

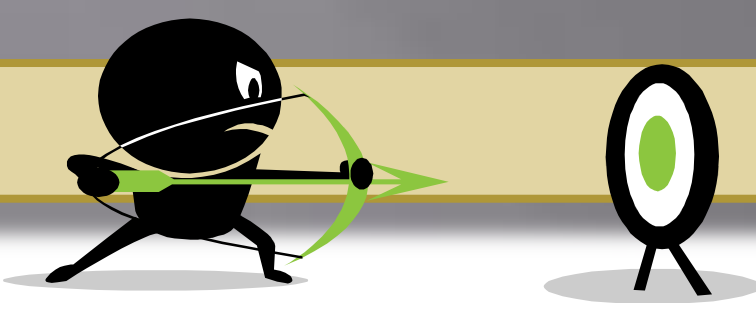


NEUROCYSTICERCOSIS

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1. Objective



Neuroinfections are important brain diseases and they affect a lot of people all over the world, but not all the people know about their existence. The aim of this work is to deepen in the pathological, biochemistry and clinical aspects of Neurocysticercosis, an helminthic disease that affects the central nervous system. It is caused by larvae of *Taenia solium*, who lives in the small intestine of humans.

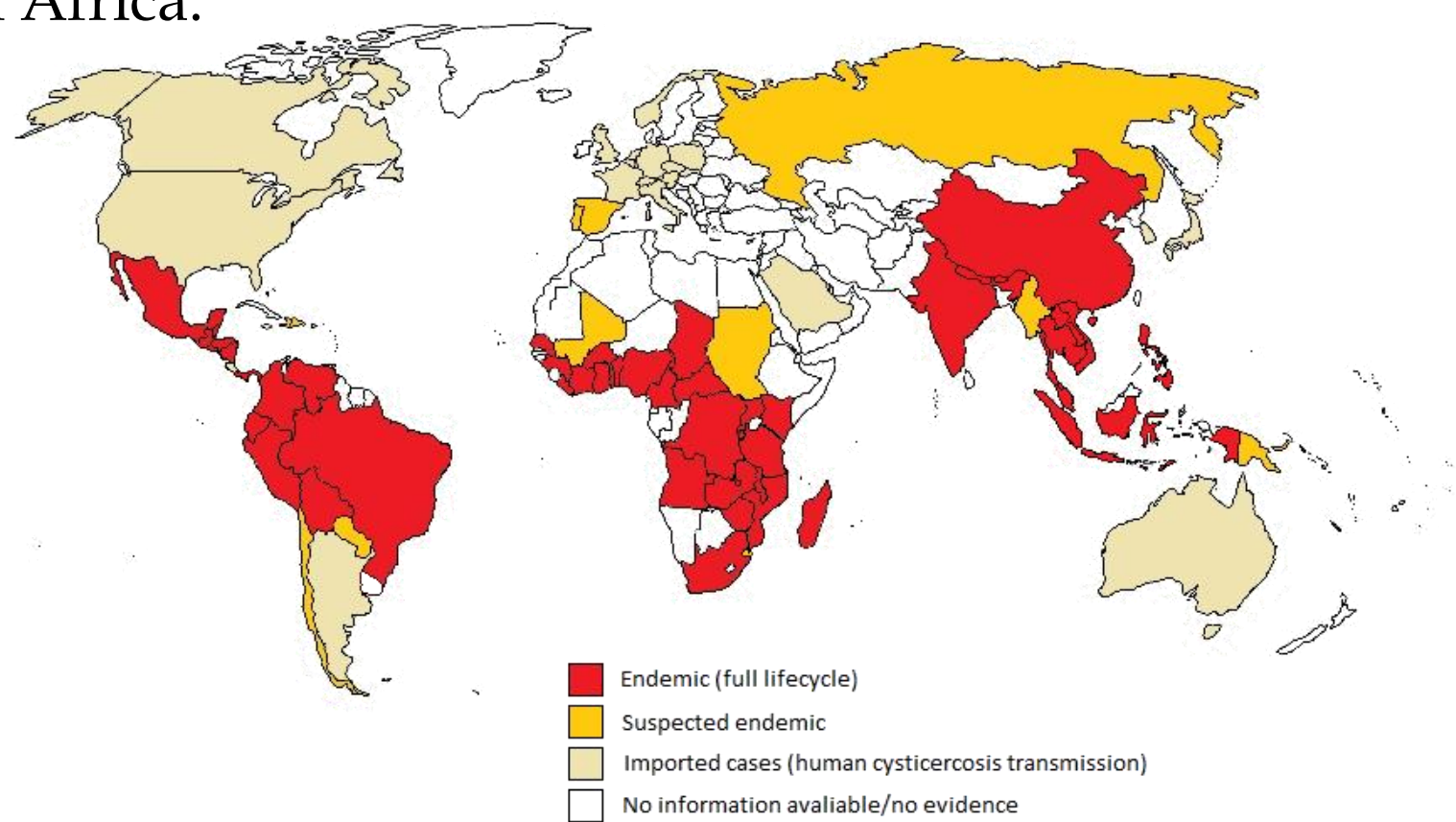
3. Introduction



General information:

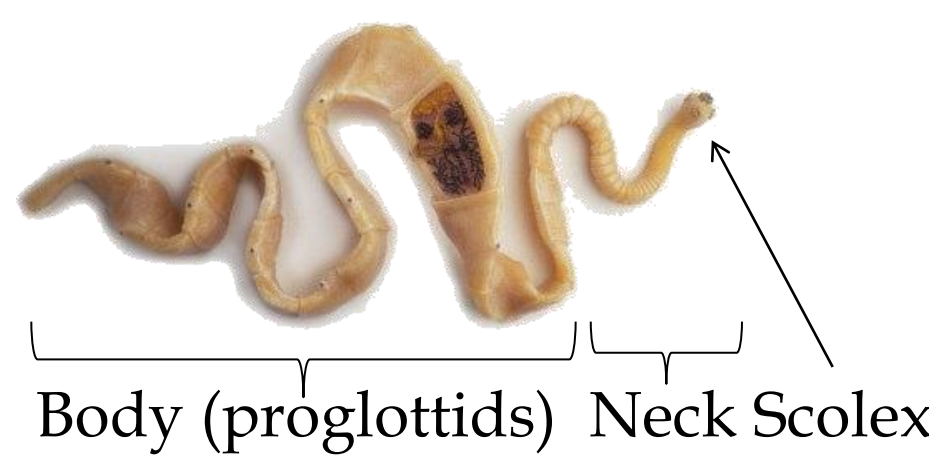
