

Cestodes

Taenia Solium

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Geographic Distribution

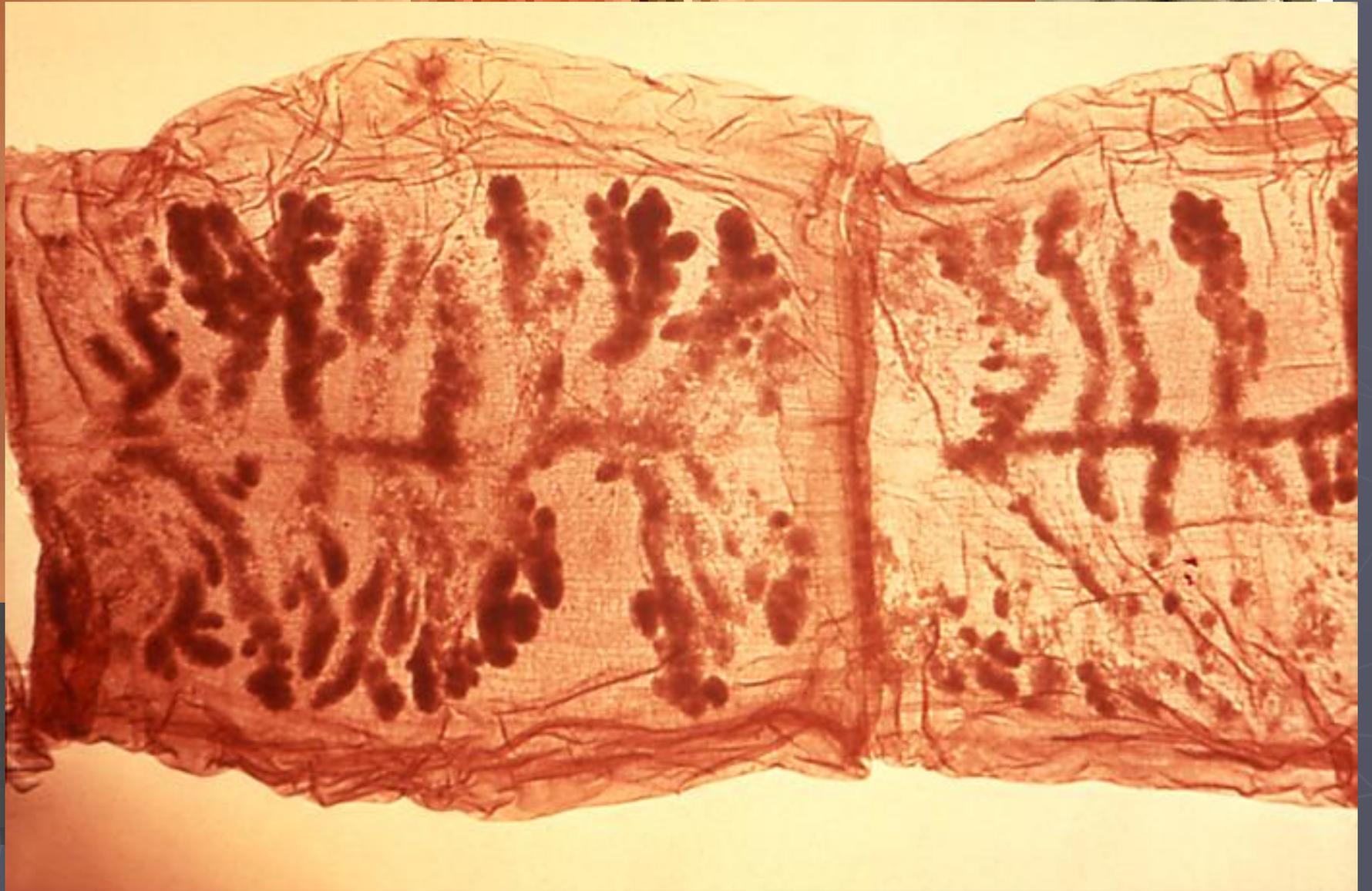
- ▶ Asia, Africa, the Philippines, South America, parts of Southern Europe and pockets of North America

