

ACUTE BACTERIAL MENINGITIS AND ANTI MICROBIALS IN NEURO SURGERY



ACUTE BACTERIAL MENINGITIS

- ABM is acute purulent infection in the subarachnoid space
- It is associated with a CNS inflammatory response that may result in decreased consciousness, seizures, raised ICP and stroke
- The meninges, subarachnoid space, brain parenchyma are frequently involved in inflammatory process.

ABM

- Community acquired meningitis vs. postoperative meningitis
- ABM Vs Aseptic meningitis

ABM : PATHO PHYSIOLOGY

ROUTES OF INFECTION

- Hematogenous spread
- Retrograde propagation from nasopharynx via infected thrombi in emissary veins
- Direct spread from contiguous foci of infection like orbital cellulitis, osteomyelitis of skull, basal skull fracture
- Direct inoculation following penetrating brain injury; in neurosurgical procedures

ABM : PATHOPHYSIOLOGY

- CSF is a moderately good culture medium as it contains very low concentration of Immunoglobulins and complement components
- Its opsonic activity is low
- It is devoid of PMN phagocytes
- Phagocytosis of bacteria is further impaired by fluid nature of CSF

ABM : PATHOPHYSIOLOGY

Critical event in pathogenesis is **inflammatory reaction** induced by invading bacteria

- Many of the neurologic manifestations and complications are result of **immune response** to invading pathogens rather than direct bacteria induced injury
- As a result, neurologic injury can progress even after CSF has been sterilized by antibiotic therapy

ABM : PATHOGENESIS

- Elevated levels of CSF cytokines and chemokines (TNF,IL 1)
 - These increase permeability of BBB
 - Vasogenic edema
 - Subarachnoid proteinaceous exudates
 - Obstructive hydrocephalus
 - Interstitial edema
- all these induce death of brain cells

INFLAMMATORY RESPONSE IN CSF

- CSF lactate increases
- CSF proteins increase
- CSF leucocytes increase
- CSF glucose decreases

POST OPERATIVE BACTERIAL MENINGITIS

EARLY :

- Within 7 days
- Direct inoculation of organisms

LATE :

- After 7 days
- Represents hematogenous or direct spread of organisms to infect damaged tissue or foreign bodies
- in many cases same organism can be isolated from elsewhere in the body

CAUSATIVE ORGANISMS

Varies with age in CAM

➤ Neonates : GNB

Streptococcus agalactiae

➤ Children : H influenzae, pneumococcus

➤ Adults : Pneumococcus, N meningitidis

In neurosurgical cases spectrum of organisms varies

➤ Following CSF leak : pneumococcus, H. influenzae

➤ Following VP shunt : S. epidermidis,

Propionibacterium acnes

➤ Following craniotomy : S. aureus, GNB, Pseudomonas

CLINICAL FEATURES

- TRIAD : high grade fever($>100.4^{\circ}\text{f}$), severe headache, neck stiffness
- Prodromal features : like URTI, ASOM/CSOM, Pneumonia
- Signs of meningeal irritation :
 - photophobia
 - kernigs sign
 - Brudzinski' s sign

CLINICAL FEATURES

Associated neurological signs :