- **Affected countries:** Latin America, India, Asia and Sub-Saharan Africa.
- **Imported cases:** Europe, Australia, USA and Canada.
- **Incidence:** 1/1000 for human teaniasis
1-10% for humans CC
20-40% for pig CC
- **Age of infection:** 5-15 years old
- **Age of manifestation:** 25-35 years old
- **Problems:** high poverty, warm weather, illiteracy...

Map illustrates the distribution of Neurocysticercosis.[1]

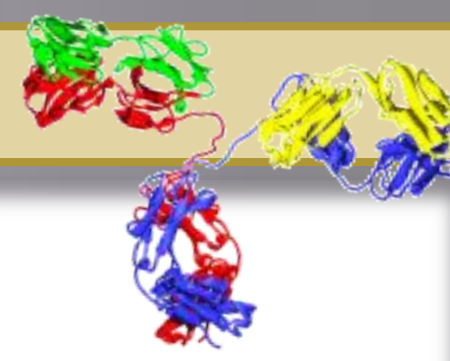


Taenia solium:

- Is a cestode that belongs to the *Cyclophyllidae* order and the *Taeniidae* family.
- **Tree Stage:** egg, larvae and adult tapeworm.
- **Target tissues:** CNS, eye, skeletal and heart muscles, subcutaneous tissues.

