Zoonosis: Cisticercosis/Teniasis

Modelo de investigación en Una Salud

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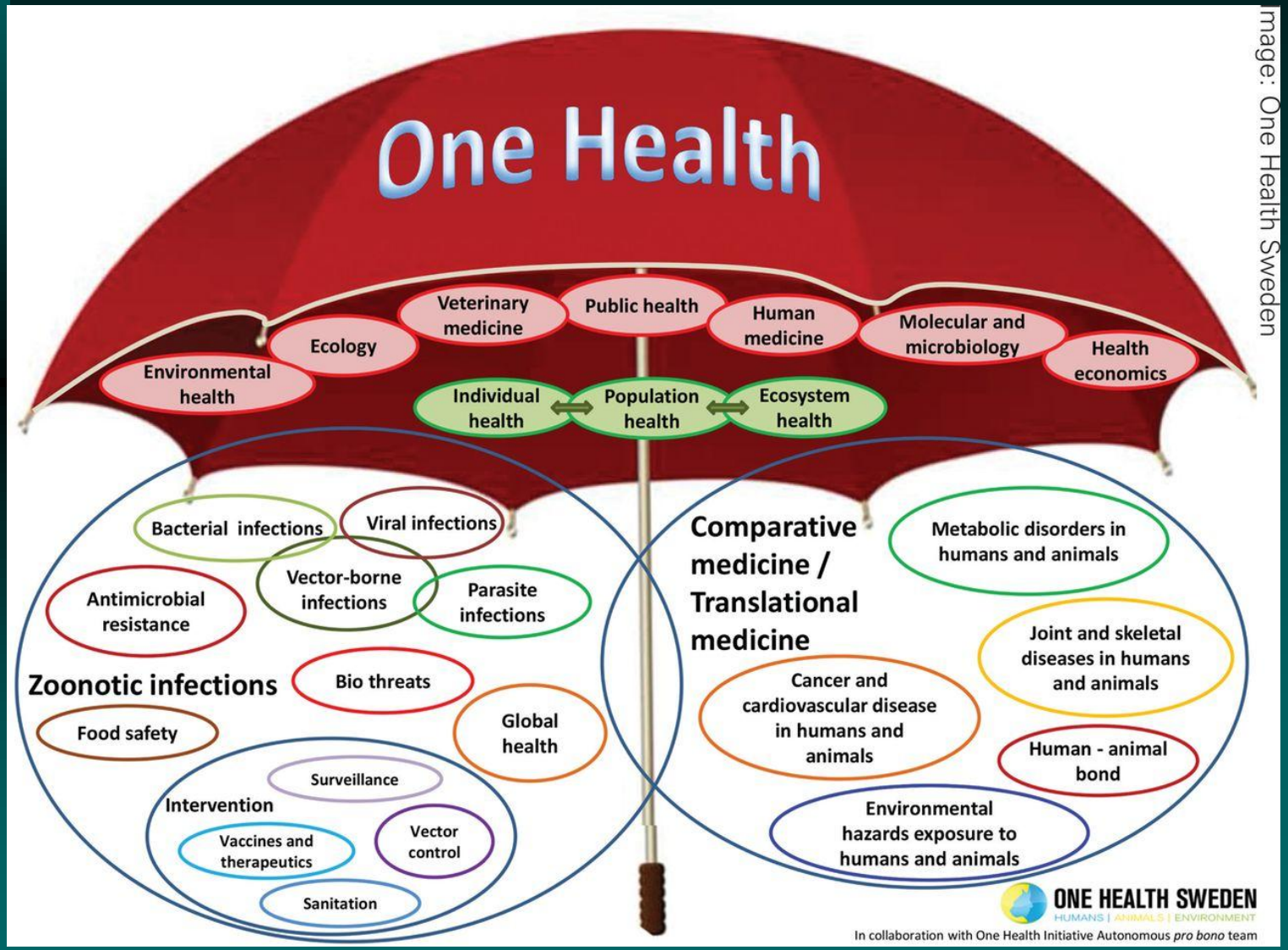
Nociones basicas de **Una Salud**




The One Health Triad
Healthy People
Healthy Environments
Healthy Animals


ANIMALS
ONE HEALTH
HUMANS
ENVIRONMENT


One Health


One Health
Animal Disease
Human Disease
Environment


INTEGRATIVE HEALTH RISK MANAGEMENT
PREVENTION
INTERVENTION
RECOVERY/REHABILITATION
ONE HEALTH
SUSTAINABILITY


ONE HEALTH
ONE PLANET ONE FUTURE


The One Health Company


face similar health threats


ONE HEALTH
One Health
The One Health concept recognizes the interrelationship between animal, human and environmental health.


HEALTH


ONE Health


Human Health
Animal Health
ONE HEALTH
Connection between health and natural & man-made environments


Emerging and Reemerging infections - 70% vector-borne or zoonotic

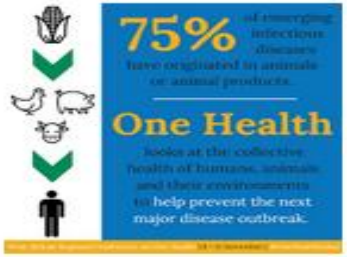

Healthy People
Healthy Animals


ONE HEALTH


ONE HEALTH


one health DAY
NOV 3


One Health
initiative


75% of emerging infectious diseases have originated in animals or animal products
One Health
looks at the collective health of humans, animals and their environments to help prevent the next major disease outbreak.


Evolution of One Health


ONE HEAL
Center for Ecosystem & Climate Change
MANY ORGA


one health DAY
november 3
check www.onehealthday.org for more information


International Journal of One Health


ONE HEALTH


Environment
Humans
Animals

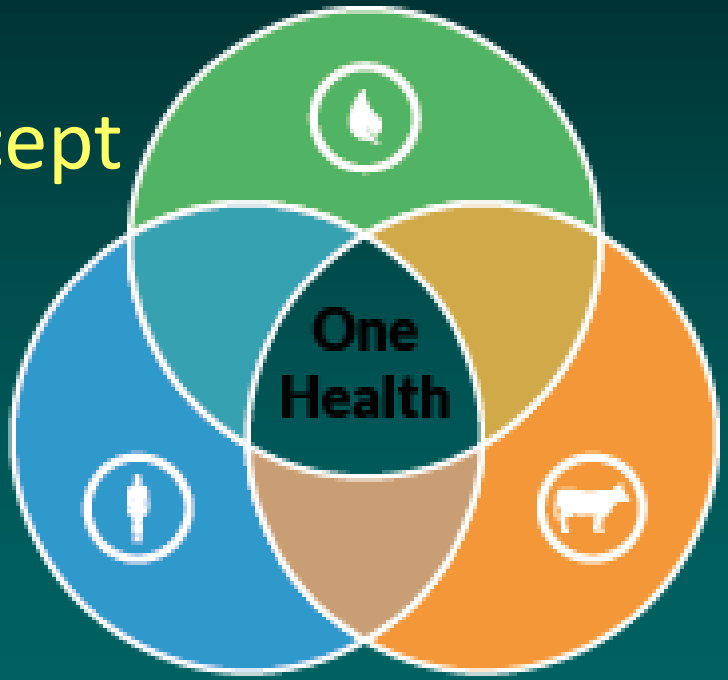

ONE
HEALTH


One Health

Health of Environment

- Ecosystems / Social-Ecological systems?
- Wildlife?
- Soil?

Simple but… complex concept



Health of humans

- Individuals
- Populations
- Well-being

Health of animals

- Production animals
- Pets
- Wildlife?
- Plants / crops?
- Production systems?

https://www.onehealth-oi.org

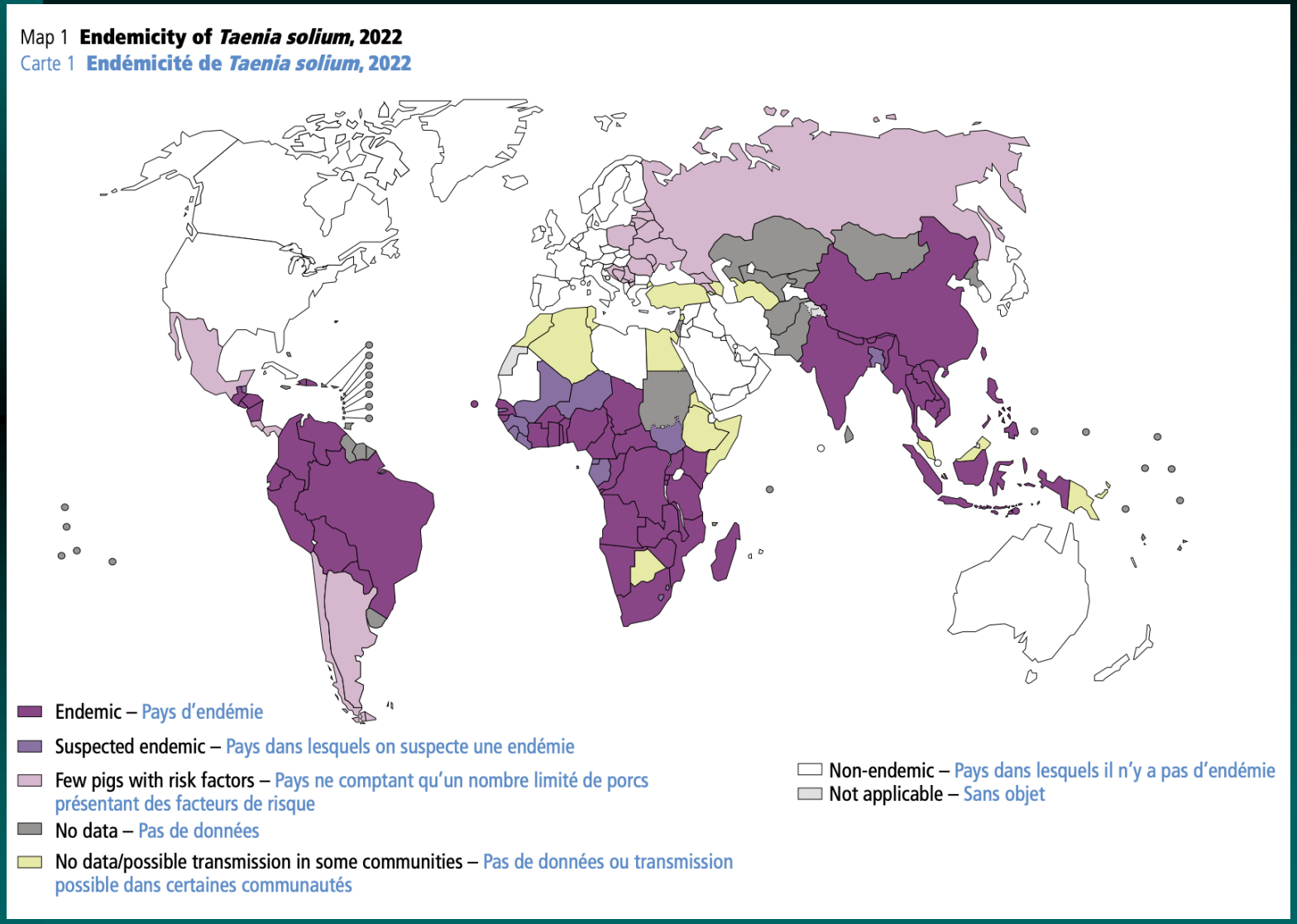
Recursos on-line

- https://www.onehealthcommission.org/en/resources__services/one_health_library/slide_presentations/
- https://www.onehealthcommission.org/index.cfm/37526/98621/one_health_una_sola_salud__in_spanish