General Recognition Features

- ▶ Size – Generally 3 meters or less
- ▶ Proglottids – less than 1000

General Recognition Features

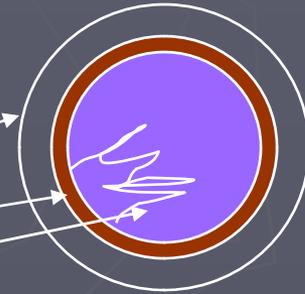
- ▶ Scolex has four suckers with a rostellum that has a double circle of alternating large and small hooks (22-36)
- ▶ Proglottid is smaller than *T. saginata* and has 7-13 lateral branches off the central uterus



General Recognition Features

► Eggs

- 31-43 um
- Outer embryonal membrane
- Brown shell
- Embryo

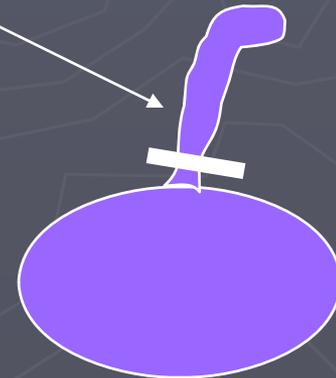
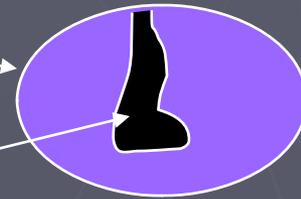




General Recognition Features

► Cysticercus

- 5-10 mm
- In muscle of pork
- Invaginated scolex
- Scolex exvaginates and breaks off when digested out of the muscle