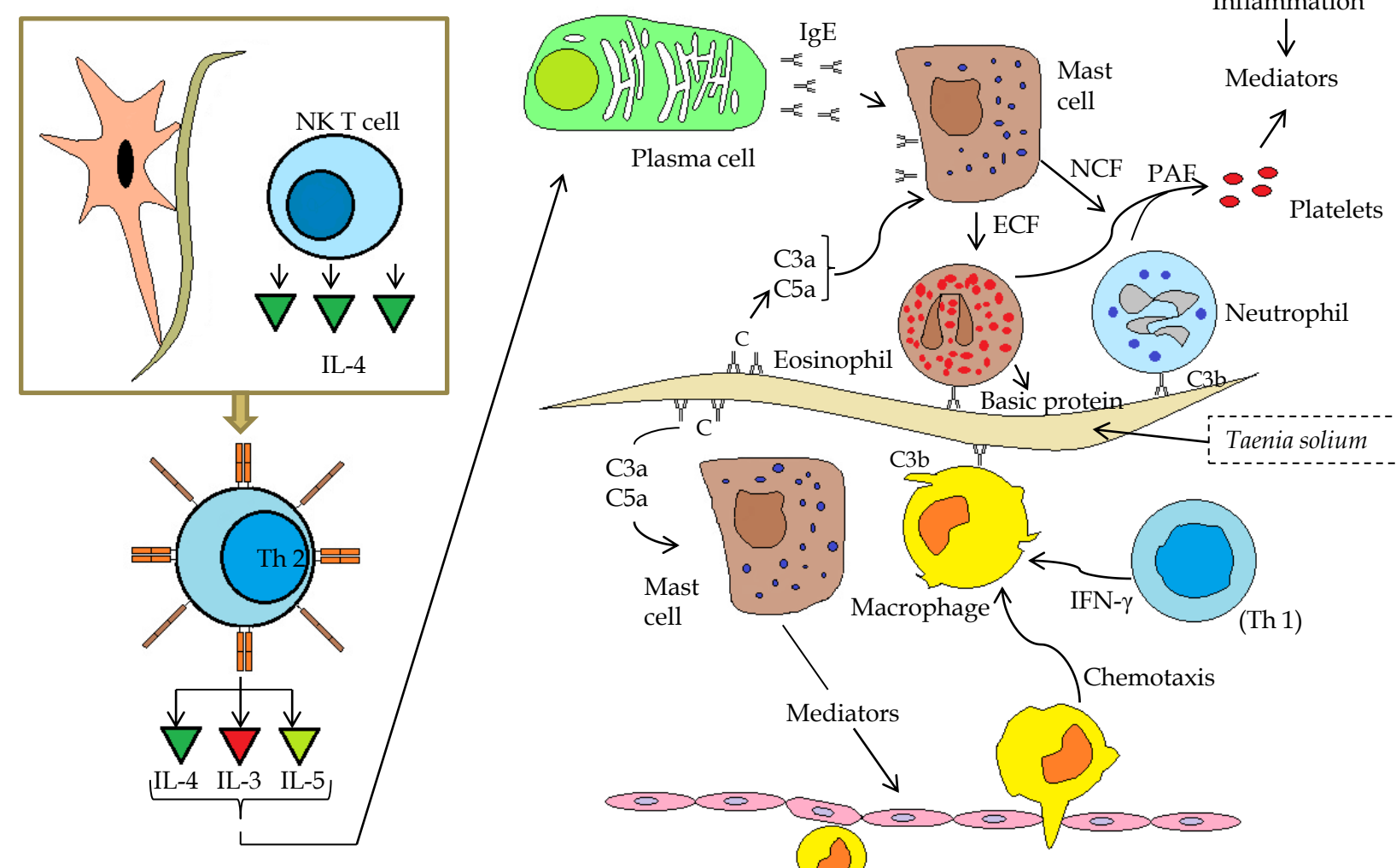


5. Immuno response



Intestinal pathology: Taeniasis[9]

Taenia solium cause the synthesis and secretion of IL-4 by NK T cells



Activation and differentiation of naive CD4 T cells in the presence of IL-4 into Th 2 cells

Cerebral pathology: Neurocysticercosis

Larvae suffer some pathological changes until its death. This evolution can be described in four stages:

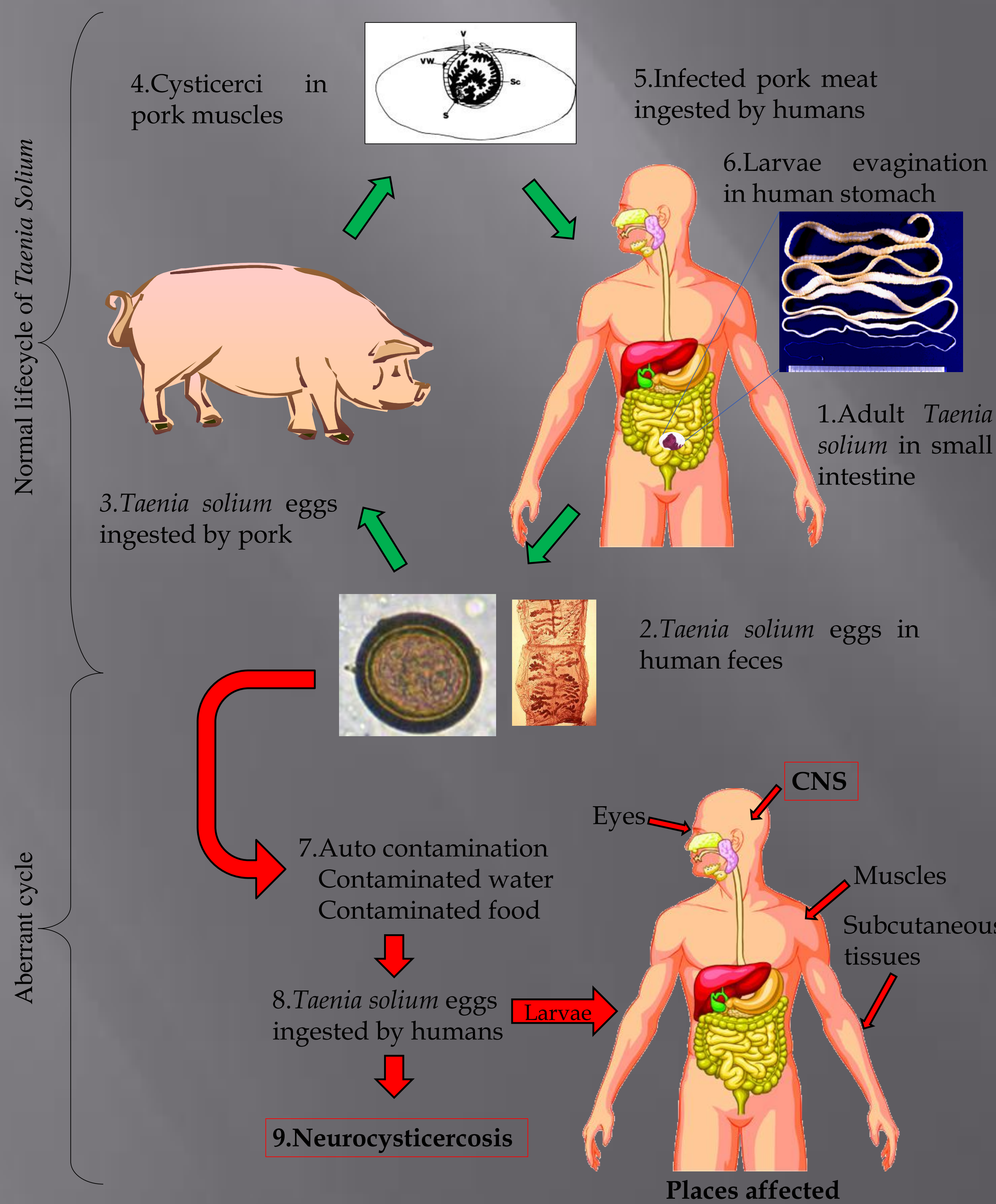
1. Vesicular stage
2. Colloidal vesicular stage
3. Granular nodular stage
4. Calcified nodular stage

These pathology is characterized by a natural progression of innate (neutrophils and macrophages), early induced (NK cells and $\gamma\delta$ T cells) and adaptive immune response ($\alpha\beta$ T cells and B cells) in infected mice. \rightarrow Th1 response

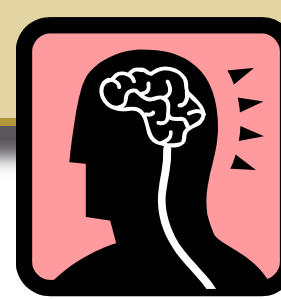
Brain parenchyma							
Time p.i	IL-2	IL-12	INF- γ	TNF- α	IL-5	IL-1,6,13	IL-4,10
2 days	-	-	-	ND	-	-	-
3 days	-	-	-	ND	-	-	-
5 days	-	-	-	ND	-	-	-
1 wk	-	-	-	-	-	-	-
3 wk	-	+	-	-	-	-	-
5 wk	-	+	+	-	+	-	-
8 wk	-	+	+	-	-	-	-
11 wk	+	+	-	-	-	-	-
13 wk	+	+	-	-	-	-	-

Cytokines were detected in immunohistochemistry reaction: -, undetectable; +, 1-100 positive cells per section; ++, 100-300 positive cells; +++, 300-500 positive cells; +++, >500 positive cells. MHC class II expression = I-Ad.[4]

