

PBL TITLE	A CHILD WITH FITS
YEAR/BLOCK	YEAR 2 BLOCK 1 2020/2021
DURATION	Total contact hours: 4 hours (2 hours x 2 weeks)
PBL MODULE DESIGNED BY	DR WAEL MOHAMED Department of Basic Medical Sciences, Kulliyyah of Medicine, International Islamic University Malaysia (IIUM), Kuantan, Malaysia wmy107@gmail.com
AIM	To expose students to the concepts of and approach to seizures in childhood, with specific focus on bacterial meningitis
LEARNING OUTCOMES	At the end of this PBL module students should be able to: <ol style="list-style-type: none"> 1. Describe the causes of fever. 2. Describe the thermoregulation and the mechanism of fever in children. 3. List the causes of seizure. 4. Describe the mechanism of seizure. 5. Explain the underlying pathophysiological basis of the signs and symptoms related to seizure. 6. Classify the types of meningitis. 7. Describe the pathogenesis of meningitis. 8. Describe the clinical features of meningitis. 9. Discuss the investigations of meningitis. 10. Describe the complications of meningitis. 11. Describe the circulation of CSF. 12. Explain the CSF analysis. 13. Classify the types of hydrocephalus. 14. Discuss the basic management of meningitis. 15. Describe the Islamic perspective regarding care of human body as Amanah from Allah SWT 16. Apply problem solving skills related to cases of meningitis 17. Apply self-directed learning in the search of information 18. Apply communication skills in discussing the case

TRIGGER 1: CHIEF COMPLAINT

HA, a 5-year-old Malay boy was admitted to Tengku Ampuan Afzan Hospital with three days history of fever.

STUDENTS' TASKS

1. Are there any term that you do not understand?
2. Identify the chief complaint - FACTS
3. Discuss your IDEAS (hypotheses) by integrating relevant basic medical sciences and clinical sciences knowledge into the case.
(please note that ideas/hypotheses are not necessarily confined to 'the diagnoses')
4. Decide on further information needed in the history and give reasons (what you NEED to know)
5. During the discussion identify 1-3 KEY (PRIMARY) LEARNING ISSUES (IMPORTANT **basic medical sciences** and or **clinical sciences** knowledge that the group need to find out more in order to work through the case).
Other issues that require further research can be categorised as SECONDARY LEARNING ISSUES

