PURULENT MENINGITIS

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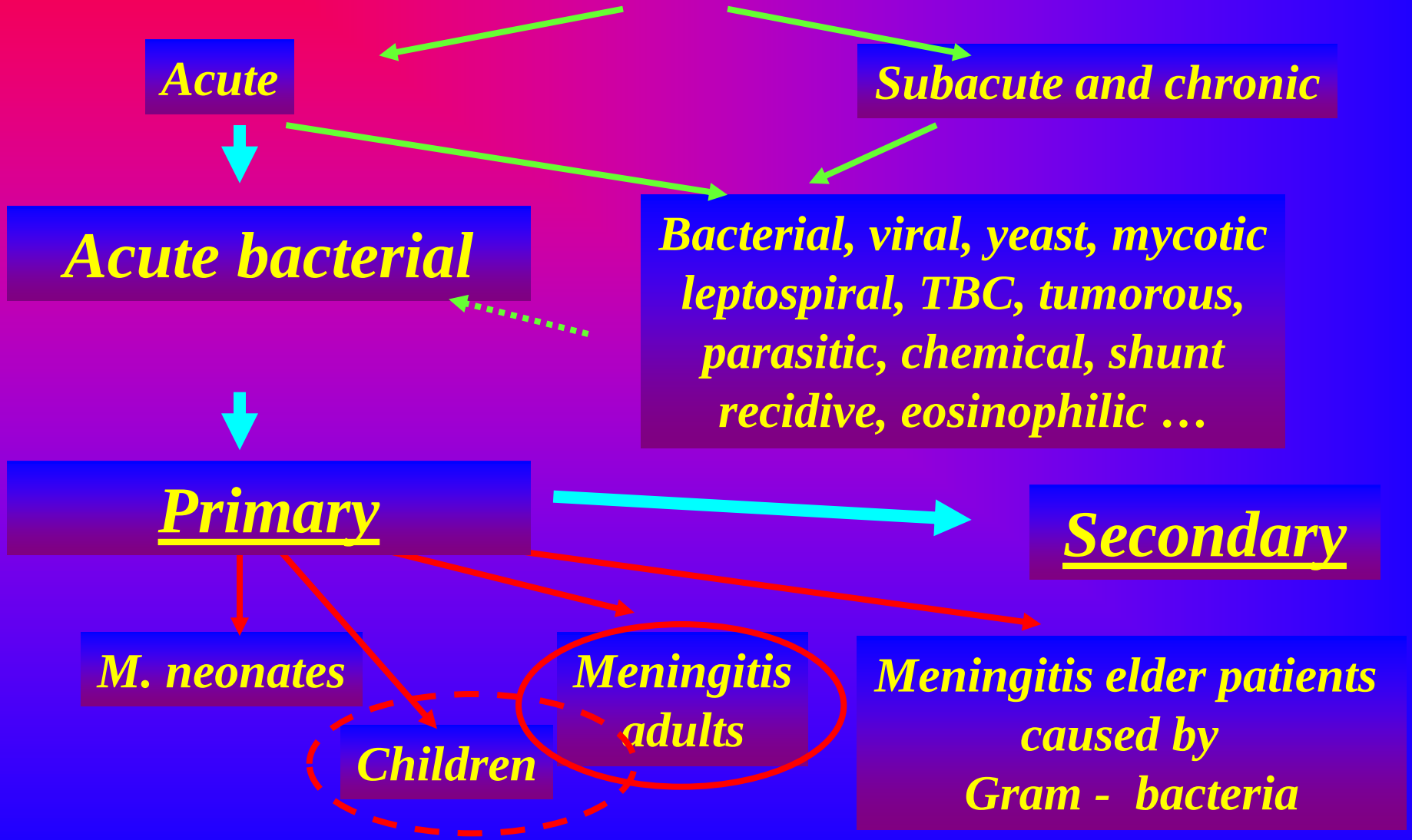
MENINGITIS


Acute
Subacute and chronic
Acute bacterial
Bacterial, viral, yeast, mycotic leptospiral, TBC, tumorous, parasitic, chemical, shunt recidive, eosinophilic …
Primary
Secondary
M. neonates
Children
Meningitis adults
Meningitis elder patients caused by Gram - bacteria

