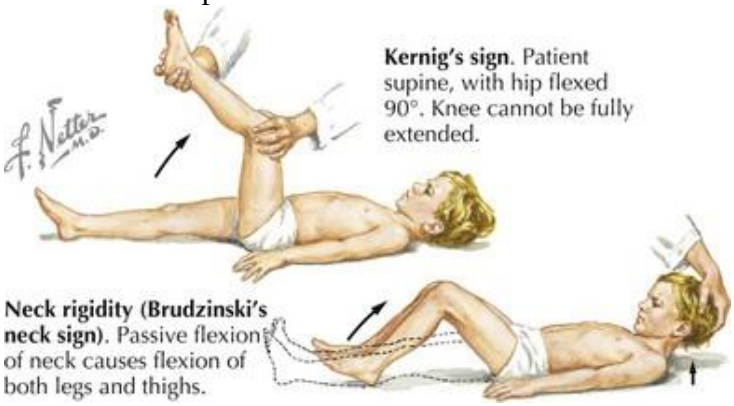
- **Case: a 2 years old child presents to the hospital with fever.**
  - **What are the questions which you need to ask (from head to toe)? Notice that the answers to our case will be in bold:**
    - ✓ You will ask about the onset of the fever, is it high-grade or low-grade, are there any rigors or shivering, is the fever continuous or intermittent and you will ask about presence of convulsions.
    - ✓ Level of consciousness? **unconscious.**
    - ✓ Are there any respiratory symptoms associated with the presence of fever (to rule out infections). **No respiratory symptoms.**
    - ✓ Vomiting (color, frequency which gives you a clue to suspect dehydration, relation of vomiting to feeding, presence of food in the vomit, it is projectile, is it associated with nausea or abdominal pain). ← GI system
    - ✓ Refusal to feed? **Yes** ← GI system
    - ✓ Is there diarrhea? **No** ← GI system
    - ✓ It there a burning mucturition (to rule out UTI)? **No**
    - ✓ You need to ask about the presence of skin rash (because fever and rash gives you a suspicion of chickenpox or meningoccemia).
  - **Physical examination:**
    - ✓ You start by taking the vital signs (temperature, pulse, blood pressure and respiratory rate).
    - ✓ Inspection:
      - ❖ Does the patient look alert and conscious (if the patient can talk then talk to him and ask about his name and if he know where he is)? **No**
      - ❖ If the patient is unable to open his eyes → this indicates photophobia.
      - ❖ Can you notice any rash (found with meningococcemia).
      - ❖ Check for signs of dehydration (if vomiting is present) which is indicated by → dry mucus membranes, sunken eyes, skin turgor, sunken fontanelle (but it will close at around the age of 18 months), tachycardia, hypotension and peripheral vasoconstriction.
      - ❖ Look for any signs of pallor (eye conjunctiva), jaundice (sclera of the eye), central cyanosis (mouth) or peripheral cyanosis (hands and feet).
    - ✓ Examination:
      - ❖ *Head*: feel the anterior fontanelle and measure head circumference (to see if there is hydrocephalus).
      - ❖ *Neck*: lymph nodes (submental, submandibular, anterior cervical, posterior cervical, preoricular, postoricular, occipital and supraclavicular).
      - ❖ *Chest (lungs and heart).*
      - ❖ *Abdomen*: **this patient has a scaphoid abdomen due to refusal of feeding.**
      - ❖ *CNS:*
        - ➢ Is there eye squinting (due to abducens nerve palsy)?
        - ➢ Fundoscopy (to look for papilledema, retinal hemorrhage… etc).
        - ➢ Meningeal signs (as meningitis is suspected in this patient):
          - ▪ Neck stiffness (that would be painful when you try to flex the head of the patient). **Positive**
          - ▪ Kernig's sign: flexing the hip and trying to extend the knee (it is considered to be positive if there is resistance). **Positive**

- Brudzinski's sign: involuntary lifting of the legs when the head of the patient is flexed. **Positive**



- **Investigations:**
  - **All of the information obtained above are suggestive of pyogenic meningitis which will be confirmed by the following:**
    - ✓ CBC: to look for leukocytosis (which is found with pyogenic meningitis). **Present**
    - ✓ Blood culture (to detect organisms causing the infection).
    - ✓ Urea and electrolytes (when vomiting is present).
    - ✓ Acute phase reactants which rise in case of inflammation (e.g. C-reactive protein and ESR). **Elevated**
    - ✓ Imaging: usually by CT-scan or MRI (first to rule out the presence of increased intracranial pressure which is a contraindication of lumbar puncture). With imaging, you will look for structural issues such as edema, hydrocephalus or dilated ventricles. "Basal enhancement" is diagnostic for Tb-meningitis.
    - ✓ Lumbar puncture: to obtain a sample of CSF that will be sent for biochemistry:

	Color	Cells	Glucose	Protein
Normal	Clear	0-5 lymphocytes	2.2-3.3	0.4
Pyogenic meningitis	Turbid	Neutrophils	↓	↑
Tuberculous meningitis	Turbid ± fibrin web	Lymphocytes	Normal/↓	↑
Viral	Clear	Lymphocytes	Normal	↑

- **Treatment:**
  - Pyogenic meningitis: 3rd generation cephalosporins with ampicillin or vancomycin.
  - Viral meningitis: supportive with no treatment required.
  - Tb meningitis: Tb medications.
- **Notes:**
  - If encephalitis it suspected all of the steps mentioned above will be the same except that you will detect brain edema and brain patches with CT-scan. In addition, you must do an EEG. The patient will be treated with antiviral medications (e.g. acyclovir) because encephalitis is mostly caused by herpes virus.
  - Common causes of pyogenic meningitis (according to age groups):

Age group	Causes
Newborns	Streptococcus agalactiae + E.coli
Infants/ children	H.influenzae + S.pneumoniae + N.meningitidis
Adolescents/ young adults	S.pneumoniae + N.meningitidis
Elderly	Listeria monocytoogenes + S.pneumoniae