FACILITATOR NOTES															
FACTS (What you know)	<ul style="list-style-type: none"> • 5-year-old boy • Malay • Fever for 3 days 														
IDEAS (Hypotheses)	<ul style="list-style-type: none"> • The child was most probably suffering from an infection. • Possible causes of fever in children include: <table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td style="width: 30%; padding: 5px;">Upper Respiratory Tract infections</td> <td style="padding: 5px;"> <ol style="list-style-type: none"> 1. Common cold (coryza)-the commonest in respiratory childhood. Usually viral origin. Common organism- tract infections rhinoviruses. 2. Tonsillitis - also a form of pharyngitis. Viruses are the commonest causes. Erythema or exudate on the tonsils. 3. Sore throat (pharyngitis) -usually due to viral infection. Pharynx and soft palate usually inflamed accompanied by enlarge and tender lymph nodes. 4. Acute otitis media -symptoms usually pain in the ear with fever 5. Rare but possible-diphtheria, viral croup, epiglottitis </td> </tr> <tr> <td style="padding: 5px;">Lower respiratory tract infection</td> <td style="padding: 5px;">Pneumonia - common organism in children is respiratoryStreptococcus pneumoniae, Haemophilus influenzae tract infection type B and Staphylococcal aureus.</td> </tr> <tr> <td style="padding: 5px;">UTI</td> <td style="padding: 5px;">Organisms -<i>E.coli</i> or <i>Proteus</i> or <i>Pseudomonas</i></td> </tr> <tr> <td style="padding: 5px;">Gastroenteritis</td> <td style="padding: 5px;">Organism - <i>Shigella</i>, <i>Salmonella</i>, or <i>Campylobacter</i></td> </tr> <tr> <td style="padding: 5px;">Meningitis or encephalitis</td> <td style="padding: 5px;">Organism - viral (most common) or bacterial</td> </tr> <tr> <td style="padding: 5px;">Viral exanthema</td> <td style="padding: 5px;">Fever associated with rashes</td> </tr> <tr> <td style="padding: 5px;">Osteomyelitis or septic arthritis</td> <td style="padding: 5px;"> <ol style="list-style-type: none"> 1. Common site - distal femur and proximal tibia 2. Organism - <i>Staphylococcus aureus</i> 3. Usually resulted from haematogenous spread </td> </tr> </tbody> </table>	Upper Respiratory Tract infections	<ol style="list-style-type: none"> 1. Common cold (coryza)-the commonest in respiratory childhood. Usually viral origin. Common organism- tract infections rhinoviruses. 2. Tonsillitis - also a form of pharyngitis. Viruses are the commonest causes. Erythema or exudate on the tonsils. 3. Sore throat (pharyngitis) -usually due to viral infection. Pharynx and soft palate usually inflamed accompanied by enlarge and tender lymph nodes. 4. Acute otitis media -symptoms usually pain in the ear with fever 5. Rare but possible-diphtheria, viral croup, epiglottitis 	Lower respiratory tract infection	Pneumonia - common organism in children is respiratoryStreptococcus pneumoniae, Haemophilus influenzae tract infection type B and Staphylococcal aureus.	UTI	Organisms - <i>E.coli</i> or <i>Proteus</i> or <i>Pseudomonas</i>	Gastroenteritis	Organism - <i>Shigella</i> , <i>Salmonella</i> , or <i>Campylobacter</i>	Meningitis or encephalitis	Organism - viral (most common) or bacterial	Viral exanthema	Fever associated with rashes	Osteomyelitis or septic arthritis	<ol style="list-style-type: none"> 1. Common site - distal femur and proximal tibia 2. Organism - <i>Staphylococcus aureus</i> 3. Usually resulted from haematogenous spread
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What you NEED to know:	Questions to refine the DD from history of presenting illness: <ul style="list-style-type: none"> • Type of fever 														

	<ul style="list-style-type: none"> • Reason: low grade-common cold, high grade-associated with severe infections such as tonsillitis with exudate, meningitis etc. • Reason: recurrent-associated with abnormality in the urinary tracts that causes unresolved fever <ul style="list-style-type: none"> • Presence of associated signs and symptoms <ul style="list-style-type: none"> • Reason: <ul style="list-style-type: none"> • Flu like symptoms- common cold • Sore throat – pharyngitis, tonsillitis • Ear pain or discharge - acute otitis media • Stridor, barking cough or shortness of breath (SOB) - croup or epiglottitis • Productive cough, SOB, pleuritic chest pain - pneumonia • Dysuria and urinary frequency - UTI • Diarrhea with or without blood and abdominal pain - AGE • Headache, photophobia, seizure, neck pain or stiffness and irritability- meningitis • Skin rash - Macular (measles/Rubella), haemorrhagic (meningococcal infection/dengue haemorrhagic fever), Vesicular (chicken pox/Shingles), Nodular (Erythema nodosum), Erythematous (drug rashes/dengue fever) • Muscle pain - viral infection • Chills and rigors - sepsis or abscess • Excessive sweating - TB • Bone pain, joint pain or swelling - acute osteomyelitis • Severity of the illness - poor feeding, lethargic or irritability <p>Other Questions:</p> <ul style="list-style-type: none"> • Past medical history - any treatment taken for similar illness (to rule out resistant strain or incomplete treatment) • Birth history- congenital defects (might predispose to infective endocarditis or recurrent UTI). • Illnesses of the family members- possibility of cross infections such as URTI, HIV or TB. • Immunization status- predispose to diphtheria infection if not immunized. • Recent travel abroad - malaria or typhoid. • Predisposition to infection - nephritic syndrome, sickle cell disease, HIV or malignancy. • Drug history – drug fever. • Developmental history- any developmental delay (cerebral palsy or epilepsy) that can contribute to recurrent infection.
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KEY LEARNING ISSUES