MENINGITIS

Acute bacterial – PRIMARY

Children meningitis

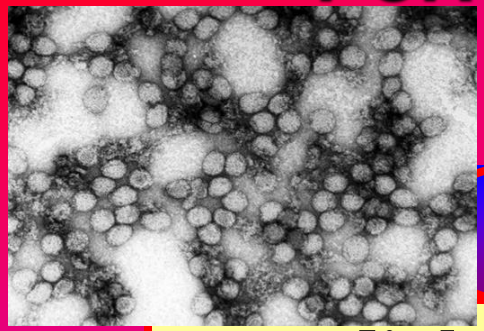
Neiseria meningitidis
Diplococcus pneumoniae
((Haemophilus infuenzae))

Meningitis of adults

Diplococcus pneumoniae
Neiseria meningitidis

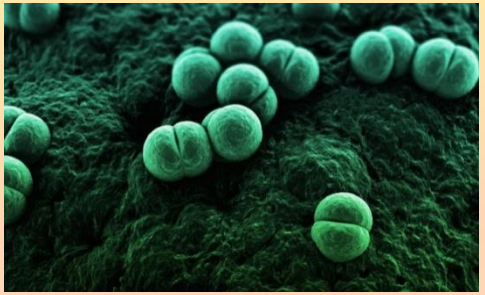
age	Incidence/100 000	Lethality/100 000
neonates	37,2	10,1
1 month -1 year	115,5	11,5
1 – 5 years	28,5	1,0
5 – 16 years	2,8	0,4

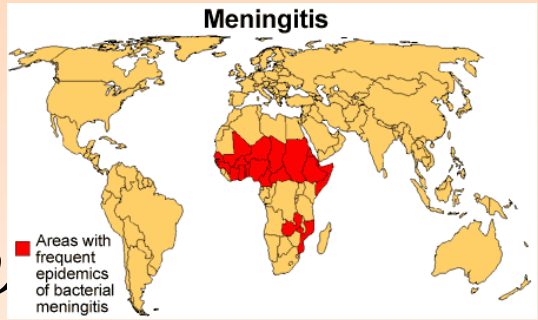
PURULENT MENINGITIS PRIMARY ETIOLOGY



Neiseria meningitidis

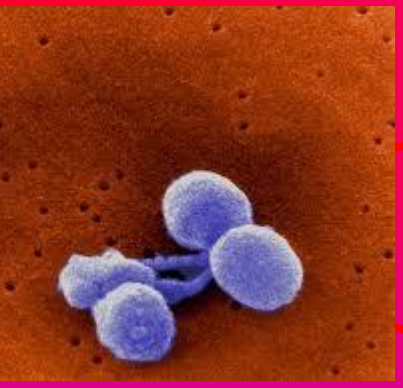
- ***G- diplococcus** – intracelullar, types A,B,C a Y, W 135; 95% of infections*
- ***Population is infected from early childhood***
- ***Epidemics in:***
  - *1) collectives of young people,*
  - *2) Mekka,*
  - *3) Western Africa,*
  - *4) Eastern South America*
- ***Sporadic diseases***
- ***Asymptomatic infection - (5-15%)***