Taenia solium Cysticercosis

- Main cause of acquired epilepsy in developing countries
- Produces important economical losses to pig-raising peasants
- Endemic (hyperendemic?) in most Non-Muslim developing countries

Taenia solium Cysticercosis



(WHO: Countries and areas at risk of cysticercosis, 2022)

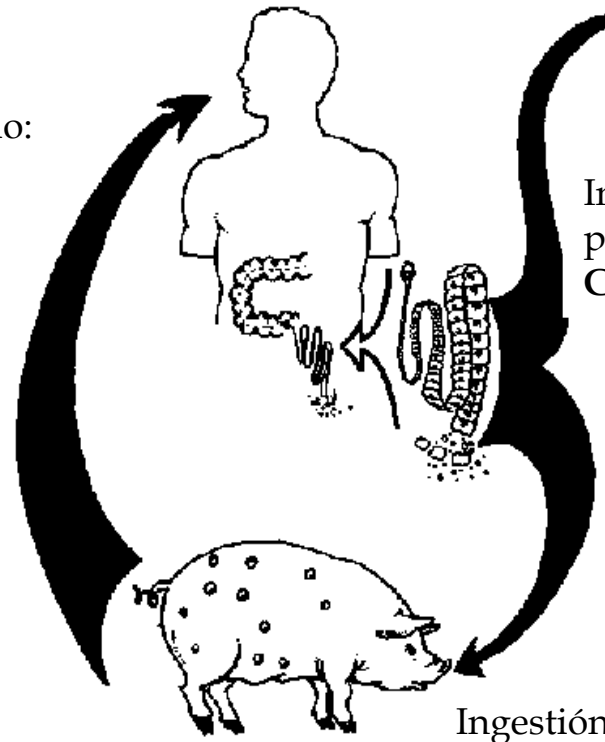
Taenia solium es endémica en gran parte del mundo

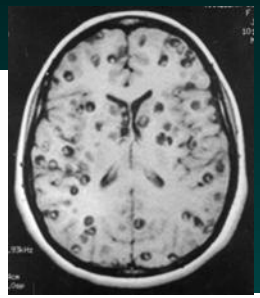
En esas áreas, la NCC contribuye significativamente a la carga de enfermedad neurológica

Recordando el Ciclo

Humano
(Hospedero Definitivo)

Ingestión de cerdo infectado, mal cocido:
Teniasis

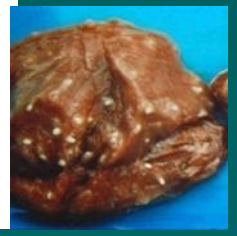




Ingestión de huevos de *T. solium* por contaminación fecal:
Cisticercosis Humana

Cerdo
(Hospedero Intermediario)

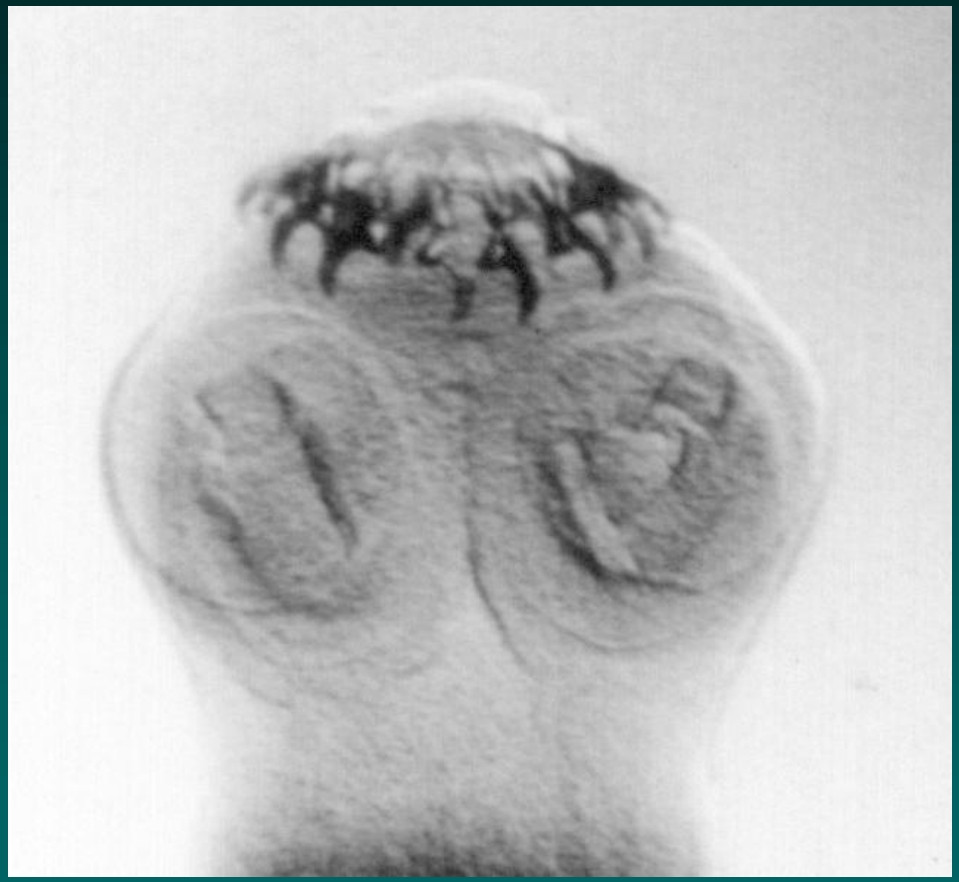
Ingestión de huevos o proglótidos de *T. solium:*
Cisticercosis Porcina



Cerdo Infectado

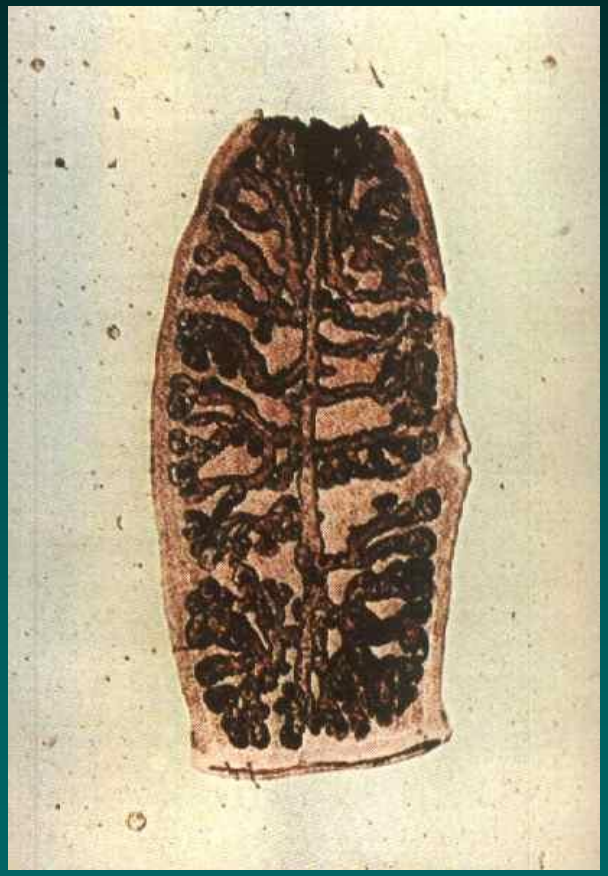
El Quiste (los quistes)

El Escólex

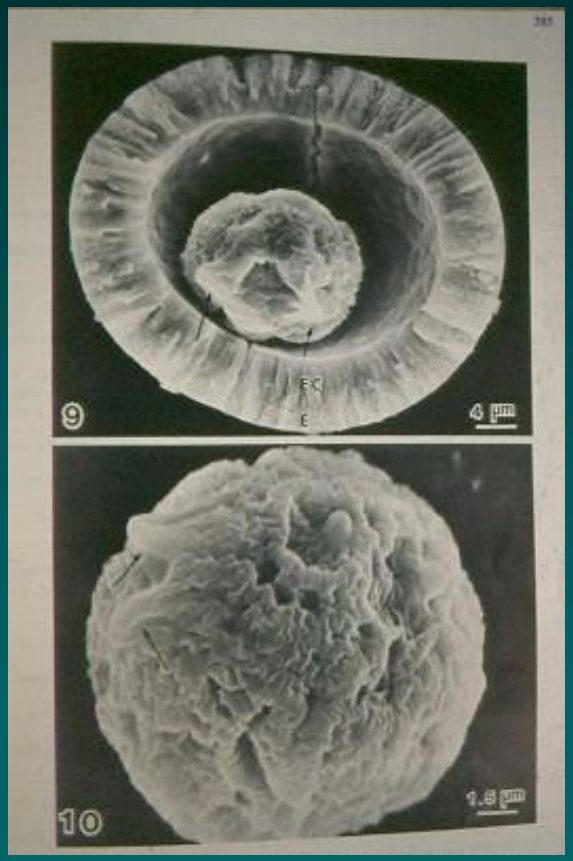


El Gusano

T. solium – Progl. Grávido



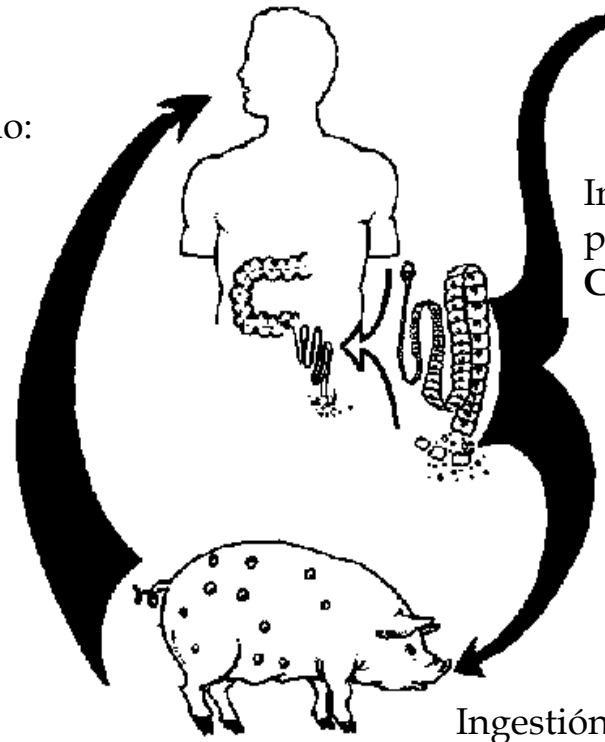
Huevo Infectivo

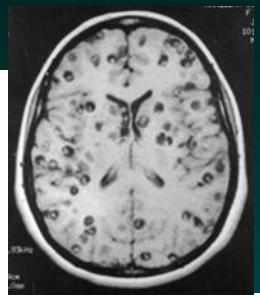


Recordando el Ciclo

Humano
(Hospedero Definitivo)

Ingestión de cerdo infectado, mal cocido:
Teniasis

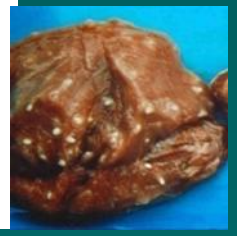




Ingestión de huevos de *T. solium* por contaminación fecal:
Cisticercosis Humana

Cerdo
(Hospedero Intermediario)