- 1. Describe the normal control of body temperature**
- 2. Discuss the common causes of fever in children**

3. Describe the mechanism of fever

TRIGGER 2: HISTORY

HISTORY OF PRESENT ILLNESS:

HA was well and active three days prior to the presentation. He started running a high-grade fever 3 days ago and shivering all day long. He was given paracetamol syrup but the fever only subsides temporarily. He had a few vomiting episodes and became more lethargic and sleepy. He also complained of headache and displayed aversion to sunlight. He preferred lying still in bed with his eye closed. The mother was unsure if he had neck stiffness. His food and water intake was also minimal. On the day of presentation, his mother noticed that the left side of the body started to twitch and later become generalized and his eyes began looking upwards. He became unresponsive to his mother's call. The episodes lasted for about 1 minute. The mother also noticed that his pants were wet around the crotch area.

On systemic review there were no other significant symptoms. There was no history of recent travelling. No other family member suffering from fever or similar presentations.

BIRTH HISTORY:

Mother had an uneventful antenatal history. The patient was born full term, spontaneous vaginal delivery with birth weight of 2.9 kg. There was no history of neonatal jaundice.

PAST "MEDICAL/SURGICAL HISTORY:

He had never been hospitalized before. He was however referred to Pediatric Clinic by a primary care health medical officer for failure to thrive at the age of one year old. However, he missed the appointment. No past surgical history.

DRUG HISTORY:

The patient was not on any medication.

IMMUNIZATION HISTORY:

Immunization was completed as scheduled for age.

DEVELOPMENTAL HISTORY:

Developmental milestones: gross motor; fine motor and vision; speech, language and hearing; social, emotional and behavioural were appropriate for age.

NUTRITIONAL HISTORY:

He was fully breast fed up to six-month of age. Weaning was subsequently started. In addition to sharing the family's diet (rice with chicken, meat or fish and vegetables such as carrot), the patient is still on formula-feeding.

FAMILY HISTORY:

The patient is the youngest child. He has two elder sisters; the eldest is 6 years old. Both sisters are well. The father is 34 years old and the mother is 32 years. Both parents are well and no history of consanguinity. No similar problem among family members. No other significant illnesses in the family.

SOCIAL HISTORY:

His father works as mechanic in a private firm. He earns about RM 2500 per month. His mother is a house wife. The father is a diploma holder. The mother's education level was up to form five. Father does not smoke. They live in a three-room single storey terrace house.

STUDENTS' TASKS

1. Are there any term that you do not understand?
2. Summarize the additional information obtained from the trigger- FACTS
3. Discuss further your IDEAS (hypothesis) based on the additional information provided by integrating relevant basic medical sciences and clinical sciences knowledge into the case.
4. List the physical examination findings you would look for and give reasons (what you NEED to know)
5. During the discussion identify 1-3 KEY (PRIMARY) LEARNING ISSUES (IMPORTANT **basic medical sciences** and or **clinical sciences** knowledge that the group need to find out more in order to work through the case).
Other issues that require further research can be categorised as SECONDARY LEARNING ISSUES

FACILITATOR NOTES	
FACTS (What you know)	<ul style="list-style-type: none"> • Fever for 3 days • High grade fever • Rigors • Seizures • Vomiting • Severe headache • Photophobia • Referred to hospital for fever with fits
IDEAS (Hypotheses)	<ul style="list-style-type: none"> • Fever is high grade • There are other symptoms to suggest infection • Duration of fever suggests the probability of an acute problem • The presence of fever, severe headache and photophobia may suggest the presence of meningitis • The possible diagnoses at this point include: <ul style="list-style-type: none"> ✓ Bacterial meningitis ✓ Viral meningitis ✓ Encephalitis ✓ Cerebral abscess ✓ Simple Febrile Fever
What you NEED to know:	<p>To look for the following signs on physical examination:</p> <ul style="list-style-type: none"> • General examination: <i>Pallor (bleeding in the brain), cachectic (malnutrition or chronic illness), jaundice, hydration status (poor water intake) and cyanosis</i>