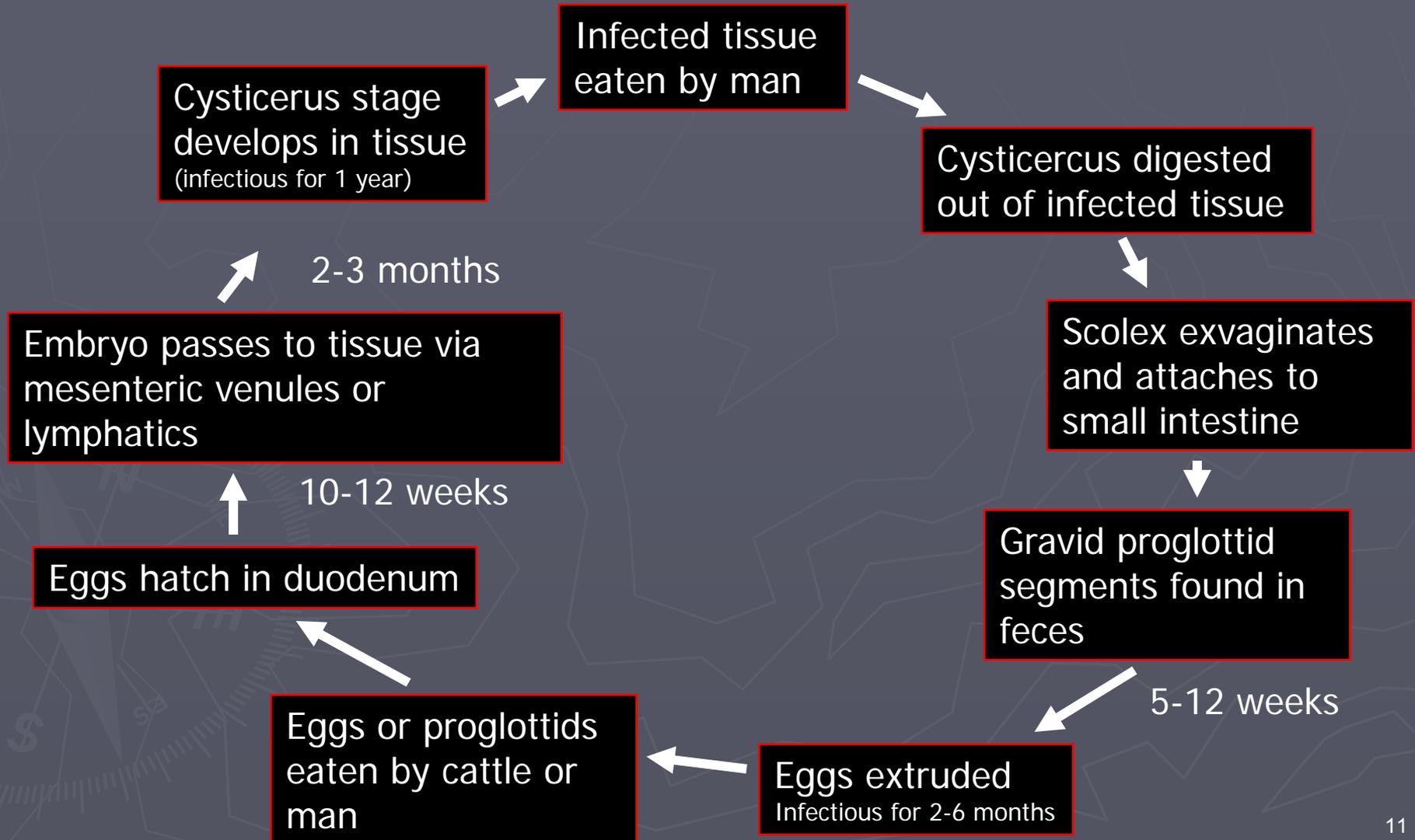
Hooks



Life Cycle

- ▶ Definitive host – man
- ▶ Stage leaving the body – gravid proglottids, occasional embryonated eggs
- ▶ Intermediate host – pigs and man
- ▶ Infectious stage for the definitive host – infectious eggs for cysticercosis, cysticerci for tapeworm infection