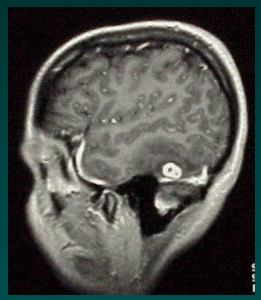
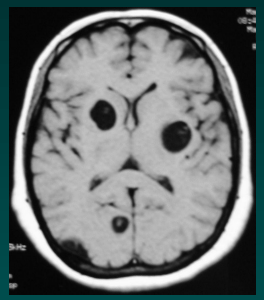
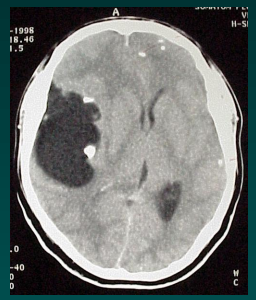
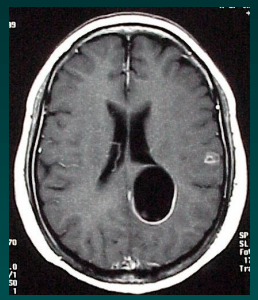
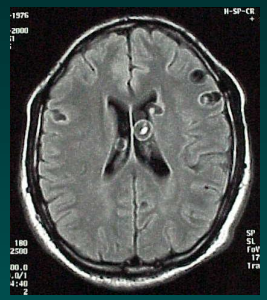
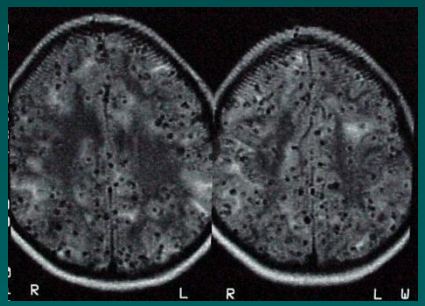
Ingestión de huevos o proglótidos de *T. solium:*
Cisticercosis Porcina

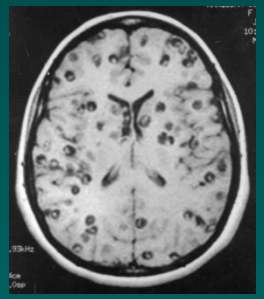
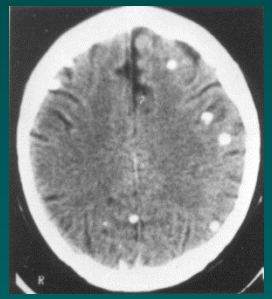
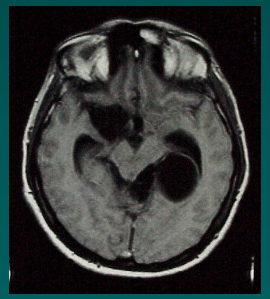


La NCC puede presentarse como casi cualquier síntoma neurológico, más frecuentemente crisis epilépticas de inicio tardío, cefaleas crónicas e hipertensión endocraneana

NCC Sintomática

Diversas Presentaciones

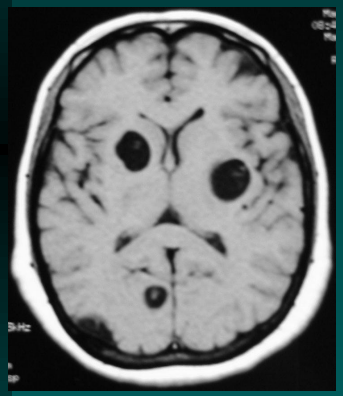
- Cualquier síntoma neurológico, principalmente crisis epilépticas de debut tardío
- Cisticercosis retinal

NCC Intraparenquimal

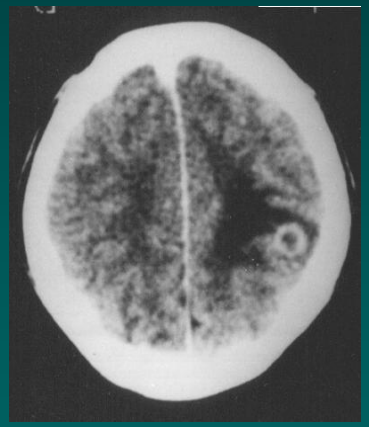
- Quiste → Granuloma → Calcificación (o desaparición)
- Evolución variable
- Otros: infecciones masivas

NCC Intraparenquimal

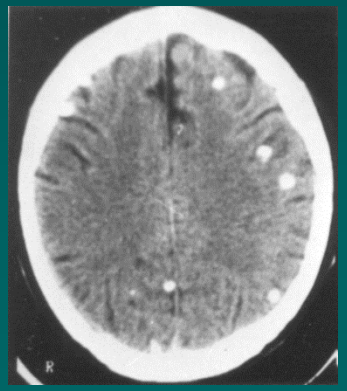
- Quiste →



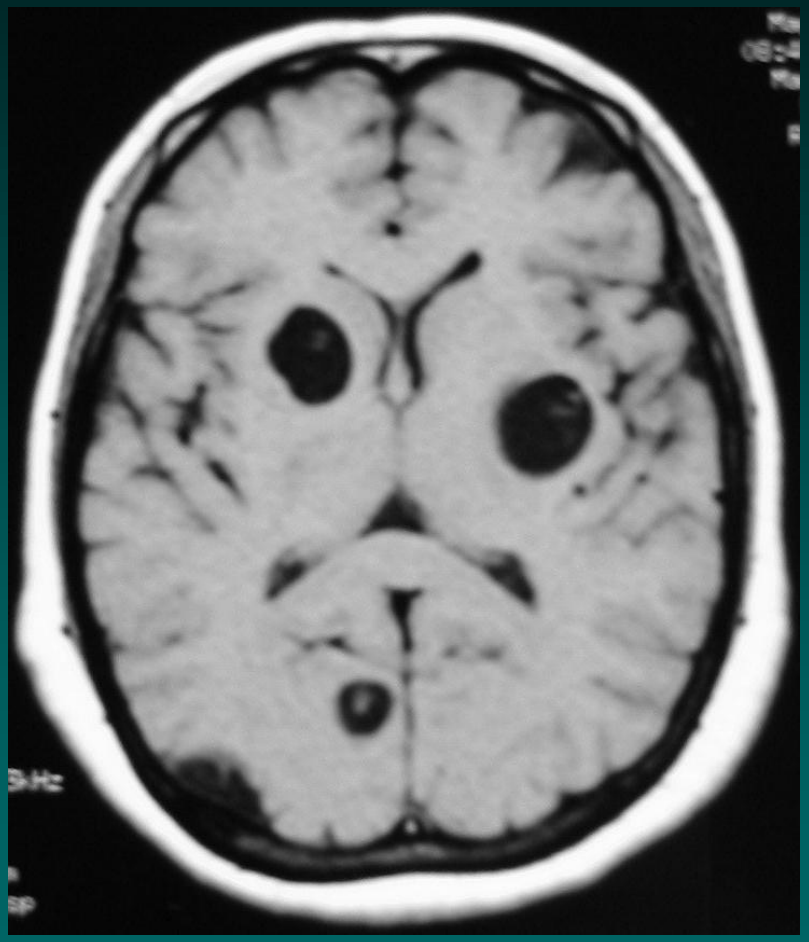
Granuloma →



Calcificación
(o desaparición)



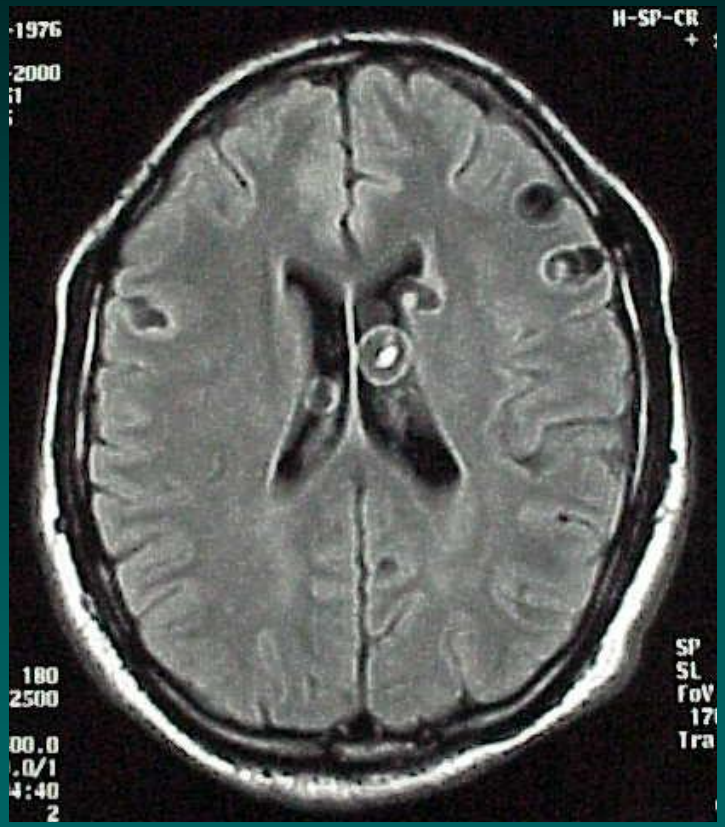
Quistes Intraparenquimales



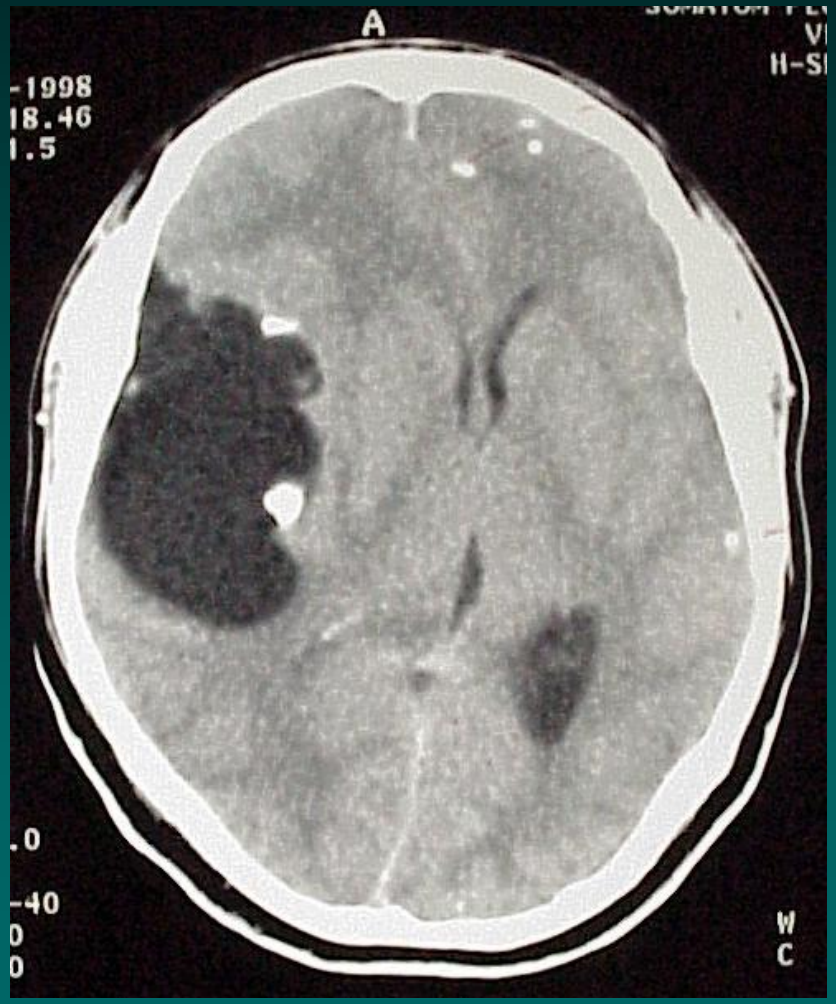
NCC Extraparenquimal

- Quistes intraventriculares
- NCC subaracnoidea (“racemosa”)
- Mayormente no asociada a epilepsia: hipertensión endoraneana, hidrocefalia
- Asociada a mortalidad
- Crecimiento descontrolado de la membrana quística