	<p><i>(reduce blood supply)</i></p> <p><i>Reason: to assess the severity of the patient's condition.</i></p> <ul style="list-style-type: none"> • Level of consciousness - Glasgow Coma Scale (GCS) <p><i>Reason: altered GCS suggestives of electrolyte imbalance, CNS infections or hypoglycemi .</i></p> <ul style="list-style-type: none"> • Vital signs <p><i>Reason: Temperature (high due to infections) and BP (low due to dehydration or severe sepsis)</i></p> <ul style="list-style-type: none"> • Systemic examinations: <p>✓ CNS</p> <ul style="list-style-type: none"> • Neck stiffness <i>Reason: possible meningeal irritation due to meningitis</i> • Papilledema <i>Reason: possible increased ICP (meningitis complication)</i> • Kernig's sign <i>Reason: examination for meningeal irritation</i> • Brudzinski's sign <i>Reason: examination for meningeal irritation</i> • Cranial nerves examination: <i>Reason: TRO localizing sign suggestive of specifics cranial nerve involvement</i> • Muscle bulk tone, power and reflexes: <i>Reason: TRO upper motor neuron lesions secondary to meningitis</i> <p>✓ ENT</p> <ul style="list-style-type: none"> • Ear and throat examination <i>Reason: TRO source of infection such as otitis media or pharyngitis</i> • Lymphadenopathy <i>Reason: to find out the source of infection</i> <p>✓ Respiratory</p> <ul style="list-style-type: none"> • Lungs examination <i>Reason: to assist in finding the source of infection (pneumonia or TB)</i> <p>✓ CVS</p> <ul style="list-style-type: none"> • Heart examination <i>Reason: to assist in finding the source of infection (bacterial endocarditis)</i> <p>✓ GIT</p> <ul style="list-style-type: none"> • Hepatosplenomegaly <i>Reason: to assist in finding the source of infection (abscess)</i> <p>✓ GUT</p> <ul style="list-style-type: none"> • Signs of UTI <i>Reason: to find out the source of infection</i>
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KEY LEARNING ISSUES

1. Elaboration and discussion on each of the possible causes of seizures
2. Explain the mechanism of seizures
3. Discuss types of meningitis
4. Explain the pathogenesis of meningitis
5. Describe the clinical features of meningitis

TRIGGER 3: PHYSICAL EXAMINATION

GENERAL EXAMINATION:

There were no gross dysmorphic features. He was irritated and lying still on the bed. There was no lymphadenopathy, pallor, jaundice or cyanosis. GCS was 13/15.

Vital signs:

Temperature: 40.5 °C
Pulse: 120/min, regular (65-110/min)
Blood pressure: 95/60 mmHg (95-110/60mmHg)
Respiratory rate: 32 /minute (<40)

ANTHROPOMETRIC MEASUREMENT:

Weight: 17.2 kg
Height: 105 cm

THROAT EXAMINATION:

Pharynx was not inflamed, and the tonsils were not enlarged. No palpable lymph nodes.

EAR EXAMINATION:

No ear discharge and there was no redness of the tympanic membranes.

FUNDOSCOPY:

Revealed no papilledema

NEUROLOGICAL EXAMINATION:

There was neck stiffness. Kernig's and Brudzinski's sign were positive. Cranial nerves examination could not be assessed properly due to child's inability to follow command. Muscle tone and power were normal in all limbs. Tendon reflexes were normal and equal bilaterally. Sensory examination was intact.

CARDIOVASCULAR SYSTEM:

The apex beat was in the left fourth intercostal space in the mid clavicular line. There was no thrill or parasternal heave. The first and the second heart sound were heard. No gallop rhythm.

RESPIRATORY SYSTEM:

The trachea was central. Vocal fremitus, percussion and vocal resonance were equal bilaterally. Vesicular breath sound was heard. There was no basal crackles (crepitation) heard over both lungs.