Life Cycle

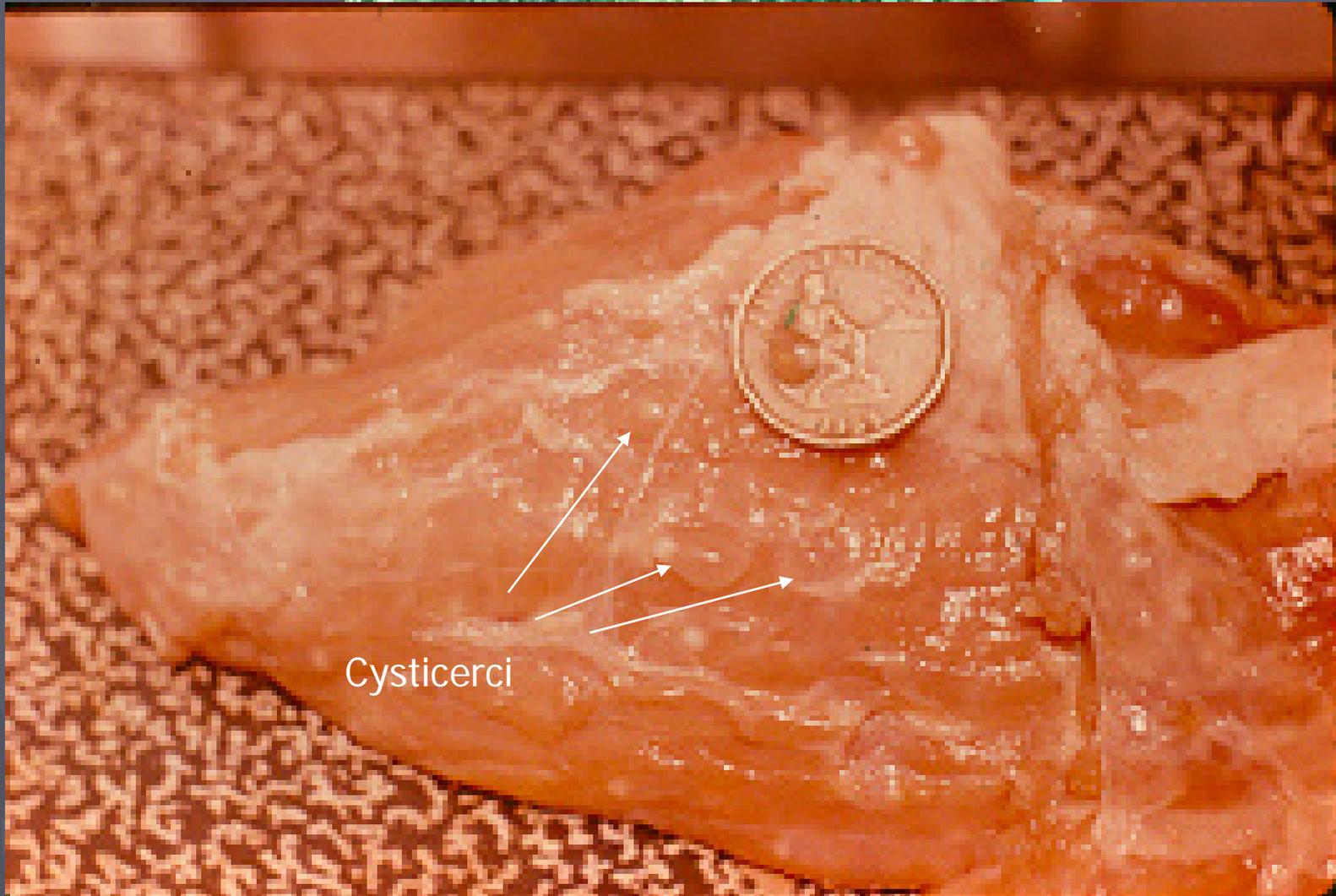
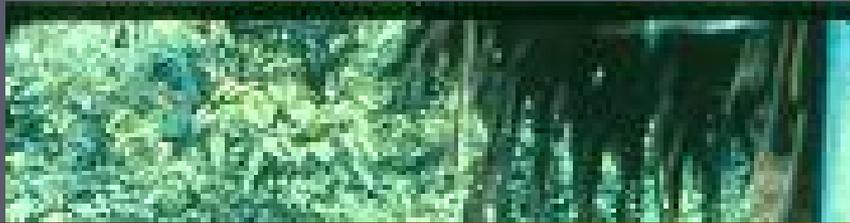


Life Cycle

- ▶ Prepatent period – 5-12 weeks
- ▶ Patent period – decades
- ▶ 3 routes of egg ingestion
 - Heteroinfection - contaminated food and water
 - External autoinfection – perineal skin to mouth
 - Internal autoinfection – regurgitation proglottids to stomach

Transmission

- ▶ Eating of inadequately cooked pork
- ▶ Contaminated food and water
- ▶ Use of raw human sewage for agriculture
- ▶ Inadequate human fecal sanitation



Pathogenicity

- ▶ Cysticercosis – encapsulation occurs around the cysticercus except in the eye or brain

Disease

▶ Tapeworm

- Generally asymptomatic except for passage of proglottids
- End of prepatent period – diarrhea and abdominal pain in ½ of the cases
- Rare – intestinal obstruction

