20
PATHOLOGY OF NERVOUS SYSTEM

- Encephalitis
- Encephalomalacia
- Spongiform Encephalopathy
- Meningitis
- Neuritis
- Model Questions
Nervous system is composed of brain, spinal cord, and peripheral nerves. The neuron is a basic functional unit of nervous system. Necrosis of neurons in brain is known as encephalomalacia while necrosis of neurons in spinal cord is termed as myelomalacia. If the necrosis occurs in gray matter it is known as polioencephalomalacia while necrosis of neurons in white matter is called as leukoencephalomalacia. There are three types of scavenger cells in nervous system known as microglial, oligodendroglial and astrocytes. Microglial cells surround the necrotic neurons and are known as satellite cells and the process is called as satellitosis. As the neuron dies, it is engulfed by microglial cell and this process is termed as neuronophagia. The necrosis of nerve fibers starts from myelin sheath and this change is called as demyelination or wallerian degeneration.

The brain and spinal cord is covered by meninges. The inflammation of meninges is termed as meningitis. Meningoencephalitis is used for inflammation of both meninges and brain. Inflammation of duramater is known as pachymeningitis and of piamater is termed as leptomeningitis. Hydrocephalus means accumulation of clear fluid in ventricles and in sub arachnoid space due to obstruction in drainage. Hydrocephalus occurs in neonatal calves due to influenza and parainfluenza virus and is termed as congenital hydrocephalus.

Some nutritional deficiency like vitamin A, folic acid, vitamin B₁₂, niacin and zinc may also lead to hydrocephalus. Cerebeller hypoplasia has been observed due to bovine virus diarrhoea, hog cholera and feline panleukopenia virus. Some other congenital malformations are as under.

**Microencephaly** means absence of brain.

**Microencephaly** means small size of brain.

**Craniocerebral** is failure of cranium to fuse which results in hernia of meninges and known as meningocele. Hernia of meninges and brain is known as meningoecephalocele.

**ENCEPHALITIS**

Encephalitis is the inflammation of brain characterized by purulent/lymphocytic or proliferative changes. Encephalomyelitis is the inflammation of brain as well as spinal cord (Fig. 20.1 to 20.11).

**Etiology**

- **Bacteria**
  - *Listeria monocytogenes* (*L. ivanovii*) main cause
  - *Haemophillus* spp.
  - *Pasteurella* spp.

- **Virus**

- **Mycoplasma**

- **Strychnine poisoning**

**Macroscopic features**

- Congestion
- Haemorrhage
- Small, tiny abscess
- Necrosis also known as encephalomalacia.
- Involvement of spinal cord leads to encephalomyelitis and of meninges is termed as meningoencephalitis.

**Microscopic features**

- Tiny or micro abscess in cerebrum
- Infiltration by neutrophils and lymphocytes.
- Perivascular cuffing in Virchow Robin space by lymphocytes
- Necrosis of neurons.
- Satellitosis, neuronophagia
- Pleocytosis- Increase in number of white blood cells in cerebrospinal fluid.

**ENCEPHALOMALACIA**

Encephalomalacia is the necrosis of nervous tissue in brain characterized by loss of normal architecture and soft friable liquified mass (Fig. 20.12 & 20.13).

**Etiology**

- Deficiency of copper, thiamine, vitamin-E.
- Poisons: Bracken fern, lead, mercury, salt poisoning, enterotoxaemia, mycotoxins.
Fig. 20.1. Photograph of brain showing congestion in poultry

Fig. 20.2. Photograph showing abscess in brain (ARS/USDA)

Fig. 20.3. Photograph showing cerebellar hypoplasia

Fig. 20.4. Photograph showing staggering gait in buffalo calf due to strychnine poisoning

Fig. 20.5. Photograph showing spasms in neck due to strychnine poisoning

Fig. 20.6. Photograph showing torticollis in buffalo calf due to strychnine poisoning

Fig. 20.7. Photomicrograph showing perivascular cuffing in brain.

Fig. 20.8. Photomicrograph showing meningoencephalitis
Macroscopic features
- Encephalomalacia - necrosis in brain.
- Myelomalacia necrosis in spinal cord.
- Poliomalacia is necrosis in brain gray matter.
- Leukomalacia is necrosis in brain white matter.
- Soft, friable liquified mass in brain.
- Congestion.

Microscopic features
- Liquefactive necrosis
- Surrounded by neurological cells/scavenger cells.
- Proliferation of small new capillaries

SPONGIFORM ENCEPHALOPATHY
Spongiform encephalopathy is characterized by the presence of vacuoles in grey and/or white matter.

Etiology
- Prion proteins
- Scrapie in sheep
- BSE in cattle

Macroscopic feature
- No characteristic gross lesion.
- Oedema of brain or hydrocephalus
- Congestion

Microscopic features
- Vacuolation in white and grey matter
- Vacuoles are usually in neurons, glial cells and in myelin
- Vacuoles are more extensive in medulla, pons and mid brain and gives brain “spongy form”.

MENINIGITIS
Meningitis is the inflammation of meninges, usually occurs along with encephalitis or encephalomyelitis and characterized by congestion and infiltration of neutrophils and mononuclear cells. Pachymeningitis is inflammation of durameter while leptomeningitis involves the piameter.

