

ACUTE BACTERIAL MENINGITIS

M6 UNIT

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SYNOPSIS

- ▶ Definition
- ▶ Etiology
- ▶ Pathogenesis
- ▶ Clinical presentation
- ▶ Diagnosis
- ▶ Differential diagnosis
- ▶ Treatment

DEFINITION

- ▶ Bacterial meningitis is an acute purulent infection within the subarachnoid space
- ▶ It is associated with a CNS inflammatory reaction that may result in decreased consciousness , seizures , raised ICP and stroke
- ▶ The meninges and subarachnoid space and brain parenchyma are frequently involved in the inflammatory reactions (Meningoencephalitis)

ETIOLOGY

▶ **S.PNEUMONIAE**

M/C/C in adults >20 years

▶ **PREDISPOSING CONDITIONS**

- Pneumococcal Pneumonia
- Alcoholism, Diabetes, Splenectomy,
Hypogammaglobulinemia, complement deficiency
- Head trauma with Skull fracture and CSF rhinorrhoea

▶ **Mortality rate is ~20%**



► **N.MENINGITIDIS**

- Incidence is decreased due to immunization with quadrivalent meningococcal glycoconjugate vaccine (Serogroups A,C,W-135,and Y)
- Presence of petechial or Purpuric skin lesions

► **GRAM NEGATIVE BACILLI**

- Individuals with chronic and debilitating disease – Diabetes , Cirrhosis , Alcoholism
- Complicated neurosurgical procedures



► **MENINGITIS COMPLICATING ENDOCARDITIS**

- Streptococcus viridians, Staph aureus, Streptococcus bovis, HACEK Group.

► **GROUP B STREPTOCOCCUS** in >50 years individuals

- **S.AUREUS and CONS**

Invasive neuro surgical procedures particularly Shunting procedure for hydrocephalus or intra thecal chemotherapy .