Disease

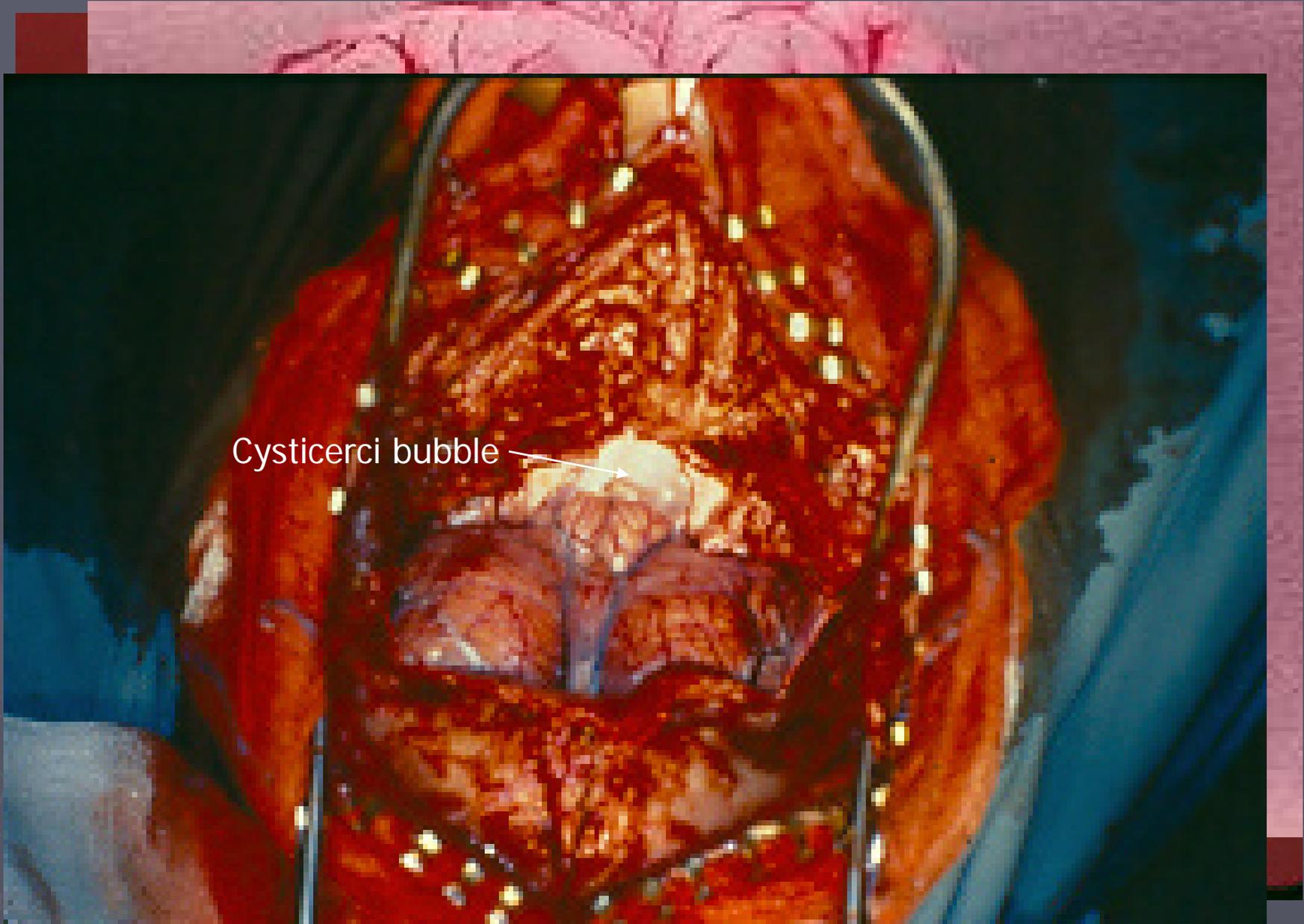
► Cysticercosis

- Major – CNS, muscle, SQ tissues and eye
- Other – lung, heart, liver, other viscera
- CNS – Seizures, stroke, hydrocephalus, headache, nausea and vomiting, dizziness, diplopia, psychiatric problems, meningoencephalitis, visual loss, CSF (elevated protein, low glucose, increased cells)
- Eye – Shadows, uveitis, iritis, retinal detachment, atrophy of the choroid, conjunctival encapsulation
- Mortality – 25-65% in neurocysticercosis