Etiology
- Virus e.g. swine fever
- Trauma
- Bacteria e.g. Pasturella, Listeria
- Toxoplasma
- Leptospirosis

Macroscopic features
- Congestion
- Thickening of meninges.
- Petechial haemorrhage

Microscopic features
- Congestion
- Infiltration of neutrophils and lymphocytes.
- Fibrosis

NEURITIS
Neuritis is the inflammation of nerves along with degenerative changes characterized by oedema, infiltration of inflammatory cells (Fig. 20.14 to 20.16).

Etiology
- Toxins
- Trauma
- Virus e.g. Marek’s disease MD
- Lead and Mercury
- Bacteria e.g. Strangles
- Deficiency of vitamin E.

Macroscopic features
- Wallerian degeneration
- Infiltration of neutrophils and lymphocytes.
- More destruction at distal end of the neuron.
Fig. 20.9. Photomicrograph showing congestion and infiltration of inflammatory cells in brain.

Fig. 20.10. Electronmicrophotograph of brain showing increase in endoneural space and wallerian degeneration in nerve fiber.

Fig. 20.11. Electron microphotograph of brain showing phagocytosis of degenerated nerve cell by phagocytic cell (Neuronophagia).

Fig. 20.12. Photograph showing encephalomalacia in a chick.

Fig. 20.13. Photomicrograph showing encephalomalacia.

Fig. 20.14. Photograph showing neuritis due to Marek’s disease.

Fig. 20.15. Electronmicrophotograph of sciatic nerve showing degeneration of myelinated fibers with swelling and fragmentation.

Fig. 20.16. Electron microphotograph of sciatic nerve showing advanced wallerian degeneration and increased endoneural space.
MODEL QUESTIONS

Q.1. Fill in the blanks with suitable word(s).
1. Necrosis of neurons in brain is known as ................ while of spinal cord in termed as ...............  
2. Encephalitis is the ................ of brain caused mainly by ................ and characterized by ................, ................, ................, ................ and ................  
3. Necrosis of nerve cells in grey and white matter is known as ................ and ................, respectively. The necrosed neurons are surrounded by ................ cells and the termed as ................ while they are eaten away by these cells and the process is known as ................  
4. Vacuoles in ................, ................ and ................ and which are more prominent in ................ , ................ and ................ and gives the brain ............... are only diagnostic lesions of BSE in cattle.  
5. The inflammation of piamater is ................ and of durameter is ................  

Q.2. Write true or false against each statement and correct the false statement.
1. ...........Meningoencephalomyelitis is the inflammation of brain and meninges  
2. ...........Vitamin B\textsubscript{12} deficiency may cause cerebral hydrocephalus.  
3. ...........Neuronophagia is necrosis of nerve fibers.  
4. ...........Inflammation of durameter is known as patchymeningitis  
5. ...........Polioencephalomalacia is inflammation of white matter of brain.  
6. ...........Spongiform encephalopathy is caused by a virus.  
7. ...........Vacuoles in neurons in brain are main diagnostic lesion which helps in diagnosis of BSE.  
8. ...........Leptospirosis may cause meningitis and myelitis.  
9. ...........Neuritis can be observed in Marek’s disease.  
10. ...........Myotoxins may cause encephalomalacia in calves.  

Q.3. Define the followings.
1. Myelomalacia  
2. Satellitosis  
3. Neuronophagia  
4. Pleocytosis  
5. Cranioschisis  
6. Microencephaly  
7. Anencephaly  
8. Meningoencephalomyelitis  
9. Corebellar hypoplasia  
10. Leptomeningitis  
11. Leukomalacia  
12. Wallerian degeneration  
13. Poliomalacia  
14. Pachymeningitis  
15. Perivascular cuffing  

Q.4. Write short notes on.
1. Bovine spongiform encephalopathy  
2. Encephalomalacia  
3. Encephalitis  
4. Meningitis  
5. Hydrocephalus
Q.5. Select most appropriate word(s) from the four options given against each statement.

1. Neuritis is observed in ............
   (a) Mucosal disease  (b) Infectious bursal disease (c) Marek’s disease  (d) ILT

2. Necrosis of brain in known as ............
   (a) Encephalomalacia  (b) Polioencephalomalacia (c) Myelomalacia  (d) None of the above

3. Removal of dead neurons through microglial cells in known as ............
   (a) Satellitosis  (b) Neuronophagia  (c) Perivascular cuffing  (d) None

4. Increase in number of white blood cells in cerebrospinal fluid in termed as ............
   (a) Encephalitis  (b) Satellitosis  (c) Pleocytosis  (d) Leukoencephalomalacia

5. Spongiform encephalopathy is caused by ............
   (a) Virus  (b) Viroids  (c) Prions  (d) Deficiency of vit B₁₂

6. Inflammation of dura mater is known as ............
   (a) Leptomeningitis  (b) Pachymeningitis  (c) Meningitis  (d) Meningoencephalitis

7. Congenitally small size brain is termed as ............
   (a) Anencephaly  (b) Hydrocephalus  (c) Microencephaly  (d) Cranioschisis

8. Phagocytic cells of brain is ............cell(s)
   (a) Astrocytes  (b) Microglial  (c) Oligodendroglial  (d) All of the above

9. Increase in CSF in sub arachnoid space is known as ............
   (a) Pleocytosis  (b) Hydrocephalus  (c) Microencephaly  (d) Hypoplasia

10. Hernia of meninges through cranioschisis is known as ............
    (a) Hydrocele  (b) Meningocele  (c) Meningoencephalocele  (d) None