

# SEMINAR ON ACUTE BACTERIAL MENINGITIS AND ANTI MICROBIALS IN NEURO SURGERY.

Presented By : DR. ROHIT K GOEL

# 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

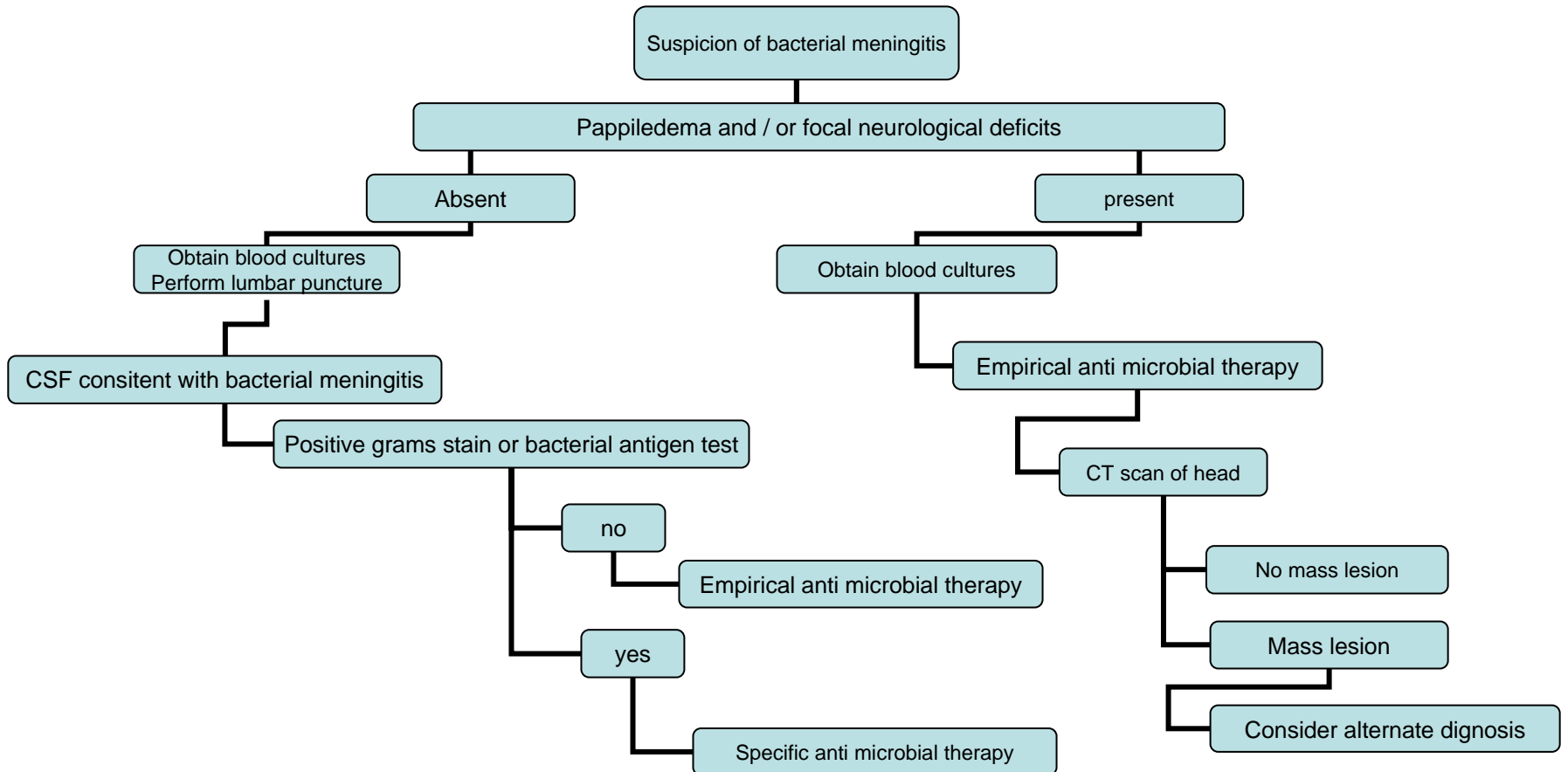
- cranial nerve signs in 15%  
cases

- 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 H<sub>2</sub>O
- WBC : >500-1000/cu.mm
- RBC : Absent in non traumatic tap
- Glucose : <40 mg/dl
- CSF/Serum glucose : <0.4
- Protein : >45mg%
- 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

# 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 (3<sup>rd</sup> 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 diosonophilssosiation
- Defervesence on withdrawal of drug.