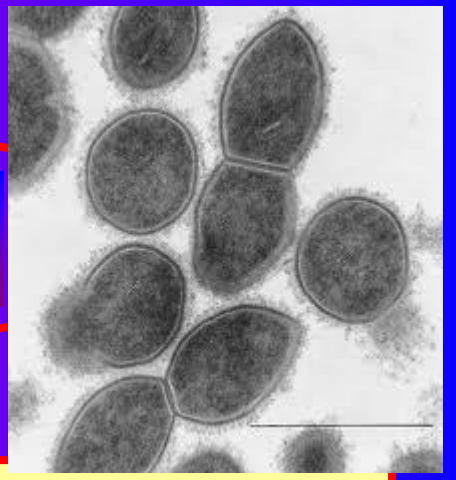


http://reference.medscape.com/features/slideshow/rash-fever&docid=uhJJFn/

PURULENT MENINGITIS PRIMARY ETIOLOGY

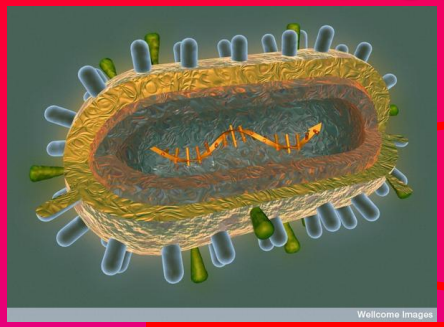


Streptococus pneumoniae

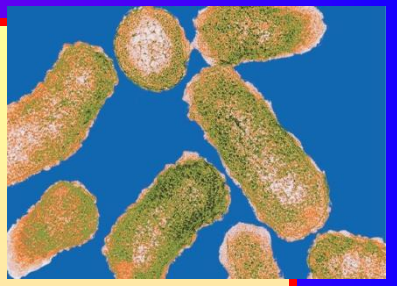


- *G+ diplococcus*
- *Common in upper respiratory tract and the most frequent pathogen of pur.*
  - *½ of midear inflammation, pneumonias,*
- *On mucosa of URT from neonate period*
- *80 serotypes (most frequent 3; 19f; 14 …), capsular polysacharide is factor pathogenicity*
- *serotype isolated from mucosa URT has not to be the cause of the meningitis*

PURULENT MENINGITIS PRIMARY ETIOLOGY



Hemophilus influenzae

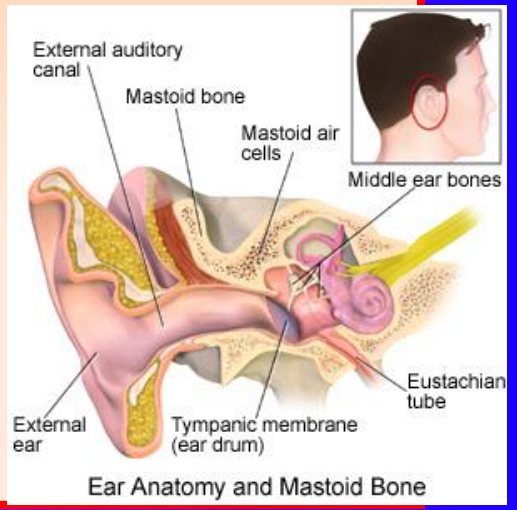


- *G - rod*
- *capsula factor pathogenicity - virulence*
- *ubiqvitous in URT mucosa*
- *spreading in child collectives*
- *serotype isolated from mucose of <u>URT usually is the pathogen</u>*
- *prevalence in the period <u>5 moths – 5 years</u>*
- *<u>Vaccination practically elminated the disease</u>*

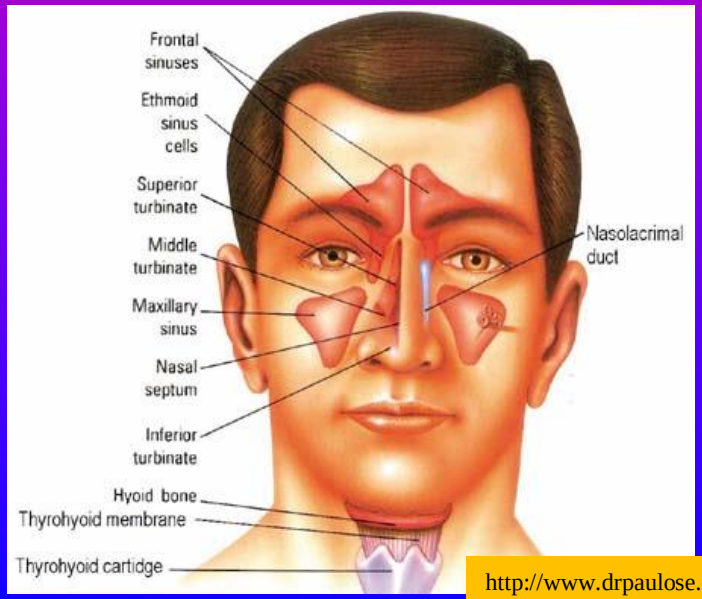
https://www.healthtap.com/#topics/haemophilus

