

NEUROCYSTICERCOSIS

BY- DR.MUJTABA QURESHI
PG PAEDIATRICS

MODERATOR- DR SRINIVAS
ASST.PROF OF PAEDIATRICS

Objectives

- ✘ Organism
- ✘ Terminology
- ✘ Life cycle
- ✘ History
- ✘ Epidemiology
- ✘ Pathophysiology
- ✘ Clinical features
- ✘ Differential diagnosis

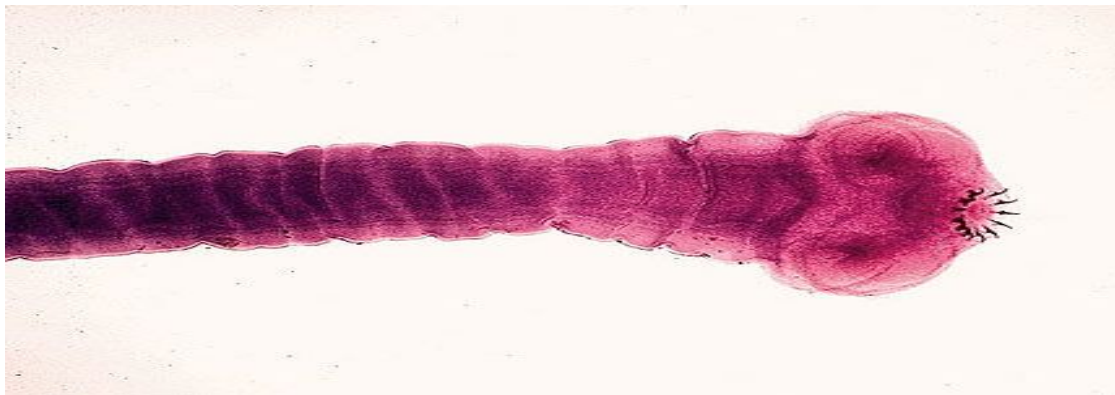
Organism

⌘ Pork tapeworm - *Taenia solium*

⌘ Host:

Intermediate – pig

Definitive - human



Terminology

- ✘ The adult taenia solium in the intestine of humans is referred taeniasis
- ✘ Larval form of taenia solium is the Cysticerci
- ✘ Presence of cysticerci in the body is Cysticercosis and
- ✘ Presence of cysticerci in the brain is Neurocysticercosis.

LIFE CYCLE

MODE OF TRANSMISSION

- Ingestion of food contaminated with taeniid eggs.
- The faeco-oral route in individuals harbouring the intestinal cestode.
- Eating of uncooked pork infected with cysticerci.



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Embryonated eggs ingested by human host **7**

Oncospheres hatch, penetrate intestinal wall, and circulate to musculature **8**

Cysticerci may develop in any organ, being more common in subcutaneous tissues as well as in the brain and eyes