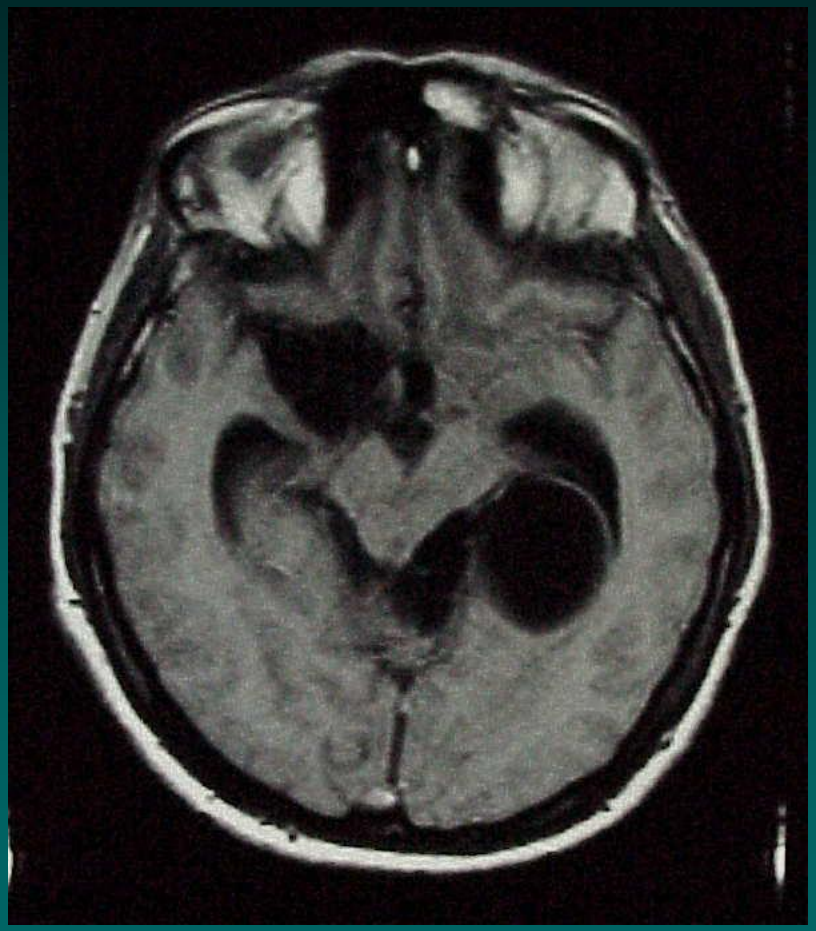
Quistes Intraventriculares



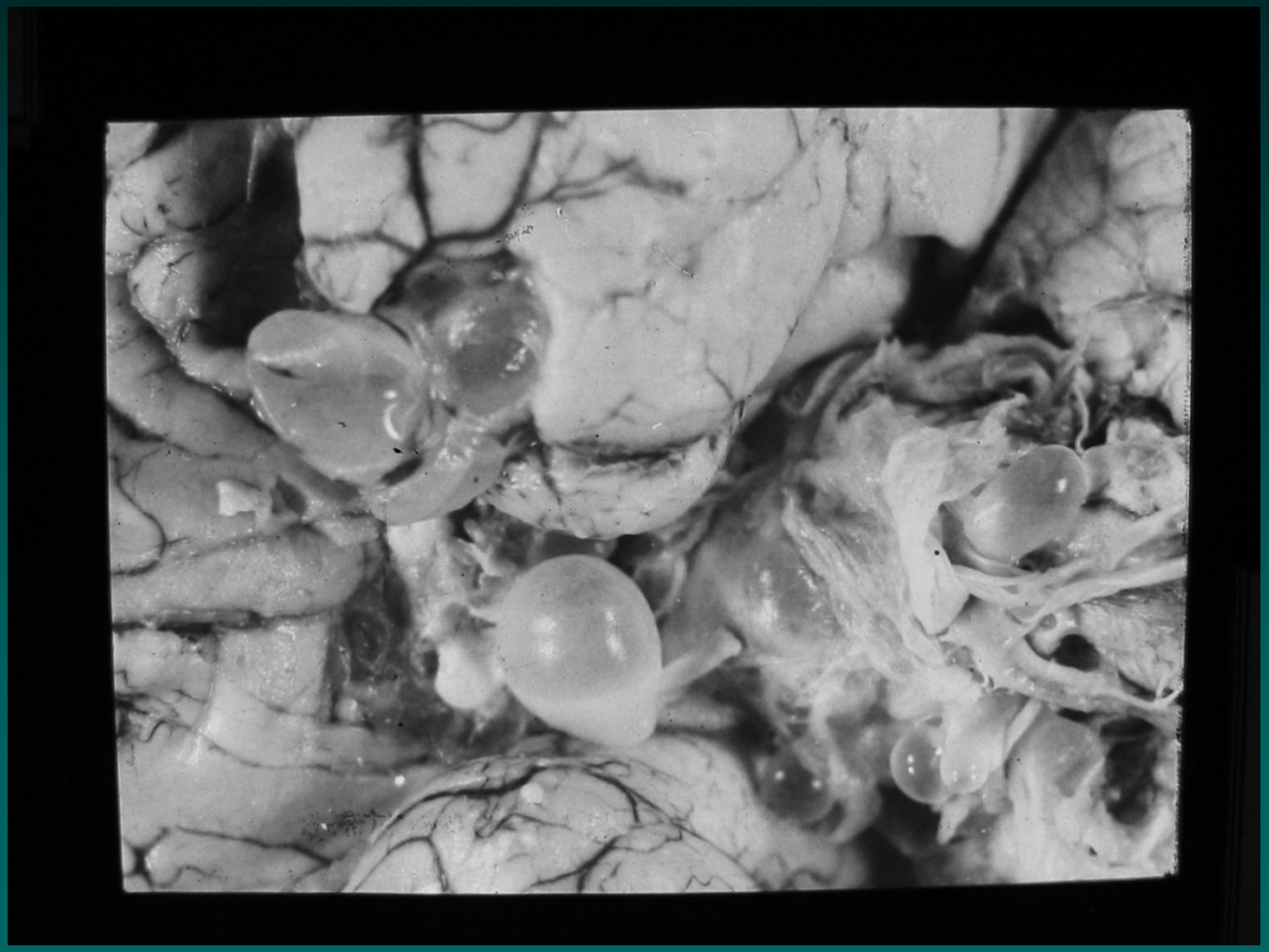
Masa Quística "Gigante" en la Cisura de Silvio



Cisticercosis Basal ("racemosa")



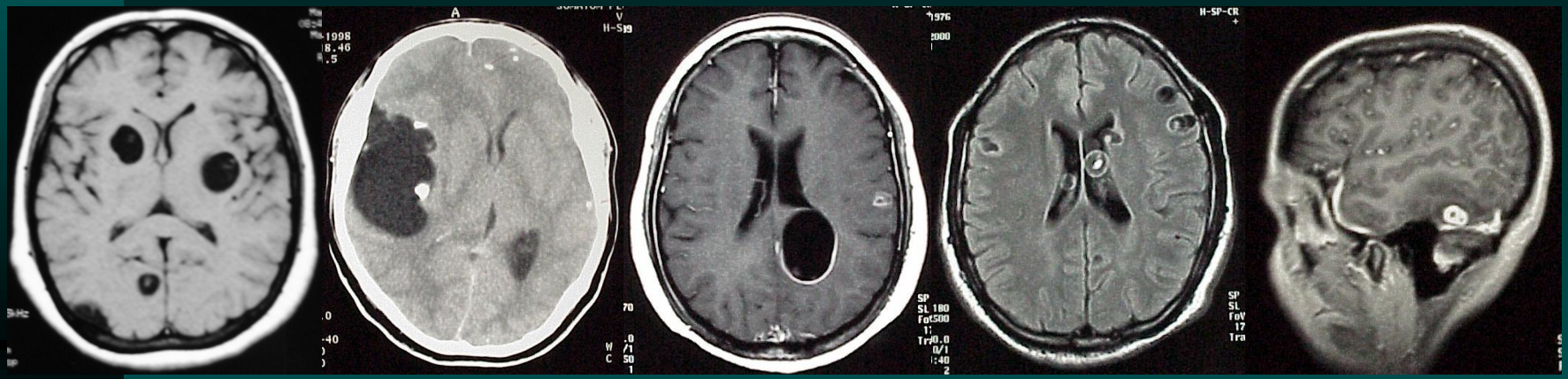
Cisticercosis Basal ("racemosa")

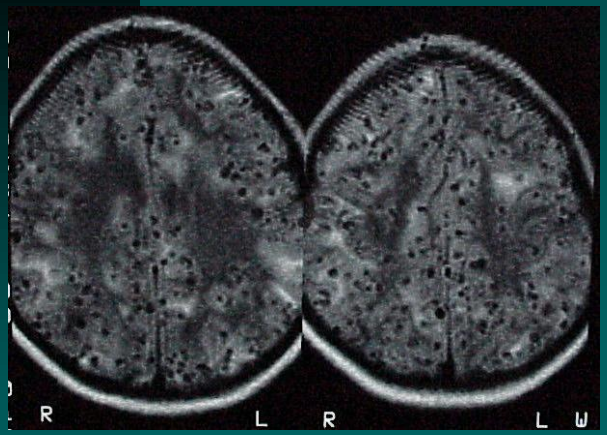


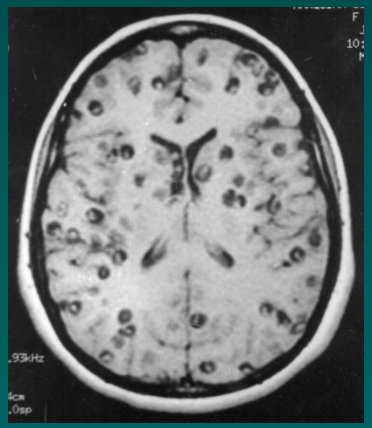
NCC parenquimal:
crisis epilépticas y epilepsias

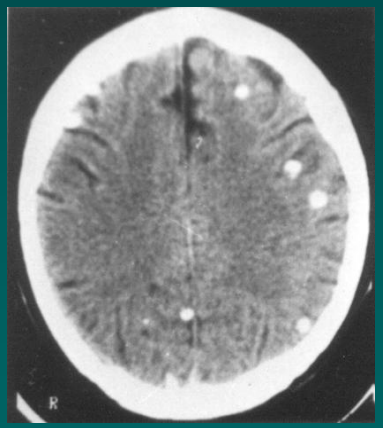
NCC extraparenquimal:
hipertensión endocraneana

