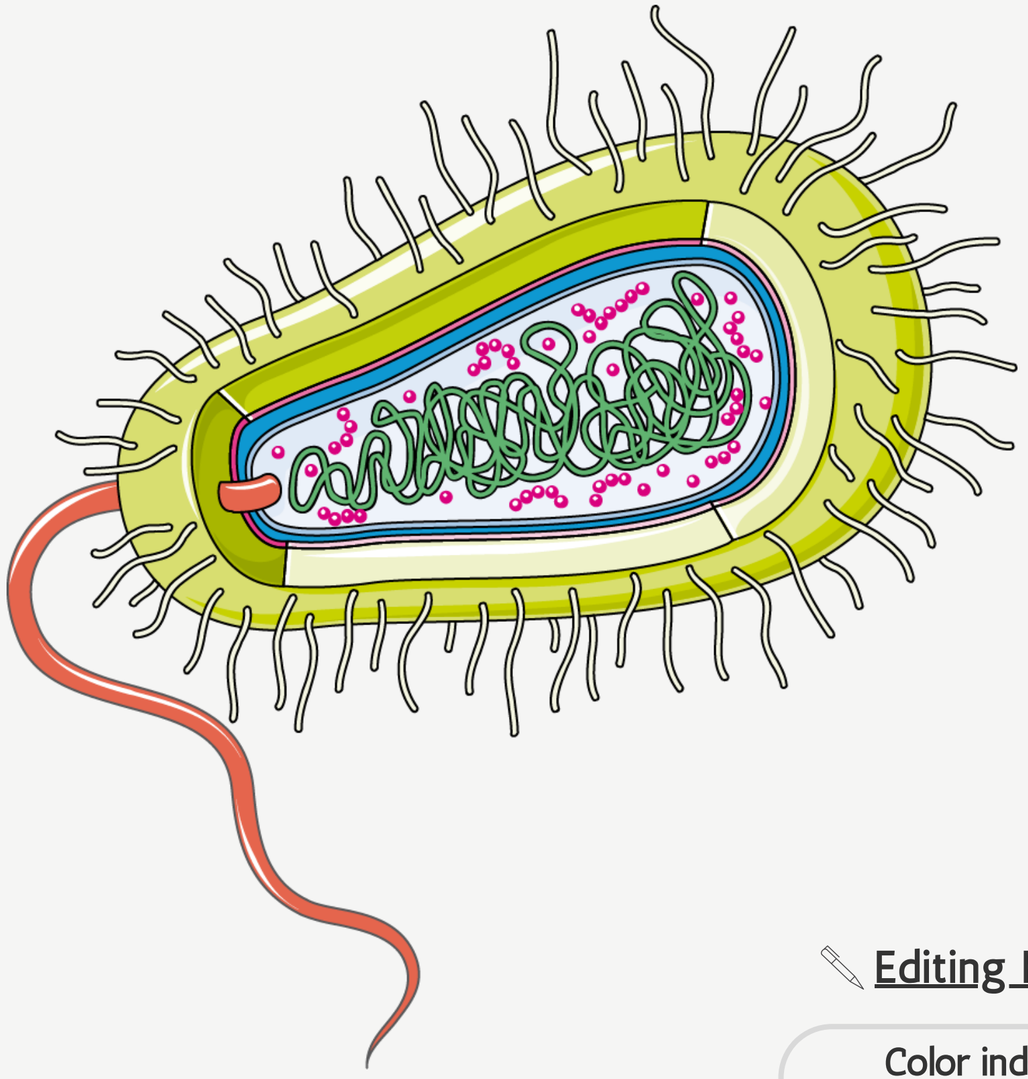
BACTERIA
CAUSING UPPER RESPIRATORY INFECTION

Lecture no.1



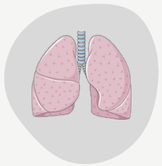
Editing File

Color index:

Main text	Girls' slides
Important	Boys' slides
Dr. notes	Extra

(اللَّهُمَّ انْفَعْنِي بِمَا عَلَّمْتَنِي، وَعَلِّمْنِي مَا يَنْفَعُنِي، وَزِدْنِي عِلْمًا)

OBJECTIVES



Discuss the epidemiology and various clinical presentations of URTIs

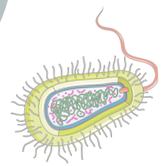
Identify the most important etiological agents causing different URTIs, and discuss their virulence factors, laboratory diagnosis and potential preventative strategies

Determine the antibiotic of choice for the different URTIs

ضروري نتذكر محاضرة Gram + / - لانها بتكون معنا في البلوك هذا والبلوكات القادمة

Click for Gram + / - Lecture

Discuss complications of GAS and C.diphtheria infections.



BACTERIA (IN THIS LECTURE)

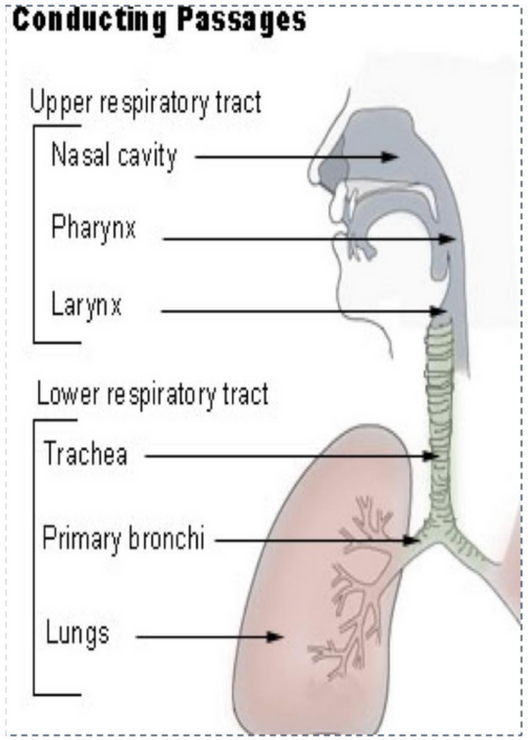
Gram -Ve Bacteria

- Bacilli
  - Fastidious
    - -Bordetella pertussis -
    - Haemophilus influenzae
    - -Campylobacter jejuni -
    - Helicobacter pylori -
    - Legionella pneumophila
  - Aerobic
    - Sugar Fermentation
      - (−) Oxidaze
        - (−) Ex. Acinetobacter
        - (+) Ex. Pseudomonas
      - (+) Oxidaze -
        - main Ex.
        - -E. coli
        - -Salmonella
        - -Shigella
        - -Yersinia and Klebsiella pneumoniae
        - -Proteus
  - Anaerobic
    - -Bacteroides fragilis
    - -Fusobacterium
- Comma Shaped
  - Oxidase Positive + Fermentative
    - Vibrio Cholera
- Cocci
  - Aerobic
    - Gram -ve Cocci in pairs
    - Neisseria and Moraxella
  - Anaerobic
    - Gram -ve Cocci
    - Veillonella (Rare)

Gram +ve Bacteria

- Bacilli
  - Anaerobic
    - spore forming
      - Ex. Clostridia)
        - Clostridium Tetani
        - Clostridium Perfringens
        - Clostridium Botulinum
    - Non-spore forming
      - Ex. Eubacterium
  - Aerobic
    - spore forming
      - Nocardia, Latobacillus, Bacillus anthracis
        - Bacillus anthracis
    - Non-spore forming
      - Listeria
      - Corynebacterium
        - Ex. Corynebacterium diphtheriae
- Cocci
  - Aerobic/ facultative anaerobes
    - Catalase
      - (−) In chains or pairs
        - Streptococcus
          - Hemolysis test
            - α
              - Ex. Streptococcus pneumoniae
              - Ex. Streptococcus viridans
            - β
              - Group A
                - Streptococcus pyogenes
              - Group B
            - γ
              - Enterococcus
      - (+) In clusters
        - Staphylococcus
          - Coagulase
            - (−) Staphylococcus epidermidis, Staphylococcus saprophiticus
            - (+) Ex. Staphylococcus aureus
  - Anaerobic
    - In chains
      - Ex. Peptostreptococcus