Cysticercosis

Oncospheres hatch, penetrate intestinal wall, and circulate to musculature **3**

Oncospheres develop into cysticerci in pig muscle

Humans infected by ingesting raw or undercooked infected meat **4**

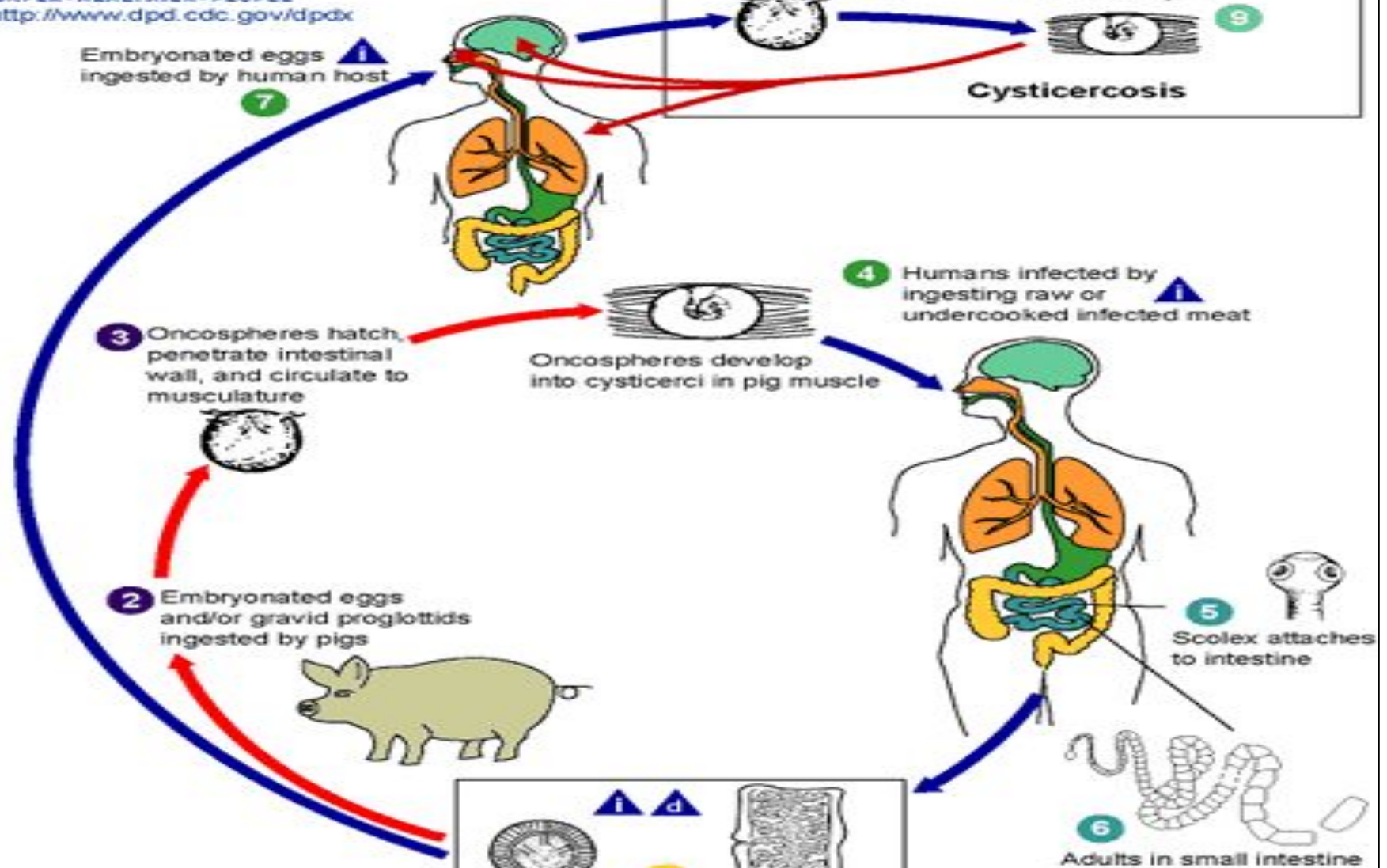
Embryonated eggs and/or gravid proglottids ingested by pigs **2**