ABDOMEN:

The abdomen was not distended and it moves with respiration. On palpation, the abdomen was soft and non tender. The liver and the spleen were not palpable. The kidneys were not

ballotable. There were no other masses. There was no fluid thrill or shifting dullness. Bowel sounds were normal

With these findings, the pediatric team decided to perform lumbar puncture for CSF examination. The child's mother strongly disagree as she believed her child will be paralyzed due to lumbar puncture. After detailed explanation by the consultant, she finally gave consent and waited for the results anxiously.

STUDENTS' TASKS

1. Are there any term that you do not understand?
2. Summarize the additional information obtained from the trigger - FACTS
3. Discuss further your IDEAS (hypothesis) based on the additional information provided by integrating relevant basic medical sciences and clinical sciences knowledge into the case.
4. List the investigations you would perform and give reasons (what you NEED to know)
5. During the discussion identify 1-3 KEY (PRIMARY) LEARNING ISSUES (IMPORTANT **basic medical sciences** and or **clinical sciences** knowledge that the group need to find out more in order to work through the case).
Other issues that require further research can be categorised as SECONDARY LEARNING ISSUES

FACILITATOR NOTES

FACTS (What you know)	<ul style="list-style-type: none"> • GCS: 13/15 • fever • irritable • neck stiffness • Kernig's sign (+ve) • Brudzinski's sign (+ve)
IDEAS (Hypotheses)	<ul style="list-style-type: none"> • The presence of fever strongly supports infection. • The presence of drowsiness and irritability favours involvement of central nervous system. • The Kernig's sign, Brudzinsk's sign and neck stiffness support the diagnosis of meningitis. • The possible diagnosis at this point include: <ol style="list-style-type: none"> 1. Bacterial meningitis 2. Viral meningitis 3. Brain abscess 4. Encephalitis
What you NEED to know:	<p>Results of the following investigations:</p> <ul style="list-style-type: none"> • Full blood picture <i>Reason: TWC (leukocytosis, Leucopenia), Hb (anemia), HCT (dehydration), platelet (bleeding).</i> • Urine analysis <i>Reason: to exclude UTI</i> • Blood glucose

<p><i>Reason: to check blood glucose level (to compare with CSF glucose level) and hypoglycemia (poor oral intake)</i></p> <ul style="list-style-type: none"> • BUSE <p><i>Reason: to check electrolyte status (dehydration)</i></p> <ul style="list-style-type: none"> • Blood culture <p><i>Reason: to check septicemia</i></p> <ul style="list-style-type: none"> • ESR <p><i>Reason: inflammations occur in the body (not specific marker)</i></p> <ul style="list-style-type: none"> • CSF analysis <p><i>Reason: to confirm the diagnosis of meningitis</i></p>				
Types of meningitis	Appearance	Glucose	Protein	Cells
Acute bacterial	Turbid	Low	High	PMNs >300/mm ³
Acute viral	Clear	Normal	Normal or high	Mononuclear <300/mm ³
Tuberculosis	Slightly opaque cobweb	Low	High	Mononuclear <300.mm ³
Fungal	Clear	Low	High	<300.mm ³
Malignant	May be bloody	Low	High	Usually Mononuclear
<ul style="list-style-type: none"> • CSF culture <p><i>Reason: to get the microbiological diagnosis and antimicrobial sensitivity.</i></p> <ul style="list-style-type: none"> • Radiological examination: CT scan & MRI <p><i>Reason: to assess the pathological lesion levels objectively</i></p>				

KEY LEARNING ISSUES

1. Describe the physiology of CSF formation and flow
2. Describe normal CSF composition
3. Describe typical CSF findings in CNS infections
4. Discuss abducens nerve palsy

TRIGGER 4: INVESTIGATION RESULTS

1. **Full Blood Picture (FBP):**

Haemoglobin	12.1 g/L
Haematocrit:	40%
MCV	80 fL
MCH	27 pg
MCHC	32 g/dL
Total White Cells	20 x 10 ⁹ /L
Neutrophils	85 %
Lymphocytes	20 %
Monocytes	11 %
Eosinophils	2.3 %
Basophils	0.5 %
Platelet count	400 x 10 ⁹ /L