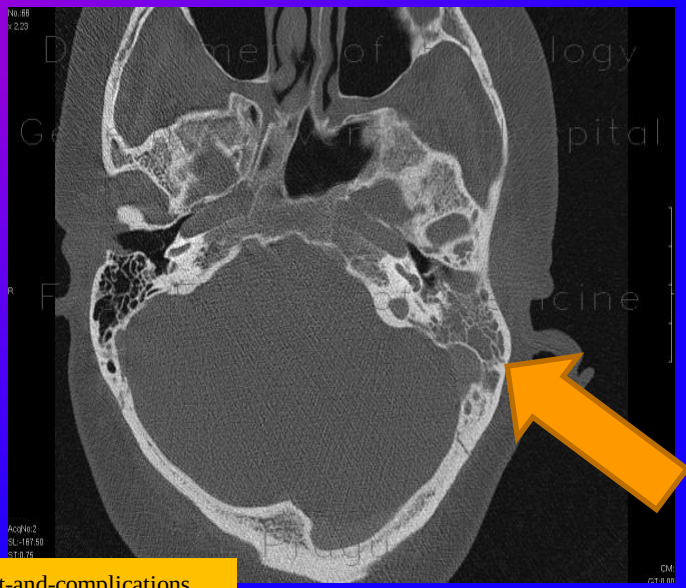
PURULENT MENINGITIS SECONDARY

- ***1) purulent focus in scull***
  - ***Paranasal sinuses***
  - ***Ear***
  - ***Mastoiditis***
  - ***Most frequvently pneumococcus***
  - ***Spreading per continuitatem;***



Ear Anatomy and Mastoid Bone

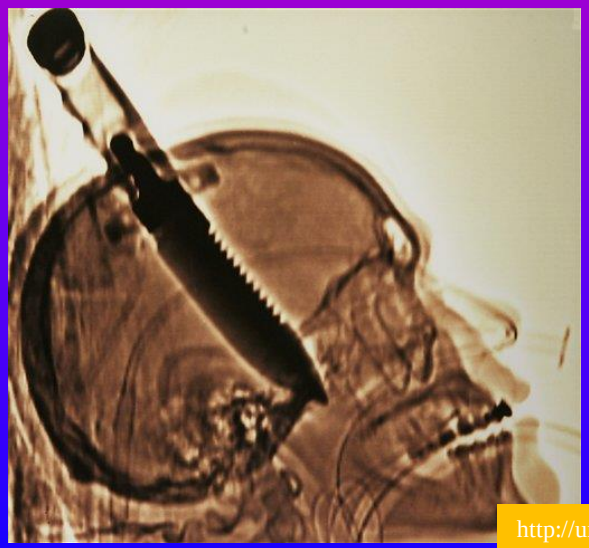




http://www.drpaulose.com/nose/sinusitis/acute-frontal-sinusitis-treatment-and-complications

PURULENT MENINGITIS SECONDARY

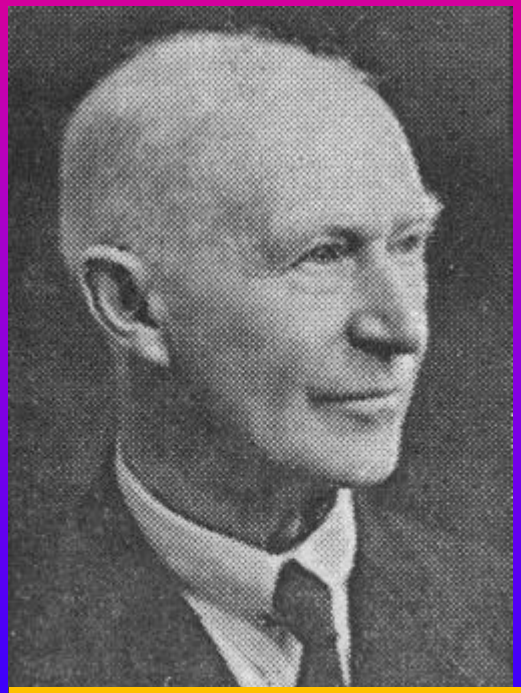
- *2) <u>traumatic</u>*
  - *microbes entered the tissue by injury*
  - *most frequent pathogens S. aureus, anaerobes, any others …*
- *3) <u>post-operative and posttraumatic</u>*
  - *Connected with treatment on intesive care unit – patients colonized by many microbes*
  - *especially <u>G -</u>*