LECTURE OUTLINE



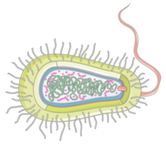
Bacterial Upper Respiratory Tract Infections

- Otitis Media
- Deep neck space infections
- Epiglottitis
  Haemophilus type B-
- Sinusitis
- Pertussis (Whooping cough)
  Bordetella Pertussis-
- Pharyngitis
  -GAS
  -Diphtheria

PHARYNGITIS

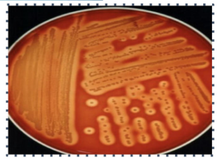
Helpful Video

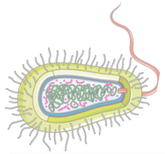
Epidemiology	❖Late fall, winter, early spring ❖ 5 - 15 years
Etiology	❖Viruses (i.e. respiratory viruses) are the most common cause. (70-80% in children, 80-90% in adults). ❖ Bacteria causes: (20-30% in children, 10-20% in adults) 1. Streptococcus pyogenes is the most important bacterial cause. (Group A streptococcus) 2.Corynebacterium diphtheriae Important but not common anymore, because of the vaccinations. 3.Fusobacterium Necrophorum: anaerobic -causes Lemierre's syndrome. 4.Neisseria gonorrhoeae. Homosexual people are the most likely to be infected by this bacteria.
Sign and Symptoms	Common symptoms: ❑Sore Throat (أهم عرض). ❑ Pharyngeal erythema. احمرار في الجلد and edema ❑ Fever
	❖ More consistent with viral: All of them begin with C -Coryza (running nose) -Cough Conjunctivitis التهاب في العين
	More consistent with bacterial (GAS): still we should do test -Tonsillar exudates (pus production on tonsils) -Tender and enlarged (>1 cm) lymph nodes -Fever 38.4 to 39.4 C -GAS pharyngitis may present with scarlatiniform rash, described as sandpaper-like



GAS-PHARYNGITIS

Helpful Video

Morphology	❖ Gram positive cocci in chains. ❖Facultative anaerobe. ❖ Beta haemolytic. ❖Catalase negative. 
Virulence Factors	❖Capsule (protection from phagocytosis) ❖M protein in cell wall (help in attachment) ❖Streptolysin O & S (toxic to cells) ❖Streptococcal Pyrogenic Exotoxins (SPE)
Causes	❖ Respiratory infections: -Pharyngitis -Otitis - Sinusitis ❖ Other: Skin and soft tissue infections   
Diagnosis	❖ 1-Throat swab نفس حق كورونا بس بالفم مو بالخشم - Rapid Bacterial antigen detection Specific but not always sensitive - 3 mins - Culture on blood agar Gold standard but takes time - 18 hrs ❖ 2. Antistreptolysin O - Determines whether a patient had a recent infection with GAS (patient is having an infection prior to 5 days & not expecting to find it anymore).



GAS-PHARYNGITIS CONT..

Treatment

❖Penicillin for 10 days **(drug of choice)**
.If the patient is allergic to penicillin: we use Clindamycin or **macrolide** (e.g.clarithromycin)

Complications

443: Dr :What is the importance of treatment? 1- decrease risk of suppurative

2- decrease duration of treatment

3- decrease reactivity

4- decrease risk of Rheumatic fever

❖Suppurative: (pus forming, with the infection. related to the pathogen)
-Peritonsillar abscess.
-Parapharyngeal space abscess

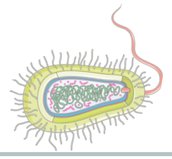
❖ Non suppurative: (more serious, related to the immune system -after the infection-) Occurs 1-6 weeks after acute S.pyogenes infection

1) Rheumatic fever (you can prevent this complication in early stage with good treatment)
- Inflammation of heart (pancarditis), joints, blood vessels, & subcutaneous tissue.
- After the infection of respiratory tract only.
- **Cause**: cross reactivity of **anti-M protein** Ab and the human heart tissue.