- **LISTERIA MONOCYTOGENES**

Neonates of <1 month, pregnant women, >60 years and Immuno compromised patients



PATHOGENESIS

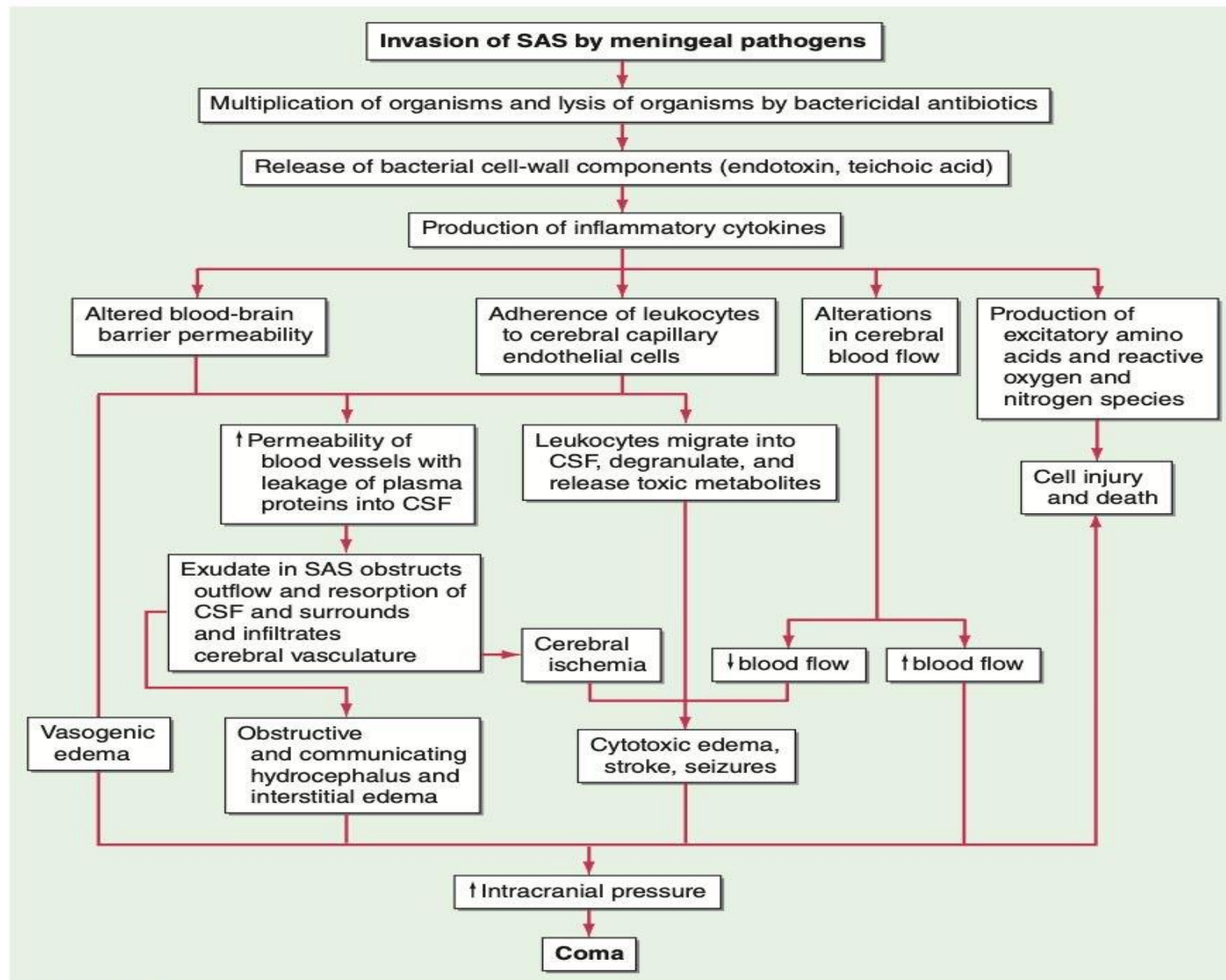


FIGURE 133-1 The pathophysiology of the neurologic complications of bacterial meningitis. CSF, cerebrospinal fluid; SAS, subarachnoid space.

PATHOGENESIS

Entry into subarachnoid space -> Bacterial multiplication -> Release of cell wall components (endotoxin, teichoic acid)

Cytokine production

Leads to ↑ BBB permeability → protein leakage

Leukocyte migration → toxic metabolites

Exudate → blocks CSF flow

Cerebral ischemia

↑ intracranial pressure

► Outcomes

Vasogenic edema

Cytotoxic edema

Hydrocephalus

Stroke / seizures

Coma

CLINICAL PRESENTATION

► CLINICAL TRIAD :

- 1.Fever
- 2.Headache
- 3.Nuchal Rigidity

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- ▶ Decreased level of consciousness
 - ▶ Nausea, vomiting and photophobia
 - ▶ Seizures occur as initial presentation in 20-40%
 - ▶ Raised ICP-CSF opening pressure $>180\text{mmH}_2\text{O}$

DIAGNOSIS

- ▶ Blood culture
- ▶ Examination of the CSF
- ▶ Neuroimaging studies(CT or MRI) prior to LP

► **PERFORM LP WITHOUT PRIOR NEUROIMAGING:**

- Immuno-competent patient
- No H/O recent Head trauma
- Normal level of consciousness
- No evidence of papilledema/focal neurological deficit



THE CLASSIC CSF ABNORMALITIES IN BACTERIAL MENINGITIS:

- ▶ Polymorphonuclear (PMN) leukocytosis(**>100 cells/microL**)
- ▶ Decreased glucose concentration (**<40mg/dl**) and/or CSF : Serum glucose Ratio of **<0.6**
- ▶ Increased protein concentration (**>45 mg/dl**)
- ▶ Increased CSF opening pressure **>180mmH2O**

- 
- ▶ CSF/serum glucose Ratio is <0.4 is highly suggestive of bacterial meningitis. Also seen in fungal , Tuberculosis, and carcinomatous meningitis
 - ▶ PCR – a technique that uses specific bacterial primer to detect nucleic acid of organisms.

NEUROIMAGING STUDIES

1.CT

2.MRI

- MRI is preferred over CT , superior in demonstrating cerebral edema and ischemia .
- Diffuse meningeal enhancement seen after administration of gadolinium

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- ▶ Meningeal enhancement is not Diagnostic of meningitis but occurs in any CNS infection with increased blood brain barrier permeability.
 - ▶ Petecial skin lesions if present – should do biopsy.