Cysticercosis

- ▶ Morbidity is almost entirely due to CNS disease
- ▶ Prevalence of CNS disease is up to 2% in endemic areas. Many are asymptomatic clinically. Found on autopsy.
- ▶ It may take years from onset of infection to onset of symptoms



Cysticerci bubble →

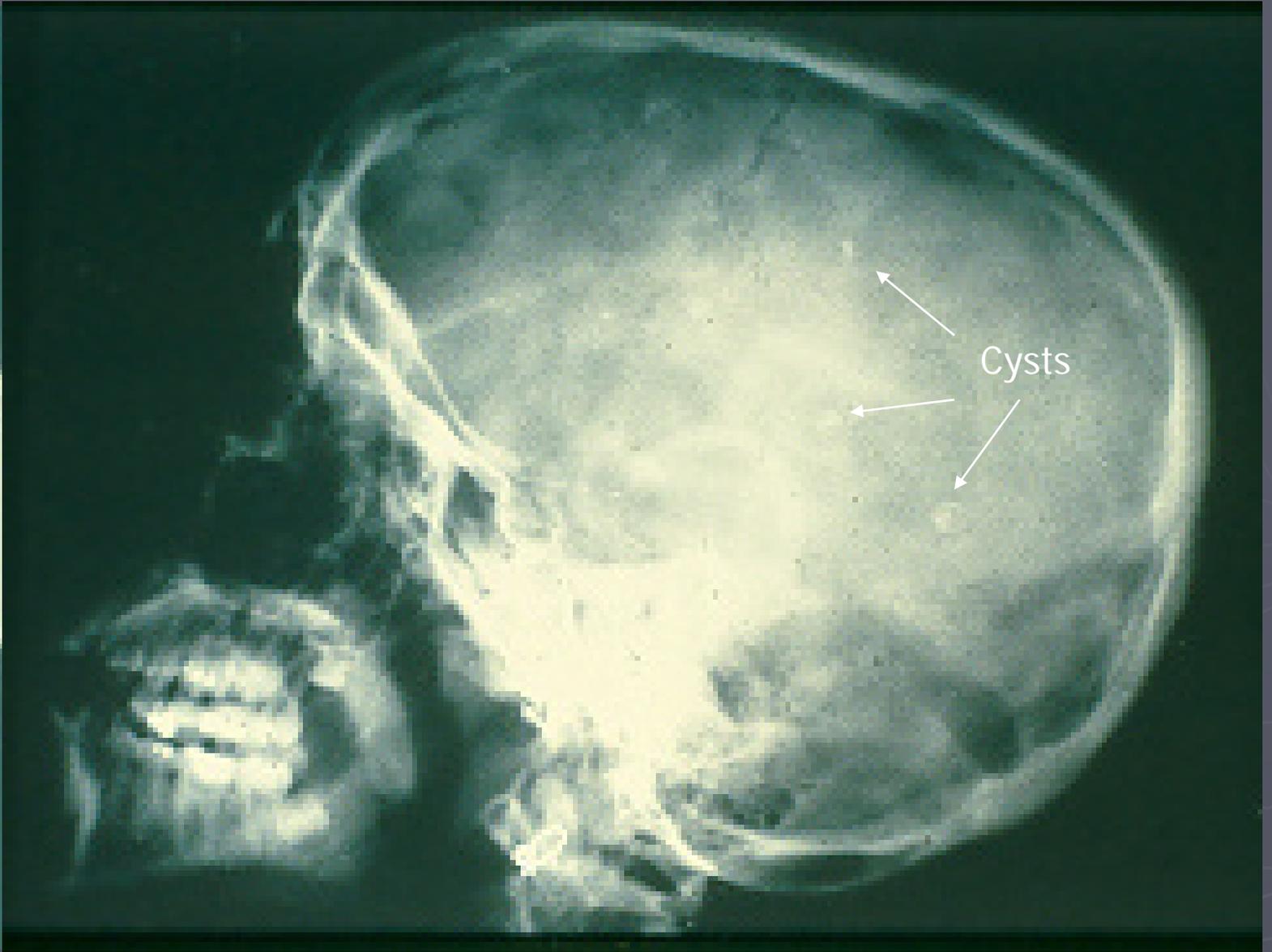
Laboratory Diagnosis

- ▶ Clinical suspicion
- ▶ Cysticerci identified
 - Excised nodules or surgical specimens
 - Mobile larvae seen in the eye
 - Brain imaging (eg CAT scan, radiographs of muscle)
 - Serology – ELISA (80% even in endemic areas). The enzyme immunoassay is likely the antibody test of choice.
 - Antigen detection in CSF and Blood
- ▶ Eggs identified
- ▶ Proglottids identified

Imaging

- ▶ Calcified lesions
- ▶ Small hypodense areas (< 2 cm) often (1/2 time) can have a central bright spot (scolex)
- ▶ Disc enhancement or ring around hypodense areas is associated with spontaneous resolution from the CT in 12 months
- ▶ Occasionally can see large cysts (6 cm). Must differentiate from hydatid disease, coenurosis or racemose cysticercosis

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Treatment of Tapeworm

Medication	Adult	Pediatric
Praziquantel	5-10 mg/kg once	5-10 mg/kg once
Niclosamide	2 gm once	50 mg/kg once

Adverse Medication Reactions

- ▶ Praziquantel (Biltricide – Bayer)
 - Frequent: abdominal pain, diarrhea, malaise, headache, dizziness
 - Occasional: neutropenia, GI disturbance, methemoglobinemia
 - Rare: CNS symptoms, hypertension, arrhythmias