Lifecycle of *Taenia solium*



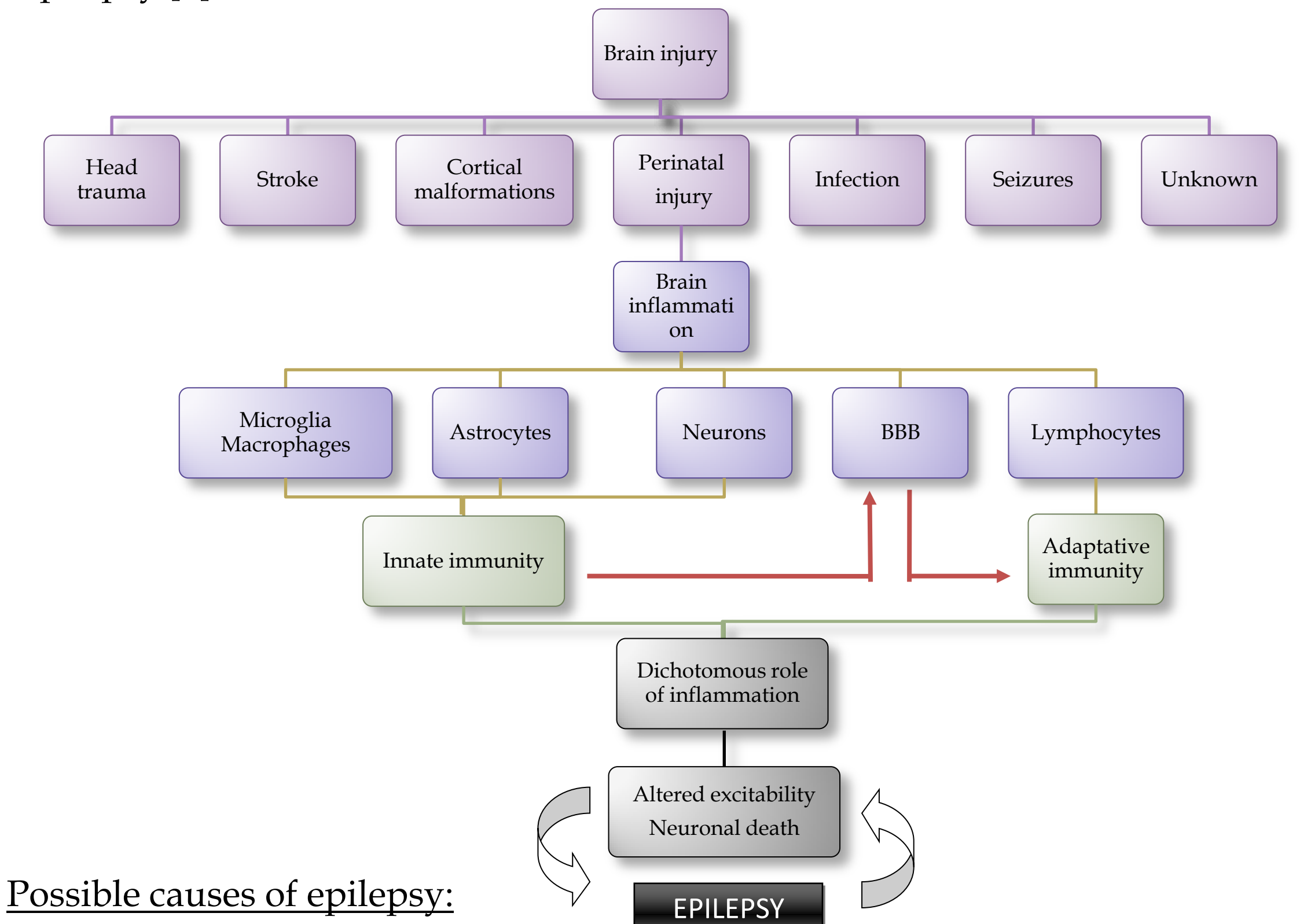
6. Clinical Manifestations



It depends on the number, size, stage and localization of cysts and the patient's immune response.

Clinical manifestation [5]	Pathology
Epilepsy	Pericyst inflammation, granuloma formation
Raised intracranial pressure	Hydrocephalus (arachnoiditis, ependymitis, ventricular cysts), pseudotumor (edema), giant cysts, cysticercal encephalitis
Focal deficits	Direct compression by large or multiple cysts
Meningitis	Widespread subarachnoid inflammation
Myelo radiculopathy	Inflammation, local mass effect, vasculitis
Others	
Dementia	Multiple parenchymatous cysts
Encephalitis	Intense inflammation and edema
Subarachnoid haemorrhage	Inflammatory aneurysm
Trigeminal neuralgia	Arachnoiditis
Subdural hematoma	Collection of multiple cysts
Stroke/transient ischemia attack	Angiitis
Dizziness	Intermittent CSF obstruction
Endocrinological or ophthalmic symptoms	Sellar/intraocular cysts