Scolex attaches to intestine **5**

Adults in small intestine **6**

i **d**
1
Eggs or gravid proglottids in feces and passed into environment

i = Infective Stage
d = Diagnostic Stage



HISTORY

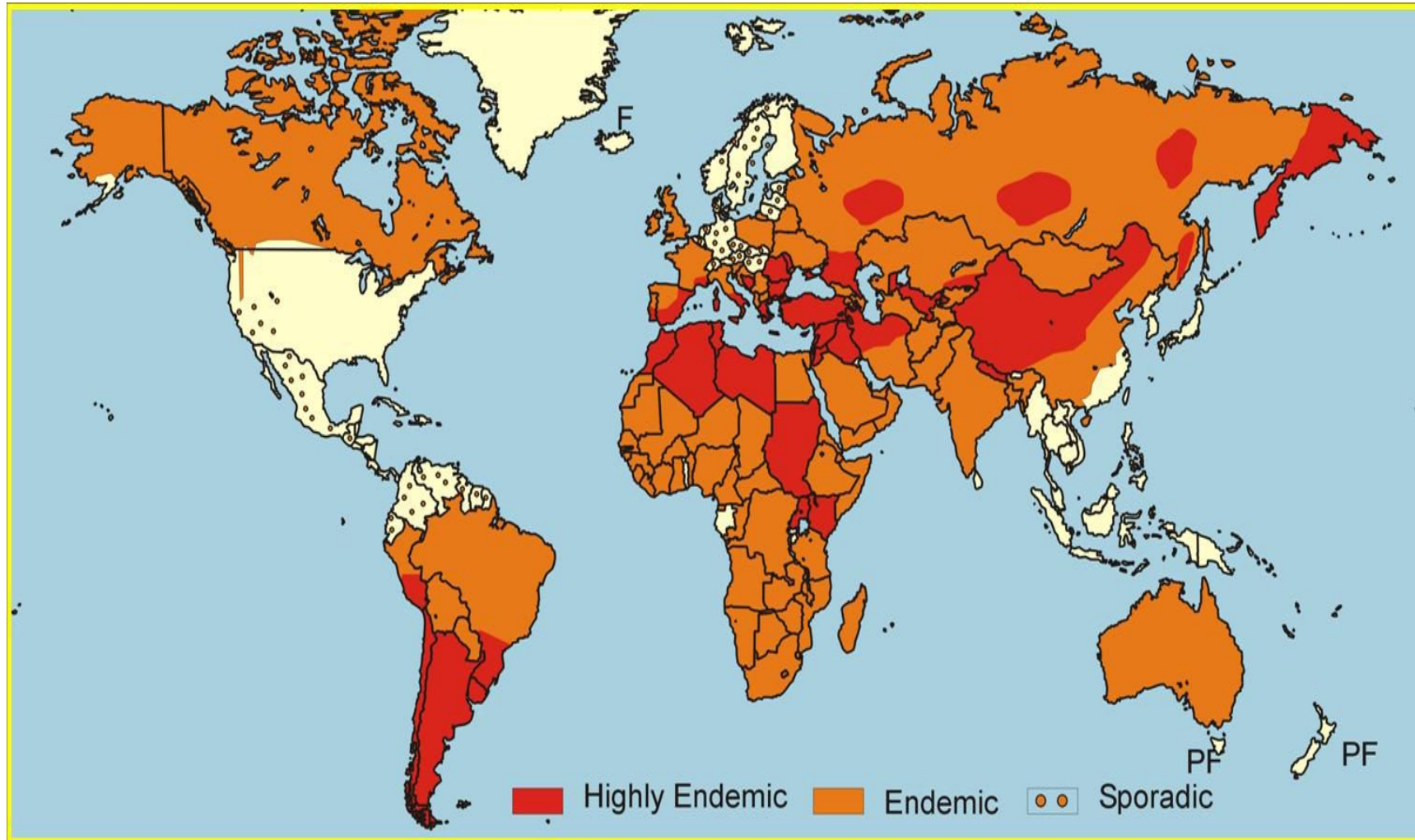
- ❧ The description of measles pork in the History of animals written by Aristotle (384–322 BC) showed that the infection of pork with tapeworm was known to ancient Greeks at that time.
- ❧ It was also known to Jewish and later to early Muslim physicians and has been proposed as one of the reasons for pork being forbidden by Jewish and Islamic dietary laws.

Recent examination of evolutionary histories of hosts and parasites and DNA evidence show that over 10,000 years ago, ancestors of modern humans in Africa became exposed to tapeworm when they scavenged for food, and later passed the infection on to domestic animals such as pigs.