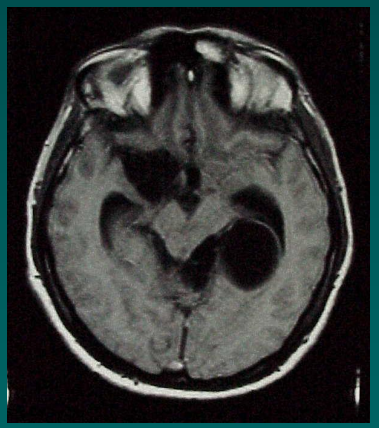
Las Neurocisticercosis



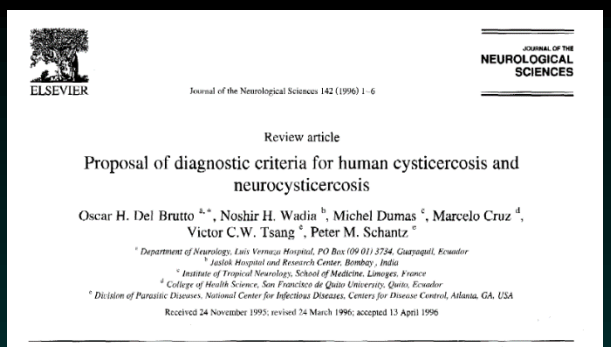








Diagnóstico



ELSEVIER

Journal of the Neurological Sciences 142 (1996) 1–6

JOURNAL OF THE NEUROLOGICAL SCIENCES

Review article

Proposal of diagnostic criteria for human cysticercosis and neurocysticercosis

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[b] Jaslok Hospital and Research Center, Bombay, India
[c] Institute of Tropical Neurology, School of Medicine, Limoges, France
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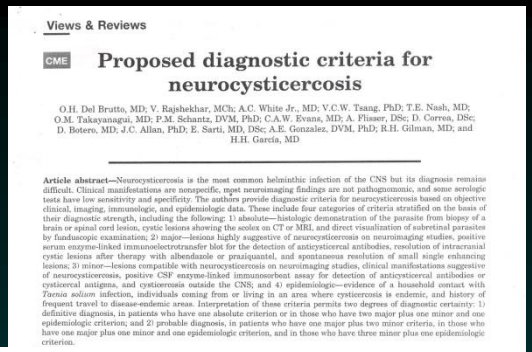
[e] Division of Parasitic Diseases, National Center for Infectious Diseases, Centers for Disease Control, Atlanta, GA, USA

Received 24 November 1995; revised 24 March 1996; accepted 13 April 1996



Views & Reviews

CME

Proposed diagnostic criteria for neurocysticercosis

O.H. Del Brutto, MD; V. Rajshekhar, MCh; A.C. White Jr., MD; V.C.W. Tsang, PhD; T.E. Nash, MD; O.M. Takayanagui, MD; P.M. Schantz, DVM, PhD; C.A.W. Evans, MD; A. Flisser, DSc; D. Correa, DSc; D. Botero, MD; J.C. Allan, PhD; E. Sarti, MD, DSc; A.E. Gonzalez, DVM, PhD; R.H. Gilman, MD; and H.H. García, MD

Article abstract—Neurocysticercosis is the most common helminthic infection of the CNS but its diagnosis remains difficult. Clinical manifestations are nonspecific, most neuroimaging findings are not pathognomonic, and some serologic tests have low sensitivity and specificity. The authors provide diagnostic criteria for neurocysticercosis based on objective clinical, imaging, immunologic, and epidemiologic data. These include four categories of criteria stratified on the basis of their diagnostic strength, including the following: 1) absolute—histologic demonstration of the parasite from biopsy of a brain or spinal cord lesion, cystic lesions showing the scolex on CT or MRI, and direct visualization of subretinal parasites by funduscopic examination; 2) major—lesions highly suggestive of neurocysticercosis on neuroimaging studies, positive serum enzyme-linked immunoelectrotransfer blot for the detection of anticysticercal antibodies, resolution of intracranial cystic lesions after therapy with albendazole or praziquantel, and spontaneous resolution of small single enhancing lesions; 3) minor—lesions compatible with neurocysticercosis on neuroimaging studies, clinical manifestations suggestive of neurocysticercosis, positive CSF enzyme-linked immunosorbent assay for detection of anticysticercal antibodies or cysticercal antigens, and cysticercosis outside the CNS; and 4) epidemiologic—evidence of a household contact with *Taenia solium* infection, individuals coming from or living in an area where cysticercosis is endemic, and history of frequent travel to disease-endemic areas. Interpretation of these criteria permits two degrees of diagnostic certainty: 1) definitive diagnosis, in patients who have one absolute criterion or in those who have two major plus one minor and one epidemiologic criterion; and 2) probable diagnosis, in patients who have one major plus two minor criteria, in those who have one major plus one minor and one epidemiologic criterion, and in those who have three minor plus one epidemiologic criterion.

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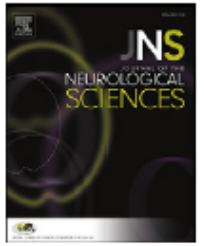

Review Article

Revised diagnostic criteria for neurocysticercosis

O.H. Del Brutto [a], T.E. Nash [b], A.C. White Jr. [c], V. Rajshekhar [d], P.P. Wilkins [e], G. Singh [f], C.M. Vasquez [g], P. Salgado [h], R.H. Gilman [i], H.H. Garcia [j,k,l,*]

[a] School of Medicine, Universidad Espíritu Santo – Ecuador, Guayaquil, Ecuador
[b] Laboratory of Parasitic Diseases, National Institute of Allergy and Infectious Diseases, National Institute of Health, Bethesda, MD, United States
[c] Infectious Disease Division, Department of Internal Medicine, University of Texas Medical Branch, Galveston, TX, United States
[d] Department of Neurological Sciences, Christian Medical College Hospital, Vellore, India
[e] Parasitology Services, Marathon, FL, United States
[f] Department of Neurology, Dayanand Medical College, Ludhiana, India
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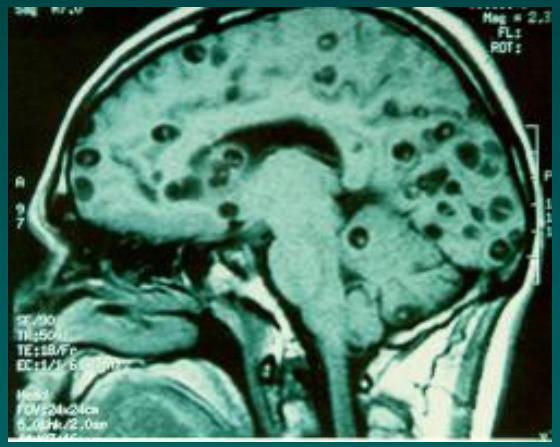
[h] Neuroimaging Unit, National Institute of Neurology and Neurosurgery Manuel Velasco Suarez, Mexico City, Mexico
[i] Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, United States
[j] Center for Global Health, Tumbes, Peru
[k] Department of Microbiology, School of Sciences, Universidad Peruana Cayetano Heredia, Peru
[l] Cysticercosis Unit, Instituto Nacional de Ciencias Neurológicas, Lima, Peru

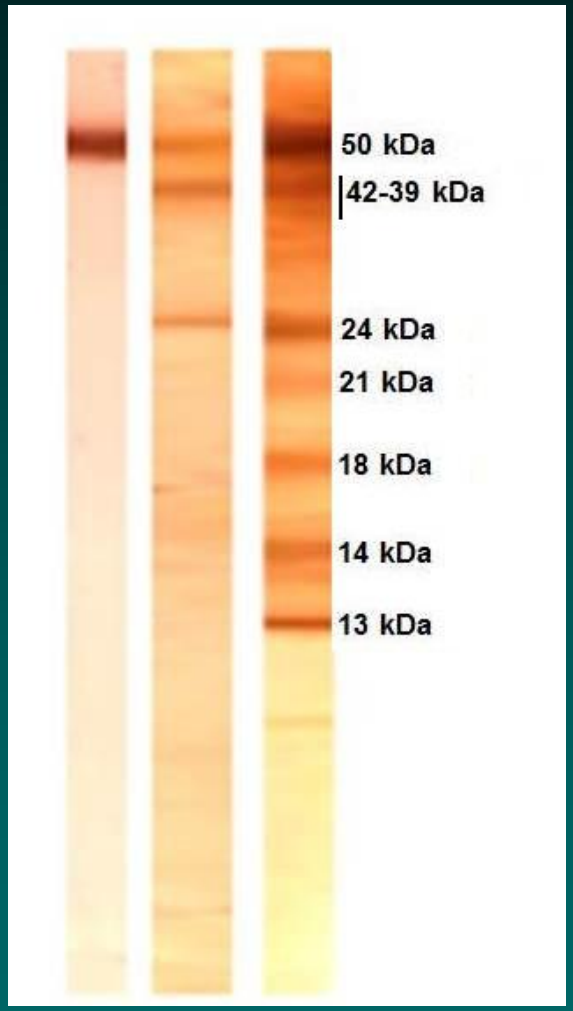
Diagnóstico - Neuroimagen

TAC introducida en los 1970, RM en los 1980



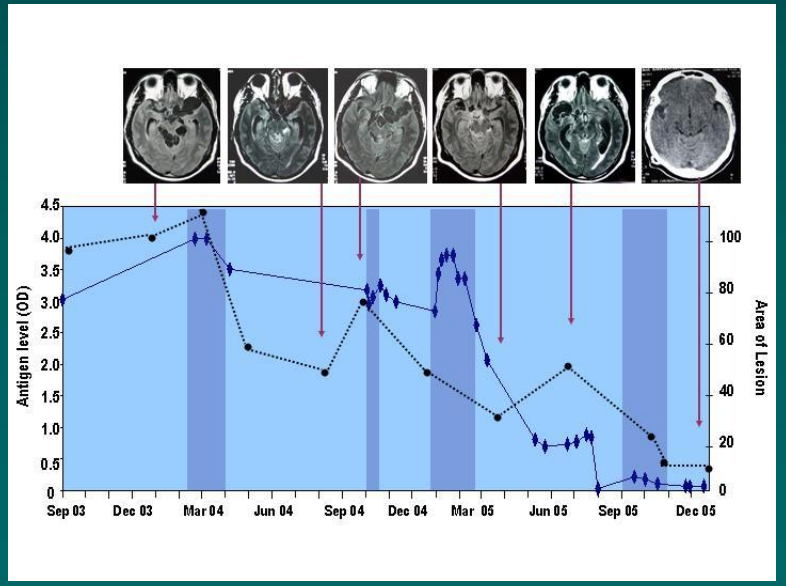
Serología – Western Blot

- Introducido en 1989 (Tsang et al, CDC)
- Muy sensible y especifico
- Anicuerpos a 7 antígenos glicoproteicos, tres familias



Serología - Detección de Antígeno

- Harrison & Parkhouse
- Geerts & Brandt
- Sensibilidad ~85%
- No hay evaluaciones de especificidad
- Util para seguimiento