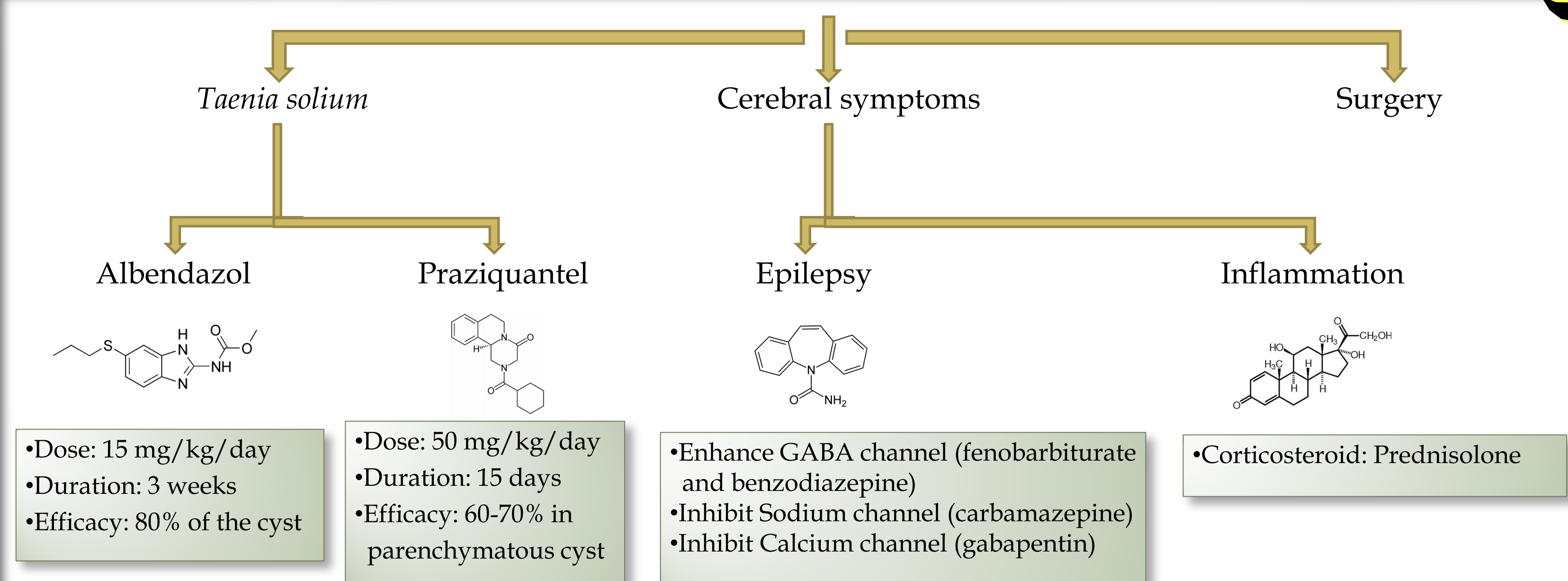
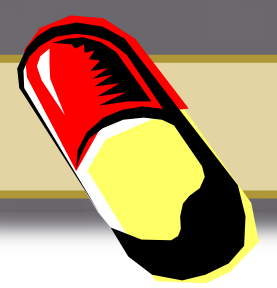
Possible explanation of relation between brain injury, inflammation and epilepsy [6]



Possible causes of epilepsy:

- Cytokines: IL-1 β , IL-6 and TNF α
- Permeability of blood-brain barrier
- Gliosis
- Neuronal death

7. Treatment



- Reference
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8. Conclusions



• Neurocysticercosis is endemic in many parts of the world, specially in developing countries. However we have to take into consideration the diagnosis in developed countries by immigration of endemic countries.

• Neurocysticercosis is the most common cause of symptomatic epilepsy worldwide. Despite the severity of the disease, most people don't give the importance to it, since it principally affects developing countries.

• Treatment and diagnosis works well, but can be improved.

• This parasitic disease is potentially eradicable, but to be effective we need eradication programs that consists:

1. Interrupt the tape worm-host cycle.
2. The vaccination of pig against infection with the parasite, which indirectly reduce the appearance of new cases of the disease.
3. Public health and awareness.
4. Possible vaccination for human.

But the best alternative is the education and the health promotion, specially in developing countries.

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