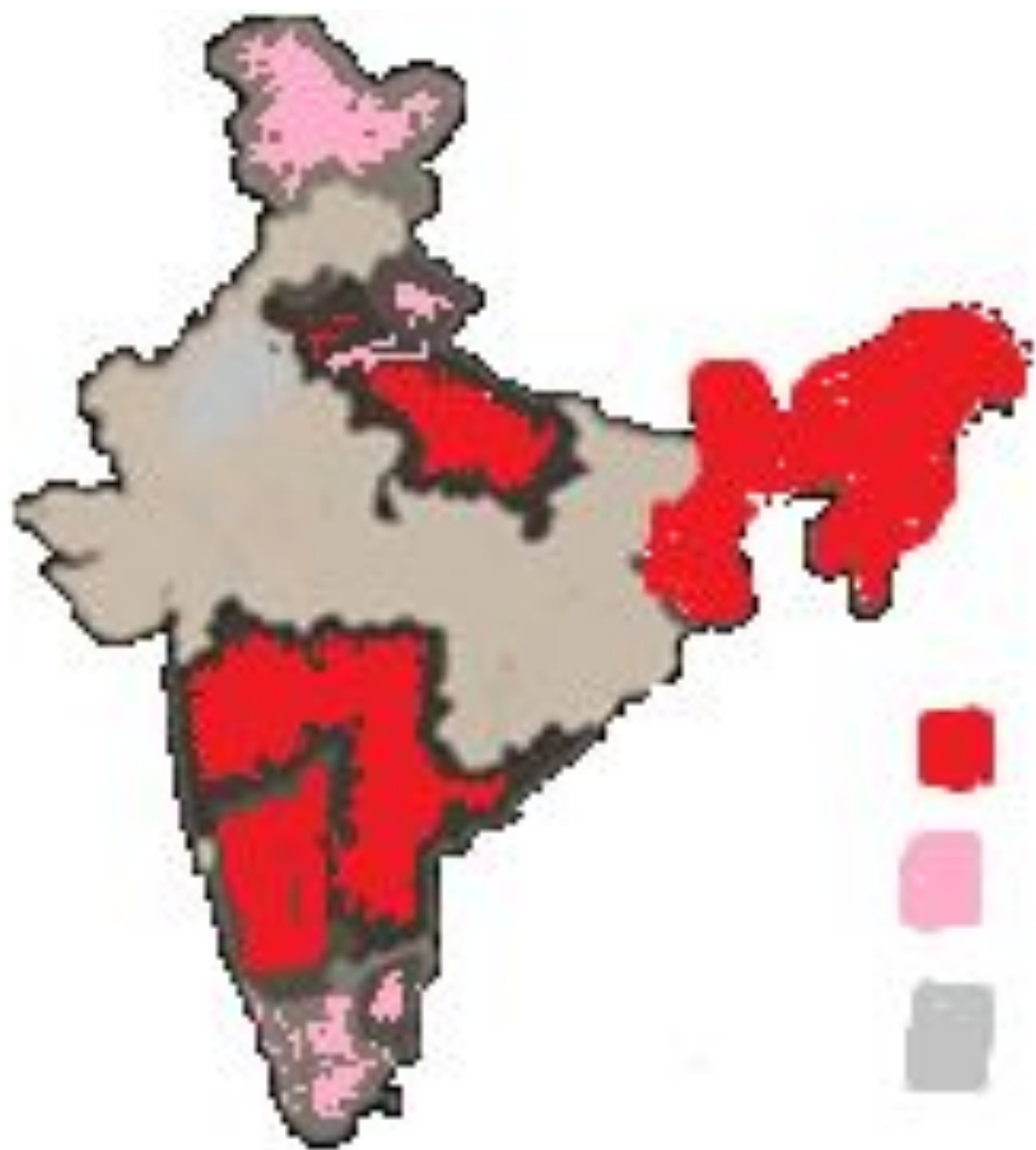
Cysticercosis was described by Johannes Udalric Rumler in 1555; however, the connection between tapeworms and cysticercosis had not been recognized at that time.




☞ Around 1850, Friedrich Küchenmeister fed pork containing cysticerci of *T. solium* to humans awaiting execution in a prison, and after they had been executed, he recovered the developing and adult tapeworms in their intestines.