- impaired consciousness level

- seizures

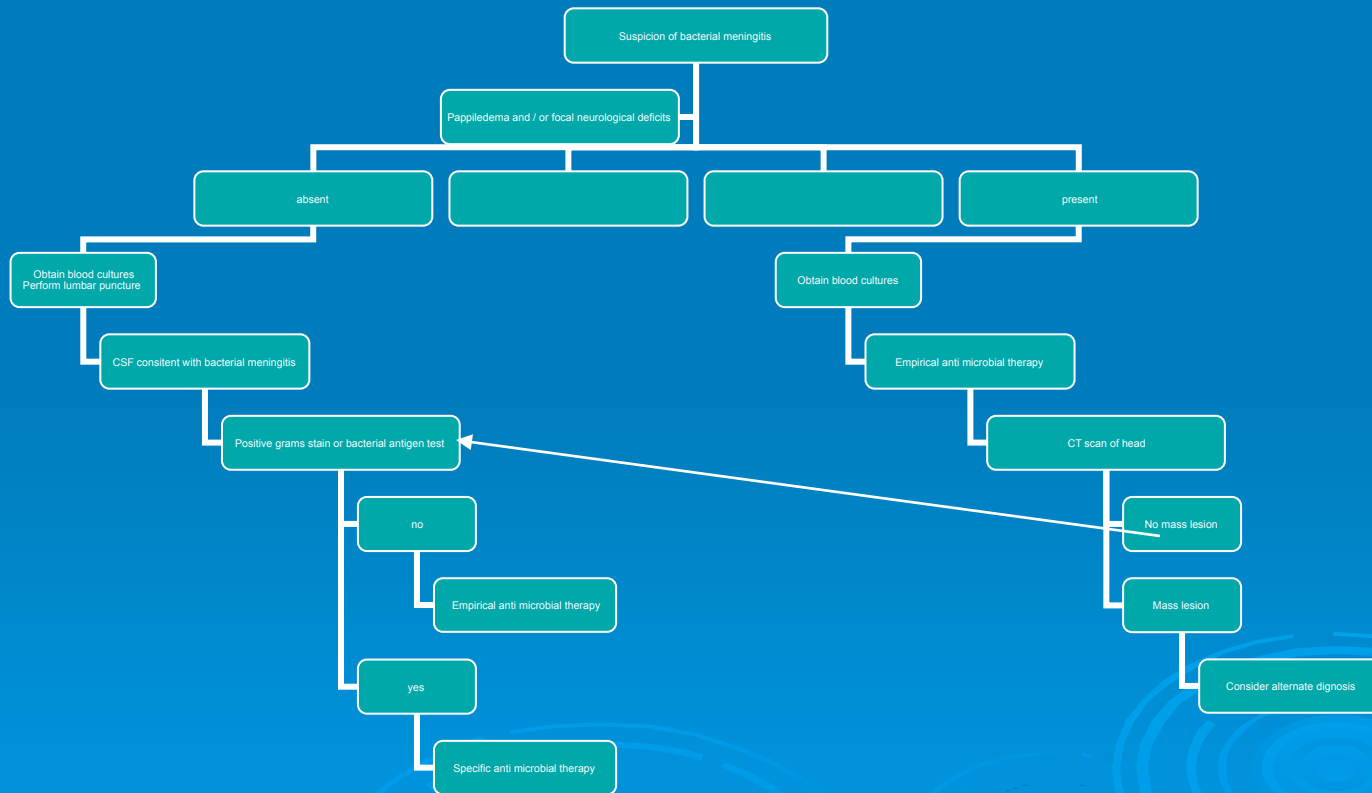
- cranial nerve signs in 15%
cases

- sensory neural deafness in 20%

- focal neurological signs in 10%

Non neurological complications : sepsis, shock,
arthritis, ABE

Management protocol



CSF ABNORMALITIES IN BACT . MENINGITIS

- Opening pressure : >180 mm H₂O
- WBC : $>500-1000$ /cu.mm
- RBC : Absent in non traumatic tap
- Glucose : <40 mg/dl
- CSF/Serum glucose : <0.4
- Protein : >45 mg%
- Gram stain : positive in $> 60\%$
- Culture : positive in $> 80\%$
- Latex agglutination : may be positive in $70-80\%$
- Limulus lysates : positive in gram negative meningitis
- PCR for bacterial DNA : research tool

D/D OF CSF PLECOCYTOSIS

	CELLS	PROTEINS	GLUCOSE	GRAM STAIN	CULTURE
ABM	20-20000 PMN	Increased	decreased	+/-	+/-
Para Meningeal infection	100-500	increased	normal	-	-
Post Op changes	100-500	increased	normal	-	-


NEWER TESTS IN CSF

- S.PROCALCITONIN > 0.5 ng/ml
-Dubos et al. in J Paeds 2006

- TNF- ALFA in CSF
-Adrian et al. in J of Paeds neurology
2005

Are useful markers for distinguishing bact. From aseptic meningitis.

Meningitis in neurosurgical settings

- Post head injury
 - Post op meningitis
 - Shunt infection
 - Ruptured MMC
 - Persistent dermal sinus
- 
- The background features several sets of concentric circles in a lighter blue shade, resembling ripples in water, positioned in the lower right quadrant of the slide.