Adverse Medication Reactions

► Niclosamide

- Occasional – abdominal pain, anorexia, diarrhea, emesis
- Rare – dizziness, skin rash, drowsiness, perianal itching, unpleasant taste

Treatment of Cysticercosis

Medication	Adult	Pediatric
Albendazole	400 mg bid X 8-30d (can be repeated)	15 mg/kg/d (max 800 mg) in 2 doses X 8-30 d (can be repeated)
Praziquantel	50-100 mg/kg/d in 3 doses X 30d	50-100 mg/kg/d in 3 doses X 30d

Cysticercosis Treatment

- ▶ Initial therapy for single inflamed parenchymal cysticercosis or with calcified lesions – Rx seizures with anti-seizure medication
- ▶ Use of albendazole or praziquantel for parenchymal cysticercosis without seizures is controversial (JM McGuire NEJM 2004;350:215)
- ▶ Patients with live parenchymal cysts who have seizures should be treated with albendazole + steroids (6 mg dexamethasone or 40-60 mg prednisone / day) (Garcia NEJM 2004:350:249)
- ▶ Patients with subarachnoid cysts or giant cysts in the fissures treat for at least 30 days (Proano, NEJM 2001:345:879)
- ▶ Surgical intervention or shunting is indicated for hydrocephalus. Give 40 mg prednisone with the surgery.
- ▶ Arachnoiditis, vasculitis or cerebral edema – treat with prednisone 60 mg/d or dexamethasone 4-6 mg/d + albendazole or praziquantel (AC White Annu Rev Med 2000:51-187)
- ▶ Any cysticercoidicidal drug may cause irreparable damage when used to treat ocular or spinal cysts even when given with steroids. An ophthalmologic examination should always precede treatment to r/o intracocular cysts.