EPIDEMIOLOGY



a major public health problem globally



-  Areas suggested to be highly endemic
-  Areas suggested to be moderately endemic
-  Areas with no or very few cases

- ✂ In a community based study in Vellore district of South India the prevalence of NCC causing active epilepsy was 1.3 per 1000 population.
- ✂ The results revealed high levels of exposure of the population to the parasite and a relatively high prevalence of active infections (4.5% antigen positives) but a low prevalence of NCC causing active epilepsy (0.13%)
- ✂ Low proportion of pork eaters amongst Indian patients is the other unusual feature of the disease, less than 1-2% of patients with NCC admits eating pork and more than 95% of Indian patients with NCC are vegetarians

Neurocysticercosis (NCC)

- MC parasitic infection of human nervous system.
- NCC accounts for 2-10% seizures in children.
- Two-third of NCC have solitary granuloma.
- Symptoms occur months to years after infection.
- Physical problems occur during death of cysticerci

PATHOGENESIS

- ✂ Evolution occurs from a non attenuating cyst, to a ring with perilesional edema, to a disc lesions which may disappear, persist or even calcify.
- ✂ Cycsticerci often live asymptotically within host tissues for years as they have developed various mechanisms for evading host response.

NCC- site

⌘ parenchymal

⌘ extra parenchymal

- intraventricular
- meningeal
- spinal
- ocular

STAGES OF NCC

four stages

- i. *Cystic or vesicular stage* is viable and comprises of well-defined, fluid-filled membrane containing scolex. Living, intact cyst usually do not provoke a strong immunologic response.

Intact cysts can be associated with disease when the initial parasite invasion of the brain is massive or when they obstruct the flow of cerebrospinal fluid (CSF).

ii. *Degenerating, colloid stage*

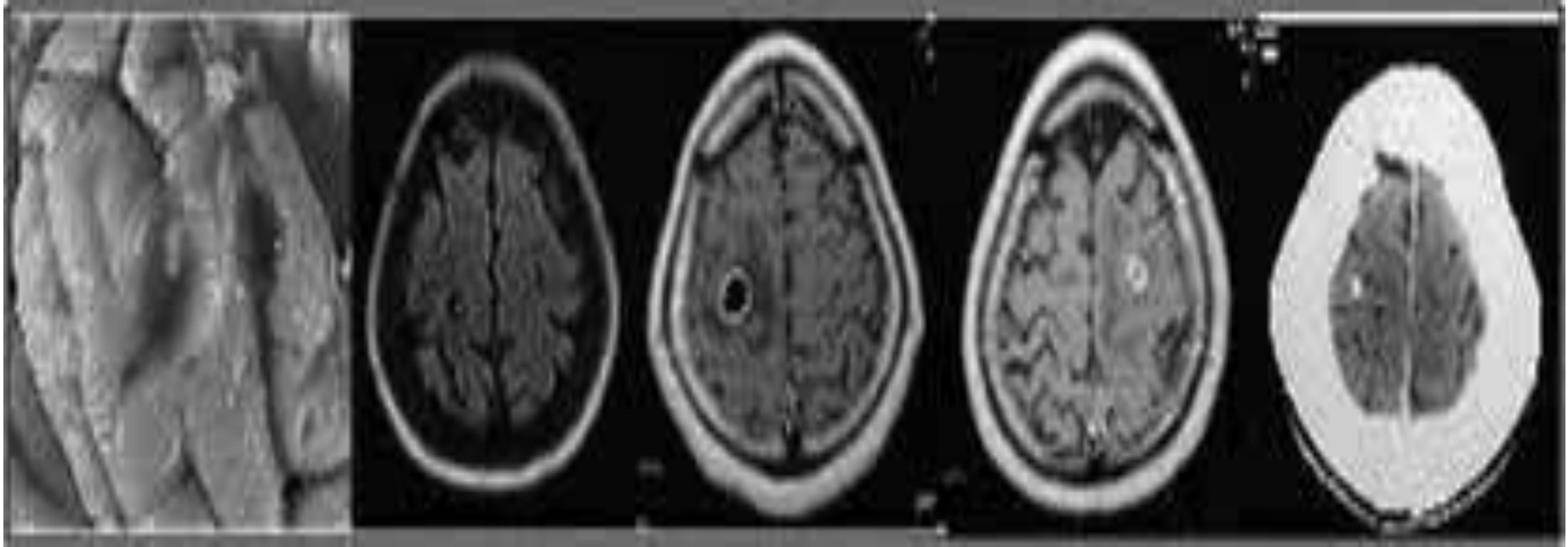
Most cysts remain viable for 5- 10 yrs and then began to degenerate, followed by a vigorous host response.