M protein in cell wall of bacteria is similar to that of heart's tissue
Rheumatic fever فعشان كذا ممكن يتأثر ويسبب

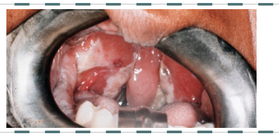
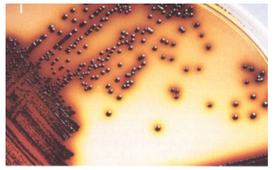
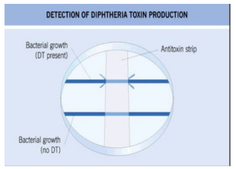
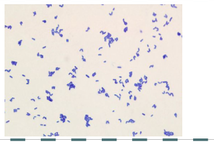
2) Acute Glomerulonephritis (no matter if you treat the patient early or not, still this complication may occur)
After infection of the skin or respiratory tract.
- Symptoms: edema - hypertension - hematuria - proteinuria.
- Cause: Ag-Ab complexes on the glomerular basement membrane (in kidney, with time will cause inflammation.)

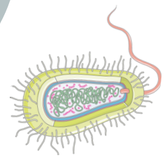
443 Dr note: DON'T write GAS in exam you should write Group A Streptococcus.



DIPHTHERIA - PHARYNGITIS

Helpful Video

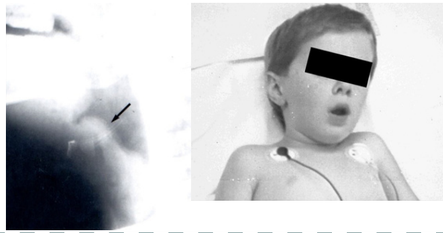
Morphology	❖ Corynebacterium diphtheriae **Gram positive bacilli.** 
Overview It has the same symptoms of GAS fever, sore throat	❖What is the bacteria cause this infection? Corynebacterium diphtheriae. ❖Rare in developed countries, because it is prevented by vaccine. ❖Mainly Presented as Upper respiratory tract infection. ❖Characterized by: formation of **pseudomembranes** (key word) in pharynx/throat. (grey thick membranes) ❖Diphtheria usually manifests as pharyngitis (can be severe -~› breath difficulties)
virulence	Diphtheria toxin.
Diagnosis	❖Throat swab ❖Culture on special media (e.g Tinsdale media) ❖ELEK's test to confirm the toxin production  
Treatment	❖Antitoxin 443:(more important) AND antibiotics (Penicillin or erythromycin) 
complications	❖ Myocarditis. ❖ Neuritis. ❖It might cause mortality because of heart failure.
prevention	❖ Vaccination with diphtheria toxoid containing vaccine (inactivated toxin)

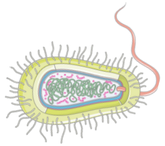


EPIGLOTTITIS

لسان المزمار

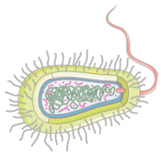
Helpful Video

Overview	Usually affect young unimmunized children. It's rare and we can't see it anymore because of what? Vaccination
Sign & symptoms	❖ dysphagia. ❖ Drooling ❖ Respiratory distress ❖ Effects on Breathing and swallowing 
Etiology	❖ **Haemophilus Influenzae Type** B ❖ S. pneumonia ❖ S. aureus ❖ Beta hemolytic streptococci
Diagnosis	❖ Blood cultures ❖ Culture of epiglottic (under controlled setting)
Managment Empiric treatment:means the treatment of the disease and the predictable cause without actually knowing the specific bacteria	1) Maintenance of airway This infection must be treated as a medical emergency, with primary emphasis on maintenance of an airway (tracheostomy or endotracheal intubation) and antimicrobial therapy. Management Clinical maneuvers such as direct examination or attempting to take a throat swab may trigger Treatment acute obstruction and fatal laryngospasm. 2)Empiric treatment: Ceftriaxone + Vancomycin if we know that the bacteria is H.influenzae we only use ceftriaxone
Prevention	Hib vaccination (Hemophilus influenza tybe B)