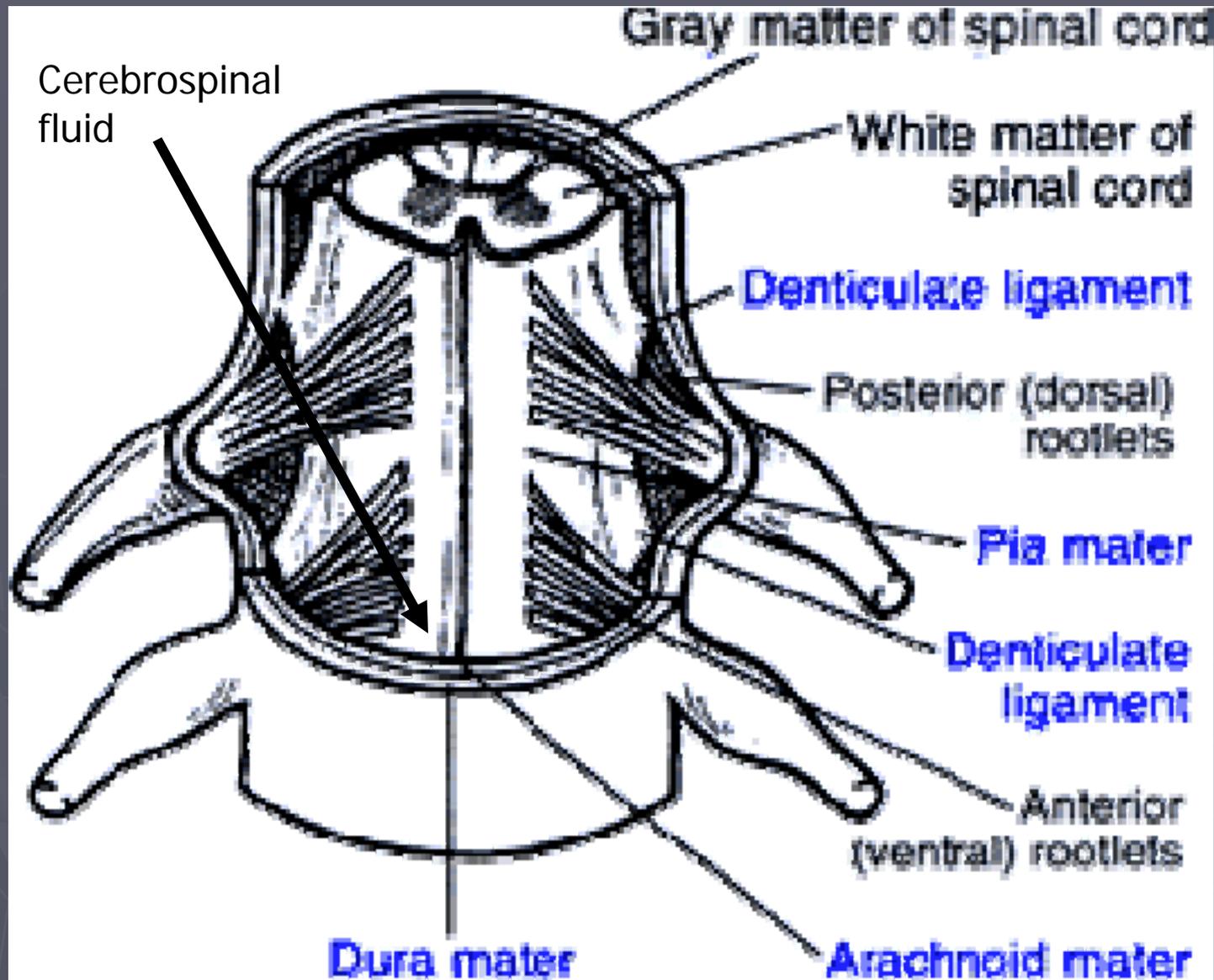
Cysticercosis Treatment

- ▶ Ocular and spinal cysts – treated with surgery

Adverse Medication Reactions

► Albendazole

- Occasional: diarrhea, abdominal pain
- Rare: leukopenia, alopecia, increased serum transaminase levels



Control Measures

- ▶ Prompt treatment of tapeworm infected humans
- ▶ Sanitary disposal of human feces
- ▶ Adequate meat inspection
- ▶ Cooking beef to $>65^{\circ}\text{C}$ or freezing at -20°C for 24 hours
- ▶ Stool examination of food handlers from endemic countries
- ▶ Avoid eating uncooked vegetables and fruits that cannot be peeled while traveling in developing countries