It appears as eosinophilic structure in which components of the bladder and scolex are in various stages of disintegration and tissue around have multinuclear giant cells, foamy macrophages, and neutrophils.

The natural history of cysts is to resolve by complete resorption or calcification.

iii. *Nodular stage*- The cyst contracts and the walls are replaced by focal lymphoid nodules and necrosis.

iv. *Calcified stage*: The granulation tissue is replaced by collagenous structures and calcification



Evolutionary stages of intraparenchymal brain cysticercosis

1. pig brain showing a viable cyst in the external side of the brain.
2. a viable intraparenchymal cyst (MRI, FLAIR),
3. a viable cyst with signs of inflammation (MRI, t1 with gadolinium),
4. a degenerating cyst or enhancing lesion (Solitary Cysticercal Granuloma, MRI, T1 with gadolinium), and
5. a calcified cyst (non-contrasted CT)

(images from different patients)

Clinical features

- Most children present with single degenerating parenchymal cysts, some with multiple cysts

Parenchymal NCC

- Age: Most cases are seen after five years of age although some cases are seen in preschoolers and even in infants



Clinical features

(i) Seizures:

- ⌘ Sudden onset Seizures occur in 70-90% of cases.
- ⌘ partial seizures (84-87%) particularly complex partial seizures; about a quarter have simple partial seizures
- ⌘ Most seizures are of short duration, generally lasting for less than 5 minutes

Clinical features

(ii) *Raised intracranial pressure:*

- ⌘ headache and vomiting (30%)
- ⌘ Papilledema (2-7%)

(iii) *Focal Neurodeficits:*

- ⌘ It is determined by the location of the cysts.
- ⌘ Focal deficits were seen in 4% of children, as compared to 16% of adults
- ⌘ Transient hemiparesis, monoparesis, and oculomotor abnormalities are common.

Clinical features

(iv) *Cysticercal Encephalitis:*

- ☞ Rarely massive cyst burden with diffuse cerebral edema may present with severe acute raised intracranial pressure and an encephalitic picture in some children and adolescents.
- ☞ These cases are difficult to treat and have high mortality and neuro morbidity.

Clinical features

Extraparenchymal NCC:

Rare in children as compared to adults

(i) Ventricular and Subarachnoid NCC:

- ⌘ It generally occur together and present as basilar arachnoiditis, obstructive hydrocephalous or chronic meningitis.
- ⌘ Some subarachnoid cysts may enlarge without scolices, become racemose and cause mass effects
- ⌘ Seizures may occur in cases with associated with parenchymal NCC

Clinical features

✂ Cysticerci located in the brain parenchyma or within the cortical sulci between two cerebral convolutions is described as “cysticercus cellulosae

(ii) Spinal cysticercosis:

✂ It is rare (1-5%) in children.

✂ Cysts are generally located in the leptomeningeal space but may occasionally be found within the cord.