HAEMOPHILUS INFLUENZAE

Morphology	❖ Gram negative pleomorphic, coccoid to rod-shaped cells (coccobacilli) ❖ Oxidase and catalase positive ❖ **Requires X (heme) and V (NAD) factors for growth ,Used to confirm ID** ❖ **Grow only in chocolate agar (Hint)**	
Types	**Encapsulated (typable) Strains**	**Non encapsulated (nontypable) Strains**
Causes	Causes invasive disease (more severe infections): • Epiglottis • Meningitis	Causes local infections (less severe infections): • Sinusitis • Otitis • Pneumonia in elderly
Virulence	• Capsule is the main virulence factor • A-F, Most important is **type B**	-
Prevention	Vaccine (so it's very rare now)	-
Treatment	• **Amoxicillin-Clavulanate (beta lactamase inhibitor)** • **2nd (as Cefuroxime) or 3rd (as Ceftriaxone) generation Cephalosporin (you should know some examples)**	



PERTUSSIS (WHOOPING COUGH)

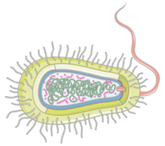
السعال الديكي

Helpful Video

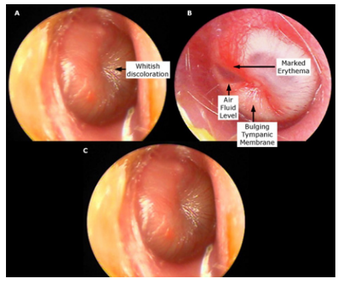
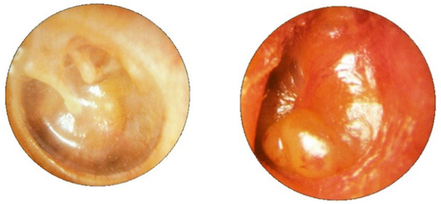
Etiology	Virulence	Stages of pertussis	Diagnosis	Treatment	Prevention
Bordetella pertussis (GNB) gram negative Bacilli	• Pertussis toxin (main one) • Filamentous hemagglutinin • Pertactin	Incubation period 1 to 3 weeks Stages of 1- Catarrhal Stage 1-2 weeks 2- Paroxysmal Stage 2-4 weeks. 3- Convalescent Stage 1-2 weeks . ثلاث مراحل تبدا اعراض خفيفة بعدين تزيد وثم ترجع تخف.	• Sample of: Nasopharyngeal (NP) swabs. تكون مسحة):443 من الخشم من الخلف). • Special media needed: - Charcoal blood (Regan-Lowe) - Bordet-Gengou	**Macrolide (erythromycin).**	By vaccination, Acellular pertussis-containing vaccine. مهم للحوامل لحماية الطفل.

مشكلة المرض في الأطفال اكثر شي تسبب مشكلة في التنفس قد تؤدي إلى الوفاة.