Post op meningitis

- Severe form of nosocomial infection
- Most common organism : staph aureus
GNB
- Seen in 0.5-0.7% of patients undergoing neurosurgical procedures if prophylactic antibiotics are given

Special considerations

- Signs of meningitis are marked /or confused with effects of operation itself or underlying CNS disease – hence delay in diagnosis
- Tempo of the disease is unpredictable acute vs. protracted course

Post op meningitis

- AIIMS NEUROSURGERY-year- 2006 experience:
- Total no. of patients operated -3114
- Total no. of CSF culture+ meningitis-70 (2.2%)
- Total cases of wound infection- 95(3.5%)
- Total no. of patients affected- 165 (5.3%)

Microbial spectrum

AIIMS NEUROSURGERY-year- 2006

experience:

- Most common are gram negative bacilli
Acinetobacter
pseudomonas

Others- MSSA, MRSA. Klebsiella,
Enterococcus

- About 80-90% of these GNB are ESBL+
hence having resistance to conventional
penicillins

Culture sensitivity pattern

AIIMS NEUROSURGERY-year- 2006 experience:

- Most cases are sensitive to
 - carbapenems like meropenem/
imipenems
 - cefoperazone+sulbactam
 - piperacillin+tazobactam
- Overall 20-30% of GNB are now showing resistance to carbapenems

ABM Treatment Principles :

- Supportive care during critical phase
 - fluid ,electrolyte management
- Eradicate causative organism with appropriate antibiotics
- Modify host's inflammatory response
 - role of steroids

Types of treatment failures:

❑ Recrudescence

❑ Relapse

❑ Recurrence



Prophylactic Antimicrobials in neurosurgery-Principles:

- Abs must be in tissues at time of contamination
- Repeat dose during prolonged surgeries
- Not cost effective in low infection risk surgeries

Role of Prophylactic Antimicrobials for specific neurosurgical procedures

- Craniotomy: role in –prolonged
-microneurosurgical
-reoperative procedure
- CSF Shunt: role is established only if infection rate is high (>10%)

Empirical therapy in post op meningitis

-Should cover:

- GNB: Ceftazidime (3rd gen. cephalosporin) + aminoglycoside
- Anaerobes: metronidazole
- GPC : Vancomycin +/- aminoglycoside

AIIMS NEUROSURGERY protocol for meningitis

- <2 years – fortum + netro + metro
- >2 years – cbactum + netro + metro

Antibiotic monotherapy- adv. :

- Fewer superinfections
- Smaller risk of toxic S/E
- Lower cost
- Smaller effect on host flora

BUT STILL ANTIBIOTIC COMBINATIONS
are used in serious infections-Rationale:

- ❑ For synergistic action
- ❑ To prevent development of resistance

- To treat polymicrobial infections
- To broaden coverage of empiric regimens



Emerging resistance of antimicrobial agents-a great concern

- Has led to closure of an ICU at Columbia, New York because of multiple resistant *Acinetobacter* !!
- Cephalosporin & Carbapenem resistant GNB
- Methicillin & Vancomycin resistant *STAPH.aureus*

Specific antimicrobials commonly used at AIIMS Neurosurgery deptt.

CHLOROMYCETIN :

- Good for G+ & G – cocci
- Excellent CSF penetration

AMINOGLYCOSIDES:

- Good for Staph. +GNB incl. Pseudomonas
- More rapid kill than B-lactams

METRONIDAZOLE:

- Good for anaerobes & micro aerophilic org.
- Readily crosses BBB

Specific antimicrobials commonly used at AIIMS Neurosurgery deptt.

CEPHALOSPORINS:

- Higher gen. are better for GNB & poorer for GPC
- Ceftazidime– best for pseudomonas

-good csf penetration

dose:1-2 gm I/V BD-TDS (max 6 gm)

MACROLIDE (VANCOMYCIN) :

-doc. for staph.

- -1 gm I/v BD-TDS

Drug fever :

- A non infectious cause of fever in neurosurgical patients
- Antibiotics / anticonvulsants
- Elevation of counts
- Temp. – pulse dissociation
- Defervescence on withdrawal of drug.

➤ ***Thank you!***