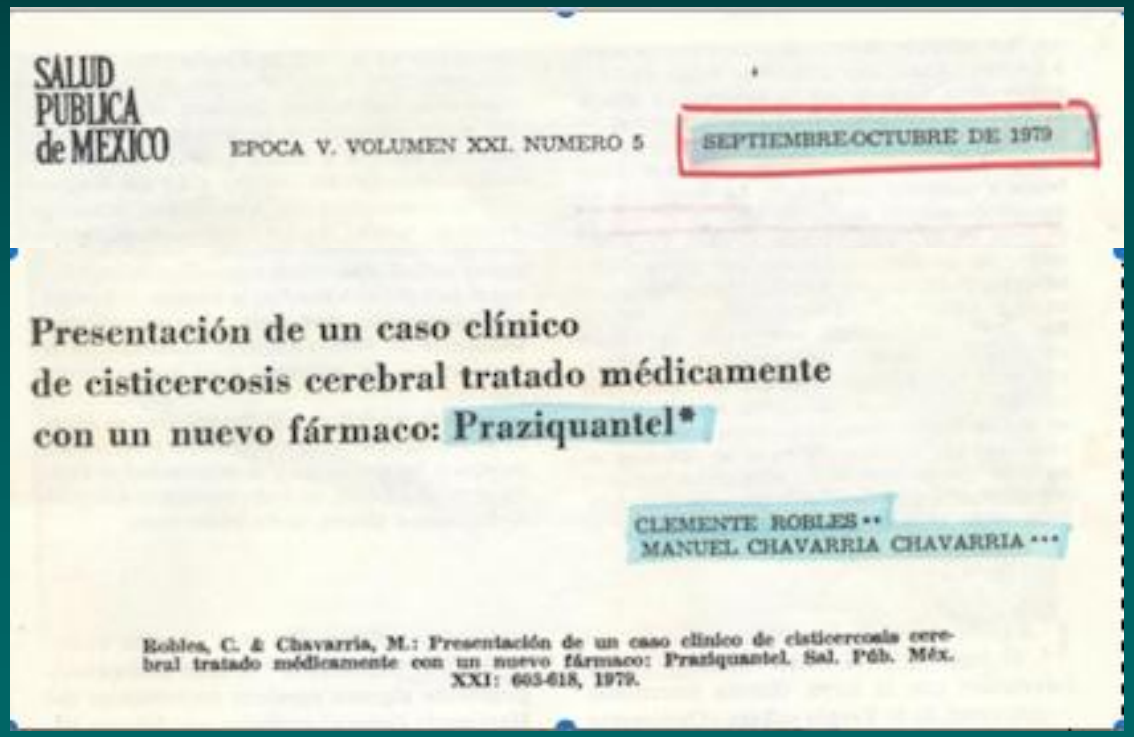


El diagnóstico de NCC se basa en neuroimagen y se apoya en pruebas serológicas específicas

Las pruebas de elección son el LLGP-EITB para anticuerpos, y ELISA basado en MoAbs para detección de antígeno

Tratamiento

- No existían tratamientos específicos hasta 1979
- Cirugía, esteroides



SALUD PUBLICA de MEXICO

EPOCA V. VOLUMEN XXI. NUMERO 5 SEPTIEMBRE-OCTUBRE DE 1979

Presentación de un caso clínico de cisticercosis cerebral tratado médicamente con un nuevo fármaco: Praziquantel*

CLEMENTE ROBLES**
MANUEL CHAVARRIA CHAVARRIA***

Robles, C. & Chavarría, M.: Presentación de un caso clínico de cisticercosis cerebral tratado médicamente con un nuevo fármaco: Praziquantel. Sal. Púb. Méx. XXI: 603-618, 1979.

Argumentos Pro-Tratamiento

- Rápida desaparición de los quistes
- Luego de la introducción de PZQ se ven menos casos severos
- Pacientes tratados con ABZ o PZQ presentan menos recurrencia de crisis que pacientes no tratados en los mismos hospitales
- Menos calcificaciones residuales (?)

Argumentos Anti-Tratamiento

- La NCC se vuelve sintomática después de varios años, cuando el parásito muere
- El tratamiento antiparasitario provoca una inflamación cerebral severa, aguda e innecesaria
- La inflamación o accidentes cerebrovasculares inducidos por el tratamiento pueden matar al paciente

Entonces, Se Debe Usar Antiparasitarios?

Tratamiento Antiparasitario

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

A Trial of Antiparasitic Treatment to Reduce the Rate of Seizures Due to Cerebral Cysticercosis

Héctor H. Garcia, M.D., Ph.D., E. Javier Pretell, M.D., Robert H. Gilman, M.D., S. Manuel Martinez, M.D., Lawrence H. Moulton, Ph.D., Oscar H. Del Brutto, M.D., Genaro Herrera, M.D., Carlton A.W. Evans, M.D., Ph.D., and Armando E. Gonzalez, D.V.M., Ph.D., for the Cysticercosis Working Group in Peru*

ABSTRACT

BACKGROUND

Neurocysticercosis is the main cause of adult-onset seizures in the developing world. Whether therapy with antiparasitic agents results in improved seizure control has been questioned because of the lack of adequate, controlled studies.

METHODS

We conducted a double-blind, placebo-controlled trial in which 120 patients who had living cysticerci in the brain and seizures treated with antiepileptic drugs were randomly assigned to receive either 800 mg of albendazole per day and 6 mg of dexamethasone per day for 10 days (60 patients) or two placebos (60 patients). The patients were followed for 30 months or until they had been seizure-free for 6 months after the doses of the antiepileptic drugs had been tapered. The efficacy of treatment was measured as the decrease in the number of seizures after treatment.

RESULTS

In the albendazole group, there was a 46 percent reduction in the number of seizures (95 percent confidence interval, −74 to 83 percent) during months 2 to 30 after treatment. This reduction, which was not statistically significant, was composed of a nonsignificant reduction of 41 percent in the number of partial seizures (95 percent confidence interval, −124 to 84 percent) and a significant 67 percent reduction in the number of seizures with generalization (95 percent confidence interval, 20 to 86 percent). Most of the difference in the number of partial seizures was attributable to a few patients who had many seizures during follow-up. The proportions of patients who had partial seizures during follow-up were similar in the two groups (19 of 57 in the albendazole group and 16 of 59 in the placebo group), but the patients in the placebo group had a greater tendency to have seizures with generalization (22 of 59, vs. 13 of 57 in the albendazole group; risk ratio, 1.63; 95 percent confidence interval, 0.91 to 2.92). More of the intracranial cystic lesions resolved in the albendazole group than in the placebo group. With the sole exception of abdominal pain, side effects did not differ significantly between the two groups.

CONCLUSIONS

In patients with seizures due to viable parenchymal cysts, antiparasitic therapy decreases the burden of parasites and is safe and effective, at least in reducing the number of seizures with generalization.

From the Department of Transmissible Diseases, Instituto Nacional de Ciencias Neurologicas (H.H.G., E.J.P., S.M.M.); the Departments of Microbiology (H.H.G., R.H.G., C.A.W.E.) and Radiology (G.H.), Universidad Peruana Cayetano Heredia; and the Department of Public Health, School of Veterinary Medicine, Universidad Nacional Mayor de San Marcos (A.E.G.) — all in Lima, Peru; the Department of International Health, Johns Hopkins University Bloomberg School of Public Health, Baltimore (H.H.G., R.H.G., L.H.M., C.A.W.E., A.E.G.); the Department of Neurologic Sciences, Hospital–Clinica Kennedy, Guayaquil, Ecuador (O.H.D.); and the Department of Infectious Diseases and Microbiology, Imperial College London, London (C.A.W.E.). Address reprint requests to Dr. Garcia at the Cysticercosis Unit, Instituto de Ciencias Neurologicas, Jiron Ancash 1271, Barrios Altos, Lima 1, Peru, or at hgarcia@jhsph.edu.

*Other members of the Cysticercosis Working Group in Peru are listed in the Appendix.

N Engl J Med 2004;350:249-58.

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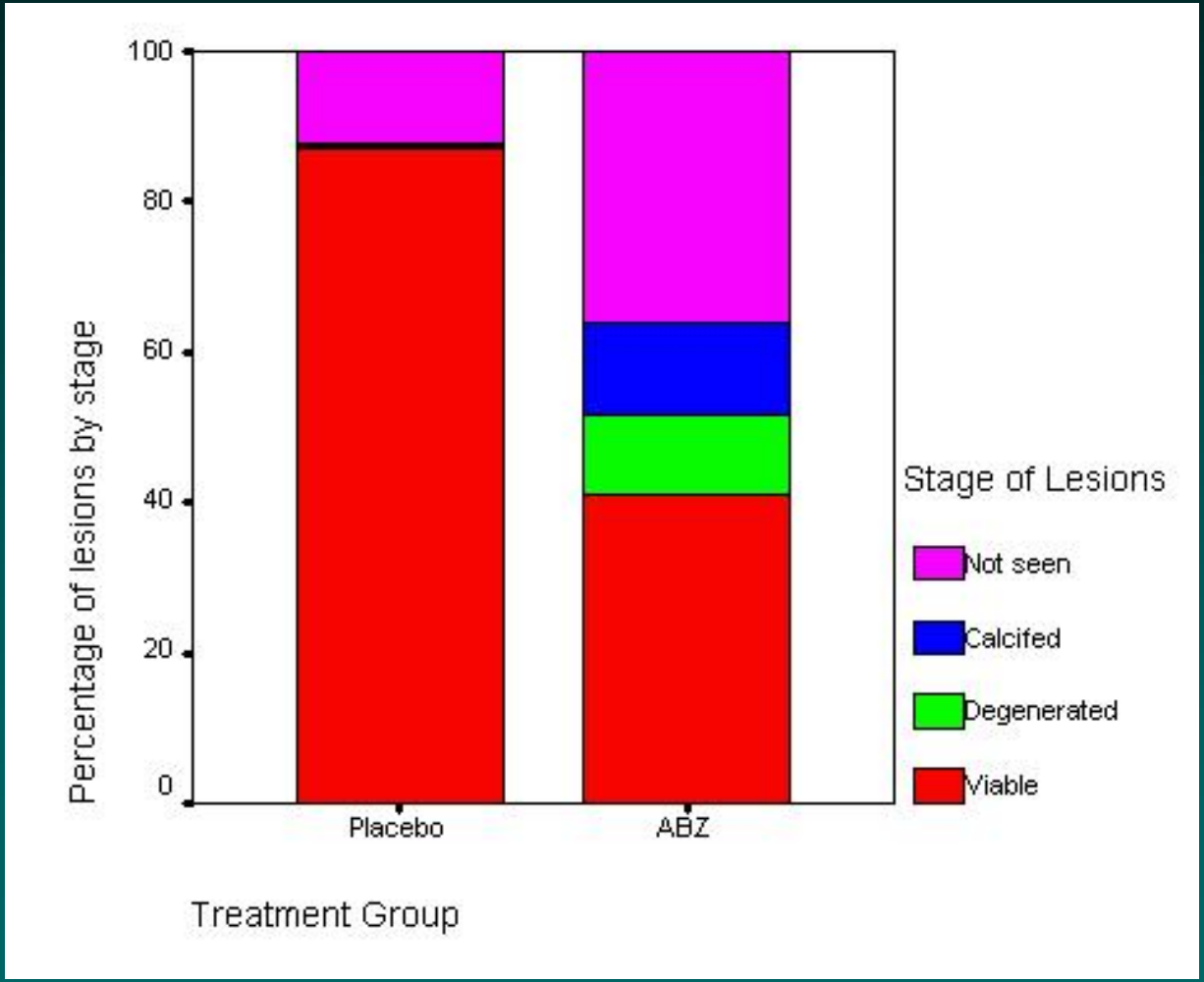
Evolución de los Quistes a 6 Meses



Antiparasitarios en Pacientes con Quistes Viables Disminuyen la Recurrencia de Crisis

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

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*Other members of the Cysticercosis Working Group in Peru are listed in the Appendix.