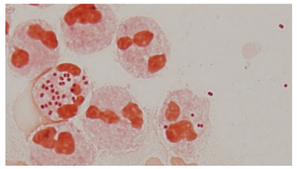
Hint symptom: severe cough

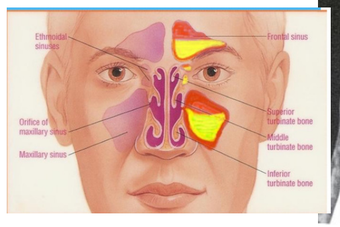


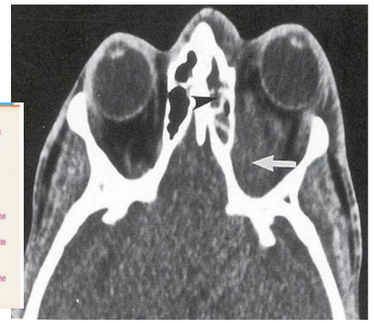
ACUTE OTITIS MEDIA

Overview	Etiology	Diagnosis	Treatment
• Fluid accumulation + inflammation of the mucosal lining of the middle ear —> (Hint) • More common in children. • 443: It cause fever 	1- S. Pneumoniae 2 - H. influenzae (Non typable) 3- S. aureus 4- Moraxella catarrhalis 5- GAS 6- Viral (alone or with bacteria) Starts as a viral infection then becomes bacterial. 	• Mainly clinical diagnosis. • Tympanocentesis sometimes needed The drum is bulging so we need to drain it to take a sample & relieve the patient. • Middle ear fluid can be sent for culture.	• Amoxicillin or Amoxicillin Clavulanic acid.

MORAXELLA CATARRHALIS

Morphology	• Gram negative diplococci. • Catalase and oxidase positive.
Infections (Causes)	❖ **Otitis** ❖ **Sinusitis** ❖ **Pneumonia** 
Treatment	Amoxicillin + Clavulanic acid

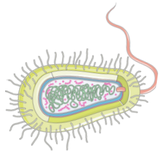




ACUTE BACTERIAL SINUSITIS

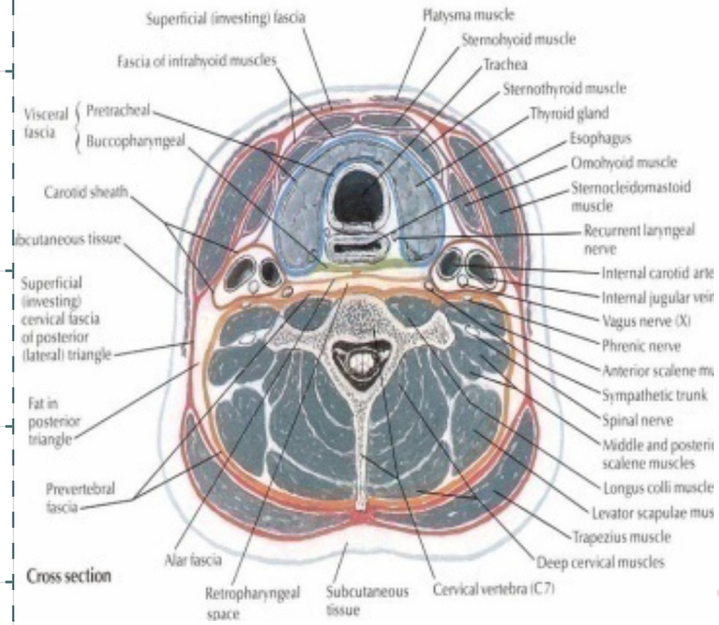
Same causes of Acute otitis

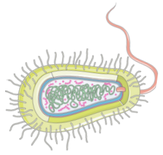
Overview	• More common in children. • Occurs with viral URTI Start as viral infection then become bacterial.
Etiology	1- S. Pneumoniae 2- H. influenzae (Non typable) 3- Moraxella catarrhalis 4- Anaerobes 5- Viral
Diagnosis	Mainly clinical diagnosis. Imaging (CT/MRI) when there is suspension of complications. (لان المرض خطير ممكن يروح للعين او المخ لان مكانها قريب لهم)
Treatment	Amoxicillin Clavulanic acid For 1-2 weeks.



DEEP NECK SPACE INFECTIONS

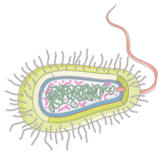
Overview	443: ❖ Rare but serious. ❖ Could be a complication of GAS. ❖ Lateral pharyngeal, retropharyngeal or prevertebral space.
Signs & Symptoms	❖ Patient is very sick and toxic. ❖ **Neck stiffness** can occur with retropharyngeal space infection/abscess.
Etiology	Usually polymicrobial. Mainly streptococci + oral anaerobes.
Complications	Retropharyngeal (danger space) infection may extend to mediastinum and present as **mediastinitis.**
Management	• Surgery. • **Antibiotics:** - meropenem - piperacillin - clindamycin **Duration:** 2-3 weeks.