2. **Erythrocyte Sedimentation Rate:** 43 mm/Hr (<20mm/hr)

3. **BUSE**

Urea	3.7 mmol/L
Sodium	137 mmol/L
Potassium	4.4 mmol/L
Chloride	98 mmol/L
Creatinine	70 µmol/L

4. **Liver Functions Test:**

Total protein	70 g/L
Albumin	40 g/L
Total bilirubin	15 µmol/L
Indirect bilirubin	54 µmol/L
Direct bilirubin	4 µmol/L
Alkaline phosphatase	77 U/L
Alanine transaminase	36 U/L
Aspartate transaminase	36 U/L

5. **Urine analysis:** No abnormality detected.

6. **Chest x-ray:** No abnormality detected.

7. **Random blood glucose:** 4.2 mmol/L (3.5-6 mmol/L)

8. **Blood culture:** *Haemophilus influenza* detected

9. **CSF analysis:**

Appearance	Cloudy	N: clear
Cell count	750/mm ³	N: 0

Polymorphs	84%	N: 0
Glucose	0.1 mmol/L	1.7-6.7 mmol/L
Protein	1.0 g/L	Bacterial: 1-5 g/L
Globulin	Positive	N: nil

10. **CSF Gram stain:** Gram-negative coccobacilli
11. **CSF culture:** *Haemophilus influenzae* detected
12. **CT scan of brain:**
Mild hydrocephalus, no herniation, no midline shift, or acute hemorrhage

STUDENTS' TASKS

1. Are there any term that you do not understand?
2. Discuss the investigation results- FACTS
3. Discuss further your IDEAS (hypothesis) and finalise your diagnosis.
4. During the discussion identify 1-3 KEY (PRIMARY) LEARNING ISSUES (IMPORTANT **basic medical sciences** and or **clinical sciences** knowledge that the group need to find out more in order to work through the case).
Other issues that require further research can be categorised as SECONDARY LEARNING ISSUES
5. Discuss the **Islamic Perspective of Alternative/Complementary Medicine**.

FACILITATOR NOTES	
FACTS (What you know)	<ul style="list-style-type: none"> • Neutrophil leucocytosis • Increased E.S.R • Positive blood culture • C.S.F Gram stain • Blood culture -<i>Haemophilus influenzae</i>. • C.S.F analysis - bacterial meningitis present • C.S.F culture - <i>Haemophilus injluenzae</i> • CT scan -Mild hydrocephalus
IDEAS (Hypotheses)	<p>This is a case of bacterial meningitis based on laboratory findings.</p> <p>Point to support the diagnosis:</p> <ul style="list-style-type: none"> • Presented with signs and symptoms related to meningitis • On examination, there were neck stiffness, Kernig's sign, Brudzinski 's sign, and extensor plantar response • Blood culture revealed presence of <i>Haemophilus influenzae</i> • Full blood picture showed neutrophil leucocytosis • C.S.F analysis showed features of bacterial meningitis • C.S.F culture showed presence of <i>Haemophilus influenza</i> • CT scan showed Mild hydrocephalus (complication of meningitis)
What you NEED to know:	<ul style="list-style-type: none"> • Further investigations to find out the cause of hydrocephalus <i>Reason:</i> to assist in further management • Principles of management of bacterial meningitis • Antibiotic therapy

KEY LEARNING ISSUES

1. Discuss hydrocephalus
2. Describe the basic principle of managment of bacterial meningitis.
3. Discuss the Islamic perspective regarding care of human body as amanah from ALLAH SWT.

NOTES ON KEY LEARNING ISSUES

TRIGGER 1

1- Control of normal body temperature

The constancy of the body's temperature is maintained by balancing the amount of heat produced in the body with that of lost.