N Engl J Med 2004;350:249-58.

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Efficacy of combined antiparasitic therapy with praziquantel and albendazole for neurocysticercosis: a double-blind, randomised controlled trial

Hector H Garcia, Isidro Gonzales, Andres G Lescano, Javier A Bustos, Mirko Zimic, Diego Escalante, Herbert Saavedra, Martin Gavidia, Lourdes Rodriguez, Enrique Najar, Hugo Umeres, E Javier Pretell, for The Cysticercosis Working Group in Peru

Summary

Background Neurocysticercosis causes a substantial burden of seizure disorders worldwide. Treatment with either praziquantel or albendazole has suboptimum efficacy. We aimed to establish whether combination of these drugs would increase cysticidal efficacy and whether complete cyst resolution results in fewer seizures. We added an increased dose albendazole group to establish a potential effect of increased albendazole concentrations.

Methods In this double-blind, placebo-controlled, phase 3 trial, patients with viable intraparenchymal neurocysticercosis were randomly assigned to receive 10 days of combined albendazole (15 mg/kg per day) plus praziquantel (50 mg/kg per day), standard albendazole (15 mg/kg per day), or increased dose albendazole (22·5 mg/kg per day). Randomisation was done with a computer generated schedule balanced within four strata based on number of cysts and concomitant antiepileptic drug. Patients and investigators were masked to group assignment. The primary outcome was complete cyst resolution on 6-month MRI. Enrolment was stopped after interim analysis because of parasiticidal superiority of one treatment group. Analysis excluded patients lost to follow-up before the 6-month MRI. This trial is registered with ClinicalTrials.gov, number NCT00441285.

Findings Between March 3, 2010 and Nov 14, 2011, 124 patients were randomly assigned to study groups (41 to receive combined albendazole plus praziquantel [39 analysed], 43 standard albendazole [41 analysed], and 40 increased albendazole [38 analysed]). 25 (64%) of 39 patients in the combined treatment group had complete resolution of brain cysts compared with 15 (37%) of 41 patients in the standard albendazole group (rate ratio [RR] 1·75, 95% CI 1·10–2·79, p=0·014). 20 (53%) of 38 patients in the increased albendazole group had complete cyst resolution at 6-month MRI compared with 15 (37%) of 41 patients in the standard albendazole group (RR 1·44, 95% CI 0·87–2·38, p=0·151). No significant differences in adverse events were reported between treatment groups (18 in combined treatment group, 11 in standard albendazole group, and 19 in increased albendazole group).

Interpretation Combination of albendazole plus praziquantel increases the parasiticidal effect in patients with multiple brain cysticercosis cysts without increased side-effects. A more efficacious parasiticidal regime without increased treatment-associated side-effects should improve the treatment and long term prognosis of patients with neurocysticercosis.

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doi:10.1093/trstmh/trv078 Advance Access publication 3 October 2015

The effect of albendazole treatment on seizure outcomes in patients with symptomatic neurocysticercosis

Matthew L. Romo[a,b], Katarzyna Wyka[a,b,c], Arturo Carpio[d,e], Denise Leslie[f], Howard Andrews[g], Emilia Bagiella[g], W. Allen Hauser[e,h] and Elizabeth A. Kelvin[a,b,c,*], the Ecuadorian Neurocysticercosis Group[†]

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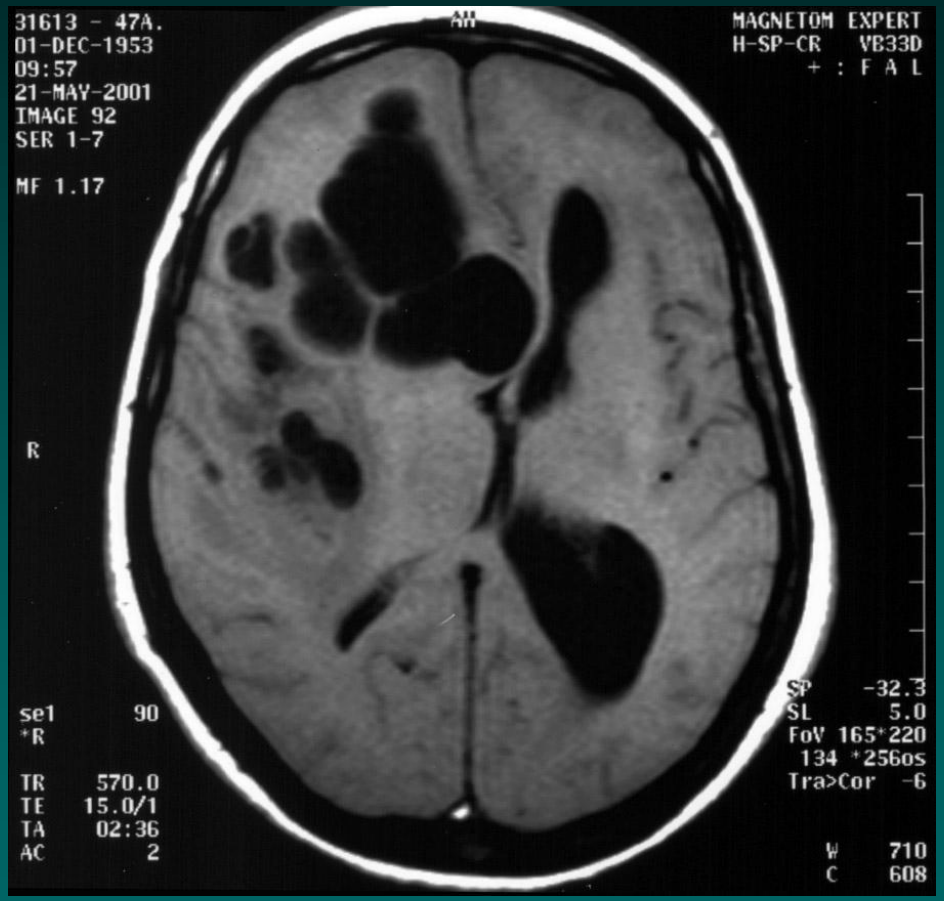
NCC Subarachnoidea



La NCC Subaracnoidea se Puede Manejar Bien

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Proof Only

Natural History of Treated Subarachnoid Neurocysticercosis

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[1]*Laboratory of Parasitic Diseases, National Institute of Allergy and Infectious Diseases, National Institutes of Health, Bethesda, Maryland;*
[2]*Diagnostic Radiology Department, Clinical Center, National Institutes of Health, Bethesda, Maryland*

Abstract. Subarachnoid neurocysticercosis (SUBNCC) is usually caused by an aberrant proliferative form of *Taenia solium* causing mass effect and arachnoiditis. Thirty of 34 SUBNCC patients were treated with extended cysticidal and anti-inflammatory regimens and followed up a median of 4.2 years posttreatment (range: 15 for ≥ 4 years, 20 ≥ 2 years, 26 > 1 year, and 3 < 1 year). The median ages at the time of first symptom, diagnosis, and enrollment were 29.7, 35.6, and 37.9 years, respectively; 58.8% were male and 82.4% were Hispanic. The median time from immigration to symptoms (minimum incubation) was 10 years and the estimated true incubation period considerably greater. Fifty percent also had other forms of NCC. Common complications were hydrocephalus (56%), shunt placement (41%), infarcts (18%), and symptomatic spinal disease (15%). Thirty patients (88.2%) required prolonged treatment with albendazole (88.2%, median 0.55 year) and/or praziquantel (61.8%; median 0.96 year), corticosteroids (88.2%, median 1.09 years), methotrexate (50%, median 1.37 years), and etanercept (34.2%, median 0.81 year), which led to sustained inactive disease in 29/30 (96.7%) patients. Three were treated successfully for recurrences and one has continuing infection. Normalization of cerebral spinal fluid parameters and cestode antigen levels guided treatment decisions. All 15 patients with undetectable cestode antigen values have sustained inactive disease. There were no deaths and moderate morbidity posttreatment. Corticosteroid-related side effects were common, avascular necrosis of joints being the most serious (8/33, 24.2%). Prolonged cysticidal treatment and effective control of inflammation led to good clinical outcomes and sustained inactive disease which is likely curative.

Lo que es más o menos claro

- La terapia sintomática (antiepilépticos, anti-inflamatorios) es extremadamente importante
- Un quiste que produce efecto de masa debe ser tratado con antiparasitarios o con cirugía
- Usar antiparasitarios o no debe ser una decisión individualizada, basada en las características de la infección y su evolución
- No hay razón para no dar esteroides si se dan antiparasitarios

Los antiparasitarios parecen ser beneficiosos en la mayoría de tipos de NCC

Se debe definir el tipo de NCC y priorizar el manejo sintomático. El tratamiento antiparasitario en NCC nunca es una emergencia

PZQ + ABZ es seguro y eficaz

Efficacy of combined antiparasitic therapy with praziquantel and albendazole for neurocysticercosis: a double-blind, randomised controlled trial

Hector H Garcia, Isidro Gonzales, Andres G Lescano, Javier A Bustos, Mirko Zimic, Diego Escalante, Herbert Saavedra, Martin Gavidia, Lourdes Rodriguez, Enrique Najar, Hugo Umeres, E Javier Pretell, for The Cysticercosis Working Group in Peru

Summary

Background Neurocysticercosis causes a substantial burden of seizure disorders worldwide. Treatment with either praziquantel or albendazole has suboptimum efficacy. We aimed to establish whether combination of these drugs would increase cysticidal efficacy and whether complete cyst resolution results in fewer seizures. We added an increased dose albendazole group to establish a potential effect of increased albendazole concentrations.

Methods In this double-blind, placebo-controlled, phase 3 trial, patients with viable intraparenchymal neurocysticercosis were randomly assigned to receive 10 days of combined albendazole (15 mg/kg per day) plus praziquantel (50 mg/kg per day), standard albendazole (15 mg/kg per day), or increased dose albendazole (22·5 mg/kg per day). Randomisation was done with a computer generated schedule balanced within four strata based on number of cysts and concomitant antiepileptic drug. Patients and investigators were masked to group assignment. The primary outcome was complete cyst resolution on 6-month MRI. Enrolment was stopped after interim analysis because of parasiticidal superiority of one treatment group. Analysis excluded patients lost to follow-up before the 6-month MRI. This trial is registered with ClinicalTrials.gov, number NCT00441285.

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8 mg DXM parecen mejor que 6

FULL-LENGTH ORIGINAL RESEARCH

Enhanced steroid dosing reduces seizures during antiparasitic treatment for cysticercosis and early after

*†‡§Hector H. Garcia, *Isidro Gonzales, §¶Andres G. Lescano, ‡Javier A. Bustos, #E. Javier Pretell, *Herbert Saavedra, **Theodore E. Nash, and for The Cysticercosis Working Group in Peru

Epilepsia, **(*):1–8, 2014
doi: 10.1111/epi.12739

Summary

Objective: Neurocysticercosis (NCC) is a major cause of seizures and epilepsy in endemic countries. Antiparasitic treatment of brain cysts leads to seizures due to the host's inflammatory reaction, requiring concomitant steroids. We hypothesized that increased steroid dosing will reduce treatment-associated seizures.

