but I will find out”
- Sometimes there is no real good answer and you just have to improvise
  - Fun part of our speciality

My key messages on getting the most out of residency

- There is so many factual data in ID / Med Micro
- Download the core references and have them easily accessible
- Take the time to create tables / figures for frequent problem
  - They will be very useful during residency, for your exams, and for your practice
- Do not hesitate to say « I am not sure but I will find out »

Thank You !