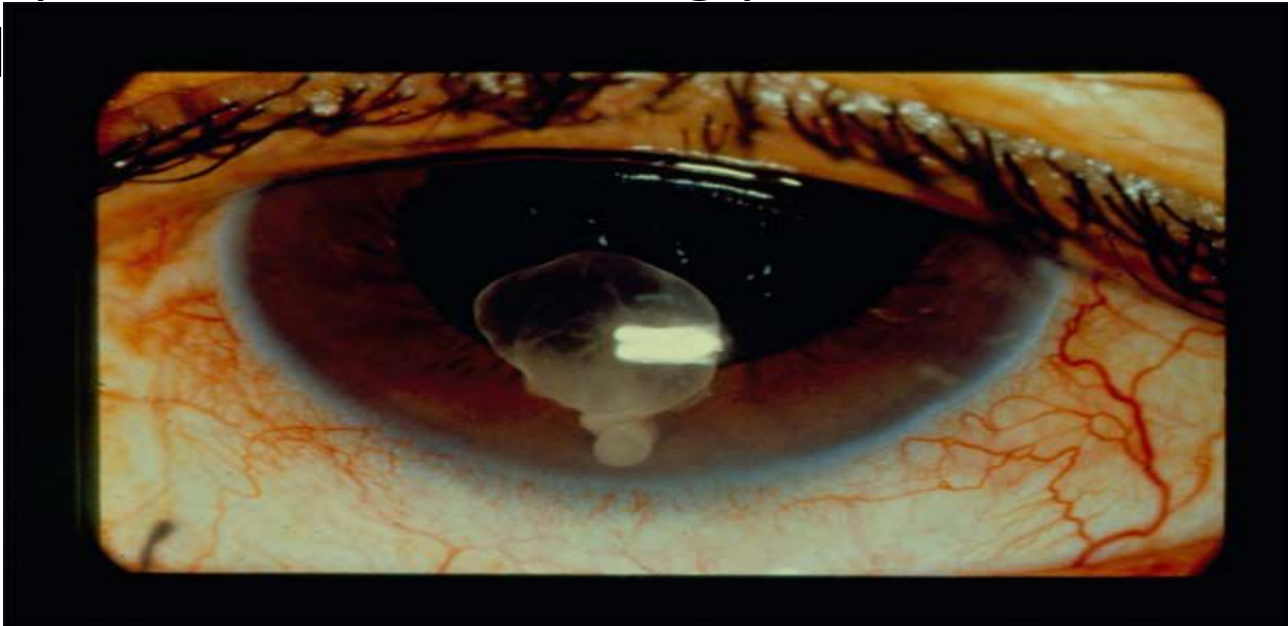
✂ Radicular pain, paresthesias, and spinal cord compression may occur.

✂ Intramedullary cysts may present as transverse myelitis with paraplegia and sphincteric disturbances.

Clinical features

(iii) Ophthalmic cysticercosis:

- ✂ cysts may lodge anywhere in the eyes including the subretinal space, vitreous humor, subconjunctiva or anterior chamber.
- ✂ Symptoms occur accordingly and include visual deficits, subconjunctival nodules etc



Clinical features

iv) *Unusual presentations*: These are variable and include

- communicating hydrocephalous,
- vasculitis,
- stroke,
- learning disability and behavioural changes,
- dorsal midbrain syndrome,
- ptosis, papillitis,
- cerebral hemorrhage, dystonia,.
- neurocognitive deficits and psychiatric morbidity particularly depression syndromes in adults

Clinical features

✎ **Out side the CNS, cysts can sometimes be palpated under the skin and in very heavy infections in skeletal or heart muscle can result in myositis or carditis.**

CLINICAL DIFFERENCE WITH TUBERCULOMAS

| | NCC | TUBERCULOMAS |
|-------------------------|--------------------------|----------------|
| PROGRESSIVE FND | ABSENT | May be PRESENT |
| RAISED ICP | TRANSIENT & LAST <24 HRS | May be COMMON |
| CONSTITUTIONAL SYMPTOMS | ABSENT | MAY BE PRESENT |
| h/o contact | Nil | May be present |

Conclusion

- ✂ Taenia solium, a pig tape worm infection is common in India
- ✂ Transmitted by ingestion of contaminated food/ fluid or undercooked pork.
- ✂ Larval form causes cysticercosis, while adult form causes taeniasis
- ✂ NCC is the MC neuroparasitic infection, which can occur in brain parenchyma, ventricles, spinal cord or eye.
- ✂ Most common lesion is single granuloma in brain which commonly presents with complex partial seizures.

THANK YOU

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