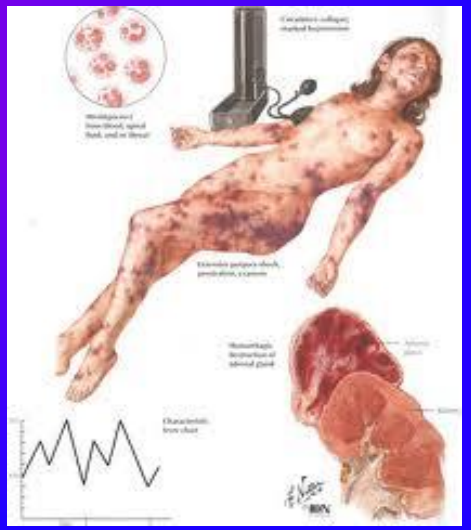


http://urbantitan.com/seven-horrific-head-injury-x-rays-of-people-who-survived

CLINICAL MANIFESTATION

- ***Peracute Sepsis – Waterhause - Fridrichsen syndrome; Most acute meningococcus inf. without meningitis***





It was first reported as an entity by Rupert Waterhouse (photo) in 1911, and the subject was comprehensively reviewed in 1918 by the Danish paediatrician Carl Friderichsen.
http://thebackgrounddoc.blogspot.cz/2010/08/purpura-fulminans.html

CLINICAL MANIFESTATION

- ***Acute*** ***Typically1-2 days***
  - ***Fever,***
  - ***headaches***
  - ***irritability***
  - ***meningeal sy***

CLINICAL MANIFESTATION

- ***Subacute*** ***Days – similar symptoms***

- ***Chronic*** ***Nonspecific symptoms at the beginning – fatigue, headaches, fever***
  Sometimes symptoms of focus
  Facultative pathogens

COMPLICATIONS

- ***Inlammatory focus***
  - ***Subdural effusion :*** *non-purulent collection of fluid; usually small, potentisl pressure changes, treatment conservative*
  - ***subdural empyema:*** *colletions of pus, persitence of purulent inflammation, fevers, pressure changes, antibiotic treatment - surgery*
  - ***ventriculitis:*** *most frequent in newborns, life-threatening*
  - ***Brain abscessus:*** *cause or result of meningitis; treatment first of all conservative, large focus - surgery*
- ***Vessel involvement***
  - ***Ictus - arterial trombosis, arteriitis***
  - ***Trombosis or tromboflebitis*** *- venous sinus oclusion, inflammatory focus; vessle oclusion; treatment anticoagulants, antibiotics*

COMPLICATIONS

- ***Hormonal disturbances***
  - ***Syndrome of inappropriate ADH secretion :***
  - ***Cerebral salt-wasting syndrome***
  - ***Diabetes insipidus***
- ***Convulsions – EPI parox***
  - ***TH - common antiepileptics***
- ***CSF circulation disturbances - hydrocephalus***
  - ***Non-communicating***
    - ***Obstruction – inner x outer hydrocephalus***
  - ***Communicating – more frequent***
    - ***Hypersecretion CSF***
    - ***Hyporesoption CSF***

COMPLICATIONS

- ***Neurological involvement***
  - ***Any topic involvement***
  - ***More – relative specific***
    - ***Hearing loss – cochlear***
    - ***Polyneuropathy, cereballar sy, vestibular sy …***

COMPLICATIONS of MENINGOCOCCAL MENINGITIS

- ***Sepsis – shock***
  - ***Disseminated intravascular coagulopathy - DIC***
  - ***casue of shock and cause of vessel occlusions –***
  - ***necrosis , organ involvement***
  - ***More – relative specific***
    - ***Hearing loss – cochlear***
    - ***Polyneurpathy, cereballar sy, vestibular sy …***
- ***Arthritis***
- ***Peri-myocarditis***
- ***Pneumonia – subacute***
- ***Chronic meningococcemia***
  - ***long-lasting excretion of meningococci***

PURULENT MENIGITS - DIAGNOSTIC

- ***CLINICAL:***

  **** fever, meningeal syndrome headache, disturbances of consciousness***

  **** skin petechia in meningococcus men.***

  **** focal neurolog. findings***

Table 2. Most frequent symptoms in patients with acute communitarian bacterial meningitis and AIDS.