KEYWORDS

word	definition
Pharyngitis	Sore throat - Fever
Diphtheria	Pseudomembrane formation
Epiglottitis	dysphagia - Respiratory distress
Otitis Media	Ear pain - bulging tympanic membranes
Pertussis	Severe prolonged cough - Symptoms occur in phases



SUMMARY

big thanks to doctors 439.

Infection	Etiology	Symptoms	Diagnosis	Treatment	Notes
GAS Pharyngitis	GAS	- Sore throat - Tonsillar exudates - Enlarged lymph nodes - Fever	1- Throat swab (then culture/antigen detection) 2- Antistreptolysin O	Penicillin for 10 days	Complications: 1- Suppurative 2- Non-Suppurative: Rheumatic fever & Acute Glomerulonephritis
Diphtheria	Corynebacterium diphtheriae	- pseudomembranes - breath difficulties	1- Throat swab (Tinsdale media) 2- EIEK's test	Antitoxin + antibiotics (Penicillin or Erythromycin)	- Complications: Myocarditis & Neuritis - Virulence factor: Diphtheria toxin - Prevention by vaccination
Epiglottitis	Haemophilus Influenzae Type B	- Dysphagia - Drooling - Respiratory distress	Blood culture (chocolate agar)	Empiric treatment	- Maintenance of airway is necessary - Usually affect young unimmunized children. - Prevention: HiB vaccination
Pertussis	Bordetella pertussis	Intense cough	nasopharyngeal swabs (special media)	Macrolide (erythromycin)	- Virulence factor: Pertussis toxin - Prevention by vaccination
Acute Otitis Media	- S. Pneumoniae - H. Influenzae -Moraxella catarrhalis - Viruses	Fluid & inflammation of the middle ear	- clinical (Tympanocentesis) - Sample of middle ear fluid	Amoxicillin-Clavulanic acid	More common in children
Acute Bacterial Sinusitis		-	Imaging (CT/MRI)		

Q1:B
Q2:A
Q3:D

MCQs:

Q1/ A patient was diagnosed by antistreptolysin o, what type of infection does he have?

A	Diphtheria	B	GAS pharyngitis	C	Epiglottis	D	Pertussis

Q2/ Treatment of epiglottis?

A	Empiric treatment	B	penicillin	C	Amoxicillin	D	Erythromycin

Q3/What infection is characterised by the formation of pseudomembranes?

A	Epiglottis	B	Haemophilus influenzae	C	Pertussis	D	Diphtheria

Q4: A
Q5: B
Q6: C

MCQs:

Q4/ The most common cause of pharyngitis is:

A	Viral	B	Immunological	C	Bacterial	D	Fungal

Q5/ Non supportive complication of GAS occurs after infection of respiratory tract only:

A	Acute glomerulonephritis	B	Rheumatic fever	C	Parapharyngeal space abscess	D	Peritonsillar abscess

Q6/ Bacterial infection, the unimmunized child presented with dysphagia, drooling, respiratory distress:

A	Pharyngitis	B	Pertussis	C	Epiglottitis	D	Otitis media

Q7: B
Q8: D
Q9: A

MCQs:

Big thanks to 442.

Q7/ Type of bacteria that cannot grow in regular aggars, it needs specific growth factors (it is fastidious):

A	GAS	B	Haemophilus influenzae	C	Strept. Pneumonia	D	Staph aureus

Q8/ Which of the following can't be prevented by vaccine?

A	Diphtheria	B	Pertussis	C	Epiglottitis	D	sinusitis

Q9/ Which of the following Tonsillar exudates is usually associated with?