Sources of heat

- a. From the environment
- b. From metabolic activity

Areas of heat loss

- a. Heat required to warm inspired air and ingested food
- b. Heat loss by convection, conduction, and radiation from the body surface
- c. Heat loss by evaporation of water

The temperature-regulating mechanism

- a. The central receptor
- b. Peripheral temperature receptors

2. Fever

a. Definition

Fever may be defined as an elevation of the body's temperature consequent upon a disturbance of the regulating mechanism.

b. Causes

- Heatstroke
- Infection
- Infarction
- Tumours
- Haemorrhage
- Brain damage
- Following injury
- Severe anaemia
- Miscellaneous conditions

c. Pathogenesis

Fever is generally due to the release of endogenous pyrogens from cells of the mononuclear phagocyte system. The principal pyrogens are the cytokines IL-1 and TNF. They are released in response to many stimuli. The inflammation may be in response to an infective agent.

The endogenous pyrogens cause fever when injected into an experimental animal. This is not direct but is mediated via an increased in synthesis of PGE2 to cause an increase in temperature.

There are number of exogenous pyrogens. These include various extracts of dead tissue but the best knowns are the bacterial pyrogens. These are lipopolysaccharide endotoxins of gram- negative bacteria. It is evident that the exogenous pyrogens act indirectly by causing the release of IL-1 and TNF from cells of the mononuclear phagocyte system.

TRIGGER 2

1. ELABORATION AND DISCUSSION ON EACH OF THE POSSIBLE CAUSES:

1. Causes of seizures

A seizure is any clinical event caused by an abnormal electrical discharge in the brain, whilst epilepsy is the tendency to have recurrent seizures.

Pathological causes:

- a. Genetic
- b. Developmental
- c. Tumours
- d. trauma
- e. Vascular
- f. Infections
- g. Inflammation
- h. Metabolic
- i. Drugs
- j. Alcohol
- k. Toxins
- l. Degenerative

Infective causes of secondary generalized epilepsy:

- a. Meningitis
- b. Post-infectious encephalopathy

Infective causes of partial epilepsy:

- a. Pyogenic cerebral abscess
- b. Toxoplasmosis
- c. Cysticercosis
- d. Tuberculoma
- e. Subdural empyema
- f. Encephalitis
- g. *HN* infection

2. Mechanism of seizure (Pathophysiology)

In the normally functioning cortex, recurrent and collateral inhibitory circuits limit synchronous discharge amongst neighboring groups of neurons. The inhibitory transmitter GABA is particularly important in this role, and drugs that block GABA receptors provoke seizures. Epileptic cerebral cortex exhibits hypersynchronous repetitive discharges involving large groups of neurons. Intracellular recordings show bursts of rapid action potential firing, with reduction of transmembrane potential. It is likely that both reduction in inhibitory systems and excessive excitation play a part in the genesis of seizure activity. Cells undergoing repetitive epileptic discharges undergo morphological and physiological changes which make them more likely to produce subsequent abnormal discharges (kindling).

The chief division of seizure types on physiological ground is between partial seizure in which paroxysmal neuronal activity is limited to one part of the cortex, and generalized seizures where the electrophysiological abnormality involves both hemispheres simultaneously and synchronously. If partial seizures remain localized, the symptomatology depends on the cortical area affected. If consciousness is preserved, the attack is termed a simple partial seizure. However, if the activity involves parts of the brain concerned with awareness, then consciousness is affected and a complex partial seizure results.

3. Causes of Meningitis:

- a. Infective causes: Bacteria, Viruses, Protozoa, Parasites and Fungus
- b. Non-infective causes: Malignant causes & inflammatory disease.

4. Pathogenesis of bacterial meningitis

Many bacteria can cause meningitis. Certain organisms are particularly common at different ages. Bacterial meningitis is usually secondary to bacteraemic illness, although infection may result from direct spread from an adjacent focus of infection in the ear, skull fracture or sinus. An important factor in determining prognosis is early diagnosis and prompt initiation of appropriate therapy.

The meningococcus and other common causes of meningitis are normal commensals of the upper respiratory tract. New and potentially pathogenic strains are acquired by the air-borne route, but close contact is necessary.