Symptom	N	%
Headache	24	77.4
Fever	20	64.5
Neck stiffness	16	51.6
Vomiting	12	38.7
Seizures	8	25.8
Kernig sign	2	6.4
Petechias*	1	3.2
Coma*	1	3.2

*Same patient.

http://www.google.cz/imgres?q=meningococcal+meningitis+pictures&um

http://www.answers.com/topic/meningitis

PURULENT MENIGITS - DIAGNOSTIC

LABORATORY:

- **CSF examination:**
  - *Antigen*
  - *Cytologic examination*
  - *Biochemical*
  - *Cultivation +*
  - *PCR*

Table 1. Typical CSF Findings in Patients With and Without Meningitis

Parameter	Normal	Bacterial Meningitis	Viral Meningitis	Fungal Meningitis	Tuberculous Meningitis
Opening pressure (mm H_2O)	<180	200-500	NA	>250 (*Cryptococcus* sp)	NA
WBC count (mm^3)	0-5	100-20,000 (mean 800)	5-500 (mean 80)	20-2,000 (mean 100)	5-2,000 (mean 200)
WBC differential	No predominance	>80% PMN	>50% L, <20% PMN	>50% L	>80% L
Protein (mg/dL)	15-50	100-500	30-150	40-150	>50
Glucose (mg/dL)	45-100 (2/3 of serum)	≤40 (<40% of serum)	30-70	30-70	<40
Gram stain (% +)	NA	60-90	–	–	37-87 (AFB smear)

+: positive; –: negative; AFB: acid-fast bacilli; CSF: cerebrospinal fluid; L: lymphocytes; NA: not applicable; PMN: polymorphonuclear cells; WBC: white blood cells. Source: References 9, 10.

PURULENT MENIGITS - DIAGNOSTIC

- ***Searching for foci***

  ORL, spondylitis, parapharyngeal abscess, other clinical foci

- ***CT – MRI:***
  - ***focus: sinusitis, mastoiditis, air - injury, abscessus, subdural empyema***
- ***biochemical parameters – intensive care***
  - ***hemocultivation***

- **** MRI angiography (trombosis)***

PURULENT MENINGITIS SUMMARY of THERAPY

- ***1) Antimicrobial***
- ***2) Anti-shock***
  - ***Corticosteroids (dexamethason 0,8 mg/kg/D; methylprednisolon, hydrocortison)***
- ***3) Antiedematic***
  - ***manitol 1,5-2 g/kg/G***
- ***4) Analgetics, sedation***
- ***5) Anticonvulsants***
  - ***Diazepam, valproat acid, phenytoin …***

PURULENT MENINGITIS
ANTIBIOTIC THERAPY

- ***EMPIRICAL:***
  - *Ceftriaxon*
  - *Cefotaxim*
  - *Ampicillin*
    - *(CHLM)*
- ***TARGETED:***
- ***hemophilus:***
  - *CTX,CTR, after ATB sensitivitypo AMP; cefepim*
- ***meningococcus:***
  penicilin G (possible rezistence), ampicilin, Ceftriaxon, cefotaxim
- ***pneumococcus:***
  penicilin G (ATB sensitivity !!), ceftriaxon Cefotaxim, cefepim

PURULENT MENINGITIS

ANTIBIOTIC TREATMENT

- ***Shunt:***
  ATB sensitivity
  S. epidermidis: vankomycin, linezolid

- ***Gramnegatives:***
  **** cefalosporin 3 rd gen. + aminglykosid***
  **** Meropenem, cefepim***

- ***Mycotic:***
  - ***amfotericin B (liposoluble);***
  - ***flucytosin;***
  - ***((flukonasol –only cryptoccus; intrakonasol aspergillus))***

PURULENT MENINGITIS ANTIBIOTIC TREATMENT 1

TABLE 1-4 **Recommended Doses for the Antibiotics Commonly Used in the Treatment of Bacterial Meningitis**

Antibiotic Agent	Total Daily Dosage (Dosing Interval in Hours)
Ampicillin	Neonate: 150 mg/kg/d (every 8 hours) Infants and children: 300 mg/kg/d (every 6 hours) Adult: 12 g/d (every 4 to 6 hours)
Cefepime	Infants and children: 150 mg/kg/d (every 8 hours) Adult: 6 g/d (every 8 hours)
Cefotaxime	Neonate: 100 mg/kg/d to 150 mg/kg/d (every 8 to 12 hours) Infants and children: 225 mg/kg/d to 300 mg/kg/d (every 6 to 8 hours) Adult: 8 g/d to 12 g/d (every 4 to 6 hours)
Ceftriaxone	Infants and children: 80 mg/kg/d to 100 mg/kg/d (every 12 hours) Adult: 4 g/d (every 12 hours)
Gentamicin	Neonate: 5 mg/kg/d (every 12 hours) Infants and children: 7.5 mg/kg/d (every 8 hours) Adult: 5 mg/kg/d (every 8 hours)