DIFFERENTIAL DIAGNOSIS

- ▶ Viral meningoencephalitis - HSV encephalitis
- ▶ Rickettsial disease (RMSF)
- ▶ Ehrlichioses
- ▶ Meningitis with inflammatory disorders
- ▶ Subacute meningitis



► **NON INFECTIOUS CNS DISORDERS**

- SAH
- Chemical meningitis
- Drug induced hypersensitivity meningitis
- Carcinomatous / lymphomatous meningitis

TREATMENT

► EMPIRICAL ANTIMICROBIAL THERAPY

- Medical Emergency
- Goal : To begin antibiotic therapy within 60 minutes
- It also includes

1. 3rd generation Cephalosporins (ceftriaxone) covers *S.pneumoniae* ,
H.Influenza, *N.Meningitidis*

4th generation Cephalosporins (Cefipime) *Enterobacter* and
pseudomonas aeruginosa

2.Ampicillin : for *Listeria monocytogenes*



3. Metronidazole : for gram negative anaerobic in otitis and sinusitis, mastoiditis

4. Meropenem : *Listeria monocytogenes* , *Pseudomonas aeruginosa* , penicillin resistant pneumococci.

5. Acyclovir (as HSV encephalitis is leading DD)

6. Doxycycline (during Tick season)



PNEUMOCOCCAL MENINGITIS

- ▶ Cephalosporins and Vancomycin
- ▶ An isolate of *S. Pneumoniae* considered to be
 - Susceptible to Penicillin with a MIC < 0.06 microgram/ml
 - Resistant with MIC is > 0.12 microgram/ml
- ▶ For MIC > 1 microgram /ml, vancomycin is antibiotic of choice.

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- ▶ Rifampicin can be added to Vancomycin for its synergistic effect
 - ▶ Resistance develops rapidly when it is used alone
 - ▶ 2 weeks antibiotic therapy is recommended
 - ▶ Repeat LP: 24 to 36 hours after the initiation of antibiotic therapy to document sterilization
 - ▶ Failure to sterilize the CSF after 24-48 hours of therapy consider evidence of antibiotic resistance
 - ▶ Intravenous route of administration is preferred over intrathecal

► **Staphylococcal meningitis**

Nafcillin

Vancomycin is DOC for MRSA & Penicillin allergies

► **Gram-Negative Bacillary Meningitis**

3rd generation Cephalosporins

3 weeks Iv antibiotic therapy recommended



► MENINGOCOCCAL MENINGITIS:

Penicillin G-antibiotic of choice

If resistance:-Rx-Cefotaxim/ceftriaxone.

A 7 days course of IV antibiotic-adequate for uncomplicated meningococcal meningitis



► Chemoprophylaxis:

For index and close contacts

2 day Regimen of Rifampin (600 mg, 12 hrly × 2 days in adults and 10 mg/kg 12 hrly for 2 days in children >1 year

Rifampin:- not recommended in pregnant woman.

Alternative, Azithromycin 500 mg one dose or one i.m, ceftriaxone 250mg

ADJUNCTIVE THERAPY

- ▶ **Dexamethasone** exerts beneficial effect by inhibiting synthesis of IL-1beta and TNF alpha at The level of mRNA,decreasing CSF outflow resistance, stabilizing BBB
- ▶ **20 minutes** before antibiotic therapy
- ▶ Dexamethasone 10mg I.V 20 min before the first dose of antimicrobial agent and repeated every 6 hours for 4 days
- ▶ It may decrease the penetration of Vancomycin into CSF and delays the sterilization of CSF
- ▶ Vancomycin dose of 45- 60 mg/kg/day IV

TABLE 138-1 Antibiotics Used in Empirical Therapy of Bacterial Meningitis and Focal Central Nervous System Infections^a

INDICATION	ANTIBIOTIC
Preterm infants to infants <1 month	Ampicillin + cefotaxime
Infants 1–3 months	Ampicillin + cefotaxime or ceftriaxone
Immunocompetent children >3 months and adults <55	Cefotaxime, ceftriaxone, or cefepime + vancomycin
Adults >55 and adults of any age with alcoholism or other debilitating illnesses	Ampicillin + cefotaxime, ceftriaxone, or cefepime + vancomycin
Hospital-acquired meningitis, posttraumatic or postneurosurgery meningitis, neutropenic patients, or patients with impaired cell-mediated immunity	Ampicillin + ceftazidime or meropenem + vancomycin