In pneumococcal and Haemophilus infection there may be an associated otitis media.

Pneumococcal meningitis may be associated with pneumonia and occurs especially in older patients and alcoholics.

5. Clinical features of bacterial meningitis

Headache, drowsiness, fever and neck stiffness are the usual presenting features. In severe bacterial meningitis the patient may become comatose and later there may be focal neurological signs. Meningococcal meningitis is associated with a purpuric rash in 70% of cases. When accompanied by septicemia, it may present very rapidly, with abrupt onset of obtundation due to cerebral oedema, probably as a result of endotoxin and/or cytokine release, and circulatory collapse.

6. Infections of the nervous system

- a. Bacterial infections
- b. Viral infections
- c. Prion diseases
- d Protozoa] infections
- e. Helminthic infections
- f. Fungal infections

TRIGGER 3

I. C.S.F. circulation

Cerebrospinal fluid is formed at a rate of about 500 ml each day, which is three to four times as much as the total volume of fluid in the entire cerebrospinal fluid system. About two thirds or more of this fluid originates as secretion from the choroid plexuses in the four ventricles, mainly in the two lateral ventricles. Additional small amounts of fluid are secreted by ependymal surfaces of all the ventricles and by the arachnoidal membranes. A small amount comes from the brain itself through the perivascular spaces that surround the blood vessels passing through the brain. The main channels of fluid flow from the choroid plexuses and then through the cerebrospinal fluid system. The fluid secreted in the lateral ventricles passes first into the third ventricle; then, after addition of minute amounts of fluid from the third ventricle, it flows downward along the aqueduct of Sylvius into fourth ventricle through three small openings, two lateral foramina of Luschka and a midline foramina of Magendie entering the cisterna magna, a fluid space that lies behind the medulla and beneath the cerebellum.

The cisterna magna is continuous with the subarachnoid space that surrounds the entire brain and spinal cord. Almost all the CSF then flows from the cisterna magna through the subarachnoid spaces surrounding the cerebellum. From there, the fluid flows into and through multiple arachnoid villi that project into the large sagittal venous sinus and other venous sinuses of the cerebrum. Thus, any extra fluid emptied into the venous blood through the pores of villi.

2. C.S.F. analysis

Lumbar puncture involves the insertion of a needle between lumbar spinous process, through the dura and into the CSF under local anaesthetic. Intracranial pressure can be measured and CSF removed for analysis. CSF is normally clear and colourless. Test usually performed on CSF include centrifuging to determine the colour of the supernatant, biochemistry, microbiology, immunology, and cytology.

3. CSF values in various diseases

CSF indices in meningitis

a. Normal

Cell type	lymphocytes
Cell count	$0-4 \times 10^9 / L$
Glucose	greater than 60% of blood glucose
Protein	up to 0.45 g /L

Gram stain -

b. Bacterial

Cell type polymorphs
Cell count 1000-5000
Glucose low
Protein normal/elevated
Gram stain positive

c. Viral

Cell type lymphocytes
Cell count 10-2000
Glucose normal
Protein normal
Gram stain -

d. Tuberculosis

Cell type Polymorphs/lymphocytes/mixed
Cell count 50-5000
Glucose low
Protein elevated
Gram stain -

4. Culture

Specimens are grown on Iso VitaleX-enriched chocolate agar until typical colonies appear. H. Influenza is differentiated from related Gram-negative bacilli by its requirements for X and V factors and by its lack of hemolysis of blood agar. Tests for X and V factors requirements can be done in several ways.

5. Bacterial causes of meningitis

a. Neonate

- Gram-negative bacilli
- Group B streptococci

b. Pre-school children

- H influenza
- N meningitidis
- Streptococcal pneumoniae

c. Older child and adult

- N Meningitidis
- Streptococcal pneumoniae

TRIGGER 4

2. PRINCIPLES OF MANAGEMENT

- 1-Chemotherapy of bacterial meningitis
- 2-Treatment of hydrocephalus according to the cause

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