PURULENT MENINGITIS ANTIBIOTIC TREATMENT 2

Meropenem	Infants and children: 120 mg/kg/d (every 8 hours) Adult: 6 g/d (every 8 hours)
Nafcillin	Neonates: 75 mg/kg/d (every 8 to 12 hours) Infants and children: 200 mg/kg/d (every 6 hours) Adult: 9 g/d to 12 g/d (every 4 hours)
Penicillin G	Neonates: 0.15 mU/kg/d to 0.2 mU/kg/d (every 8 to 12 hours) Infants and children: 0.3 mU/kg/d (every 4 to 6 hours) Adult: 24 mU/d (every 4 to 6 hours)
Rifampin	Infants and children: 10 mg/kg/d to 20 mg/kg/d (every 12 to 24 hours) Adults: 600 mg/d to 1200 mg/d (every 12 hours)
Vancomycin*†	Neonates: 20 mg/kg/d to 30 mg/kg/d (every 8 to 12 hours) Infants and children: 60 mg/kg/d (every 6 hours) Adults: 2 g/d to 3 g/d (every 6 to 12 hours)

*For intravenous vancomycin therapy, maintain serum trough concentrations of 15 μg/mL to 20 μg/mL. Recommended peak levels 1 hour after intravenous administration, vancomycin 25 μg/mL.
†Intraventricular vancomycin administration: children 1 mg/d to 2 mg/d, adults 10 mg/d to 20 mg/d.

PURULENT MENINGITIS – OUTCOME

- ***Paresis***
- ***Movement disorders***
- ***Mental deficiency***
- ***EPI***
- ***Peripheral neuropathy***
- ***Hearing loss***
- ***Hydrocephalus***

- ***Meningoccus:***
  - ***Acral necrosis, myocardial lesions, arthropathy***

PURULENT MENINGITIS PREVENTION

- ***VACCINATION:***
- ***1) HIB: children, part of polyvaccines***
- ***2) Meningococcus: optional, some groups (recruits)***
- ***3) Pneumococcus: risk groups (elders, spleenectomized …)***

- ***Chemoprophylaxis:***
  - ***N. meningitis, (H.influenzae)*** V-PCR; ERY; (rifampicin, ciprofloxacin)

MENINGITIS - OPPORTUNISTIC PATHOGENS

- ***PATOGENESIS:***

  * ***immunosupression (HIV, NEO, elder pat.)***

- ***CLINICAL SYMPTOMS:***
  - ***Symptoms of bysic disease, slowly increasing problemy, subfebrility – fever, headaches***

- ***DIAGNOSTIC:***
  - ***Cultivation of CSF***
  - ***hemokultivation,***
  - ***„Black ink“, uncertain prognosis – due to basic disease***

- ***TREATMENT:***
  - ***2-3 weeks, toxic reactions***

MENINGITIS - OPPORTUNISTIC PATHOGENS

- *TBC*
- *Listeria monocytogenes*
- *Mykosis*
- *Protozoa*
- *Gram - negative pathogens*
- *Shunt - S. epidermidis*
- *<u>Neonates</u> – E. coli, Listeria monoc., Str. agalactiae*

MENINGITIS - TBC

- ***Slow beginning***
- ***TBC infection in history***
- ***Carefull examination of CSF***
- ***Cultivation of CSF !!! – high volume (20-40ml of CSF) centrifuagtion, PCR examination, sometimes Abs in CSF***
- ***Long – time treatment***
- ***4 combination of antituberculotic - ATB***

MENINGITIS - LISTERIA MONOCYTOGENES

- ***G + Rod aerobic – facultative anaerobic***
- ***Nature:***
  - *Ubiquitous; in nature, in intestine; source – food*
  - *Incidence low (0,7/100000)*
  - *Immunocompromized patients – newborns and eldrely, HIV, Mortality up to 20%, in CR cca 10 cases per year*
- ***Pathogenesis:***
  - *Intracellular localization – capability of phagosome lysis*
  - *Low pH, penetration to cytolosol and continuing spreading*
- ***Clinical symptoms:***
  - *Congenital and adnate infections – granolumatous inflammation*
  - *Later period – granulatous and septic infections, invasive meningitis slowly progressive*
  - *Lesion on scull basis and cranial nerves*