A	Pharyngitis	B	Pertussis	C	Epiglottitis	D	Otitis media

SAQs:

Q1/ A pediatric patient with severe prolonged cough, symptoms occur in phases, started by runny nose and cough, now he have sever cough, it comes in phases with 10-15 cough and sometimes he vomits after it.

a) What is the most likely clinical condition? Pertussis (whooping cough)
b) What is the most likely causative bacteria? Bordetella pertussis **c) what is the most important virulence factor?** Pertussis toxin
d) How do we prevent it? By Vaccination **e) How do we treat it?** Macrolide (erythromycin)

Q2/ A patient have Pharyngitis and unvaccinated traveled from India with his parents, so he is a pediatric patient. he came with a fever and sore throat. examination showed pseudomembrane.

a) What is the most likely clinical condition? Diphtheria **b) What is the causative organism?** Corynebacterium diphtheriae
c) what is the most main virulence factor and the complications it cause? Diphtheria toxin, Myocarditis & Neuritis.
d) How is it diagnosed? Throat swab & culture on tinsdale media **e) How do we treat it?** Antitoxin+penicillin or erythromycin

Q3/ A patient with fever and sore throat. culture showed beta hemolytic colonies on blood agar plate

a) what is the most likely organism? streptococcus pyogenes
b) what its complication?
1- Suppurative: Peritonsillar &Parapharyngeal space abscesses. 2- Non suppurative: Rheumatic fever & Acute Glomerulonephritis.

SAQs:

Q4/ A patient with fever and ear pain. on exam showed bulging erythematic tympanic membrane. what is the diagnosis? what the most likely organism for each gram stains below?

a) diagnosis? otitis media
b) gram negative diplococci? Moraxella catarrhalis c) gram positive diplococci? streptococcus Pneumoniae
d) gram negative coccobacilli, fastidious? Haemophilus Influenzae e) what is the treatment? Amoxicillin Clavulanic acid.

Q5/ A patient came with dysphagia, fever, and respiratory distress. blood culture taken showed gram negative coccobacilli.

a) What is the most likely clinical condition? Epiglottitis
b) What is the causative organism? Haemophilus Influenzae
c) what is the best treatment? Ceftriaxone

SAQs:

Big thanks to 443.

Q6/ A 6 year old unvaccinated patient that has recently arrived from India has fever, sore throat, and formation of pseudomembranes on the throat.

a) What is the most likely diagnosis? Diphtheria b) What is the causative organism? Corynebacterium diphtheriae c) Treatment? Antitoxin+penicillin or erythromycin
d) What is the main virulence factor? Diphtheria toxin e) Name of the toxic? Diphtheria toxoid f) How is it diagnosed? Throat swab & culture on tinsdale media
g) What are 2 potential complications? Myocarditis & Neuritis

Q7/ Mother with her baby 6-months years old was seen in the ER, with severe cough started by runny nose, then cough that got worse and after a week the baby still coughing, then lead to vomiting. What is the most likely diagnosis and organism?

Pertussis, Bordetella pertussis

Q8/ Patient come with Ear pain and fever on examination of (Bulging Tympanic membrane) what is the most likely diagnosis?

Acute otitis Medias

SAQs:

Big thanks to 443.

Q9 / patient comes with fever and sore throat, culture is taking and shows beta hemolytic colonies, gram + cocci in chain.

a) what is the clinical diagnosis? Pharyngitis
b) what is the causative organism? Streptococcus pyogenes c) potential complications? Rheumatic fever
d) treatment? Penicillin

Q10 / 5 years old patient unvaccinated went ER with acute dysphagia , fever and respiratory distress.

a) what is the clinical diagnosis? Epiglottitis
b) How to manage the condition? Maintaining airway empiric treatment
c) treatment? Empiric treatment: Ceftriaxone + Vancomycin

Q11 / 3-months old went to ER with severe prolonged cough , runny nose , continuous cough.

a) what is the diagnosis? Pertussis (whooping cough)
b) What is the most likely bacterial cause? Bordetella pertussis
c) What is virulence/pathogenesis? Pertussis toxin
d) treatment? Macrolide (erythromycin)
e) How to prevent it? Vaccination –> acellular pertussis-containing vaccine

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