MENINGITIS - LISTERIA MONOCYTOGENES

- ***DIAGNOSTIC:***
  - *Immunodeficiency*
  - *CSF findings: hundreds of lymphs.;*
  - *Cave pleomorphism of listeria (2/3 of microscopic examination of CSF are assessed as „negative“ !!!)*
  - *Hemocultivation is positive in ½ of patients*

- ***TREATMENT – basic is lenght and choice of ATB:***
  - *Ampicillin, mega-doses or PNC*
  - *PNC + aminoglycosides*
  - *Less effective: TMP-SMX; imipenem/cilastatin,; fluorochinolons*
  - *Lenght of tretment 3-4 weeks; immunospressed - longer*

MENINGITIS - UNCOMMON PATHOGENS

- ***ACTINOMYCETES***

  cotrimoxazol

- ***MYCOSES:***
  - ***Cryptococcus; aspergillus, candida***
- ***Pathogenesis*** ***– influenced by specific sensitivity of organism; Immunocompromized; newborns, AIDS …***
- ***Examination of CSF – volume, cultivation***
- ***CSF synthesis of antibodies***
- ***PCR***
- ***Long-term therapy***
- ***Amphotericine + lipide emulsions (AmBisome)***
- ***Flukonasol, intraconasol, voriconasol (Vifend)***

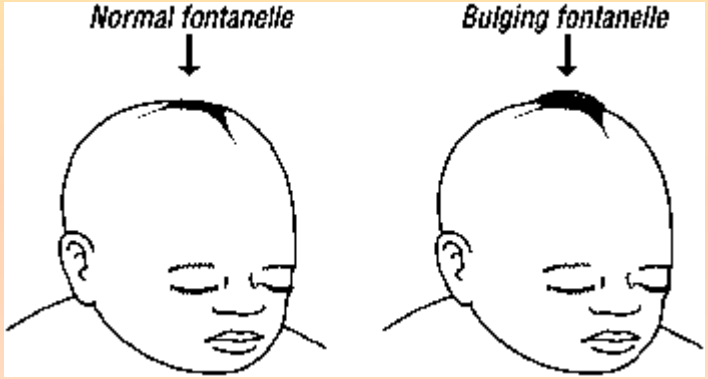
MENINGITIS - NEONATES

- ***Clinical symptoms:***

  poore clinical picture

  somnolence, hypotonia, high cry

  bulging of fontalle – late symptom



- ***Pathogenes:***
  - ***Listeria monocytgenes; E.coli, Str. agalctiae …***
- ***Treatment:***
  - ***Cefotaxim, ampicillin + according to culture***

MENINGITIS - UNCOMMON PATHOGENS

- ***TOXOPLASMA GONDII***
- ***Nature:***
  - *Inborne infection*
  - *Later infection - meat*
  - *Immunocompromized patients – HIV*
- ***DIAGNOSIC:***
  - *Brain CT, CSF negative or non-specific; cultivation not helpfull*
- ***TREATMENT:***
  - *Combination ATB: pyrimethamin, sulfadiazin, clindamycin, spiramicin*

MENINGITIS - OPPORTUNISTIC PATHOGENS

- ***AMOEBAE:***
- ***Negleria gruberi:***
  - *Bathing*
  - *Clinical sympt: fever or wthout, men. Sy.*
  - *Diagnostic: microscopy of CSF – laboratory worker must be informed*
  - *CSF finding is nonspecific*
  - *Th: amfotericin B – rifa or TTC*
- ***Balamuthia mandrilaris + acathamoebae:***
  - *Meiningitis, encephalitis*
  - *Therapy unknown*

MENINGITIS - OPPORTUNISTIC PATHOGENS

- ***GRAM-NEGATIVE PATHOGENS***
- ***Pseudomonas, proteus, acinetobacter …***
- ***Immuncompromized – intensive care***
- ***Clinical symptoms:***
  - *fever or not*
  - *Meningeal syndrome differently expressed*
- ***Diagnostic:***
  - *Cultivation necessary, sensitivity to ATB*
- ***Treatment:***
  - *Ceftriaxon, cefotaxim, meropenem, cefepim*
- ***Bad prognosis***

THANKS for ATTENTION