Methods: Open-label randomized trial comparing 6 mg/day dexamethasone for 10 days (conventional) with 8 mg/day for 28 days followed by a 2-week taper (enhanced) in patients with NCC receiving albendazole. Follow-up included active seizure surveillance and brain imaging. Study outcomes were seizure days and patients with seizures, both measured in days 11–42. Additional analyses compared days 1–10, 11–21, 22–32, 33–42, 43–60, and 61–180.

Results: Thirty-two individuals were randomized into each study arm; two did not complete follow-up. From days 11 to 42, 59 partial and 6 generalized seizure days occurred in 20 individuals, nonsignificantly fewer in the enhanced arm (12 vs. 49, $p = 0.114$). The numbers of patients with seizures in this period showed similar nonsignificant differences. In the enhanced steroid arm there were significantly fewer days and individuals with seizures during antiparasitic treatment (days 1–10: 4 vs. 17, $p = 0.004$, and 1 vs. 10, $p = 0.003$, number needed to treat [NNT] 4.6, relative risk [RR] 0.1013, 95% confidence interval [CI] 0.01–0.74) and early after dexamethasone cessation (days 11–21: 6 vs. 27, $p = 0.014$, and 4 vs. 12, $p = 0.021$, NNT 4.0, RR 0.33, 95% CI 0.12–0.92) but not after day 21. There were no significant differences in antiparasitic efficacy or relevant adverse events.

Significance: Increased dexamethasone dosing results in fewer seizures for the first 21 days during and early after antiparasitic treatment for viable parenchymal NCC but not during the first 11–42 days, which was the primary predetermined time of analysis.

KEY WORDS: Cysticercosis, Neurocysticercosis, Seizures, Epilepsy, *Taenia solium*, Cestodes, Peru.

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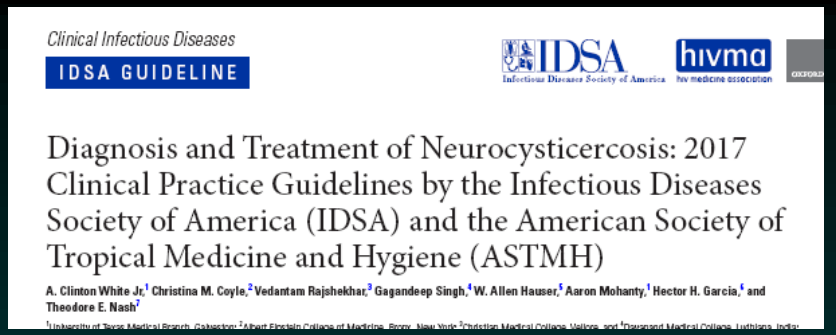

Clinical Infectious Diseases

IDSA GUIDELINE

IDSA Infectious Diseases Society of America

hivma hiv medicine association

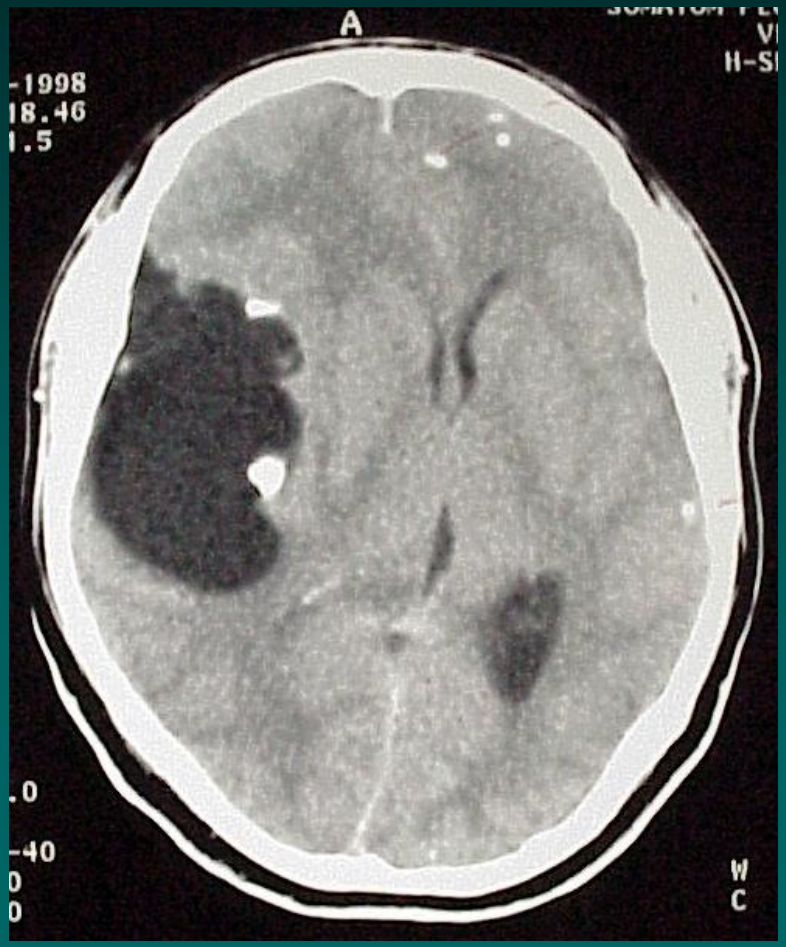
Diagnosis and Treatment of Neurocysticercosis: 2017 Clinical Practice Guidelines by the Infectious Diseases Society of America (IDSA) and the American Society of Tropical Medicine and Hygiene (ASTMH)

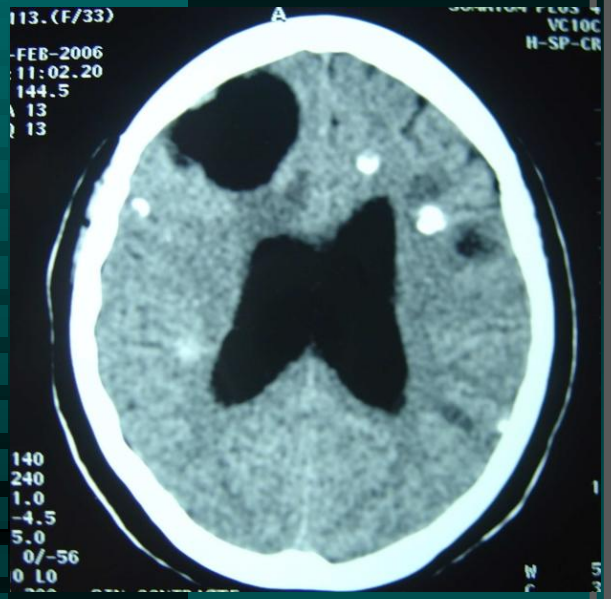
A. Clinton White Jr,[1] Christina M. Coyle,[2] Vedantam Rajshekhar,[3] Gagandeep Singh,[4] W. Allen Hauser,[5] Aaron Mohanty,[1] Hector H. Garcia,[6] and Theodore E. Nash[7]

Viable Parenchymal NCC	- 1–2 viable cysts - >2 viable cysts	- ABZ, 15 mg/kg/d up to 1200 mg/d, 10 days - ABZ, 15 mg/kg/d up to 1200 mg/d, plus PZQ, 50 mg/kg/d, 10 days
Single Enhancing Lesion		ABZ, 15 mg/kg/d, 1–2 weeks
Cysticercal Encephalitis		Avoid antiparasitic drugs, treat cerebral edema with corticosteroids.
Intraventricular		Surgical removal, preferably neuroendoscopy
Subarachnoid		Priorize management of hydrocephalus. ABZ, 15 mg/kg/d or ABZ + PZQ, 50 mg/kg/d for long periods

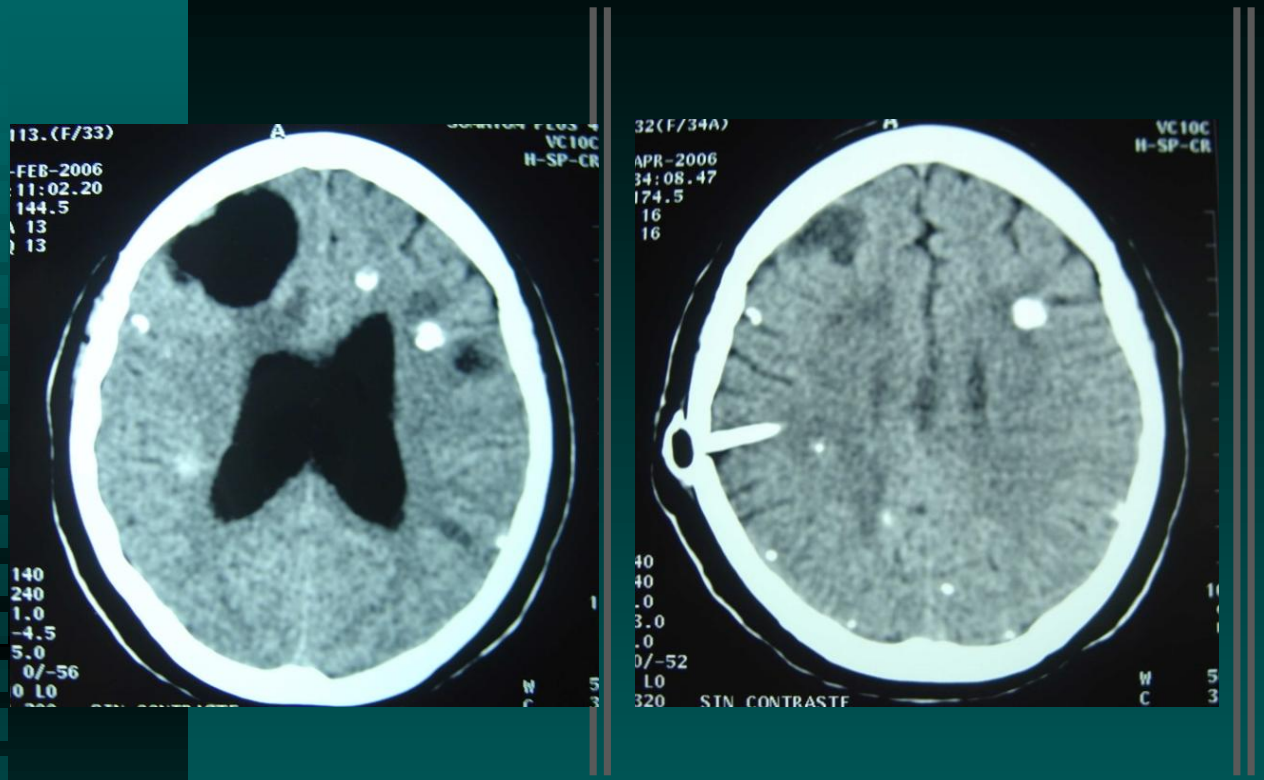
- Do not use antiparasitic drugs if there is intracranial pressure
- Corticosteroids are indicated when antiparasitic drugs are use

NCC *subaracnoidea*: *Hay un rol para la cirugía?*





NCC Calcificada



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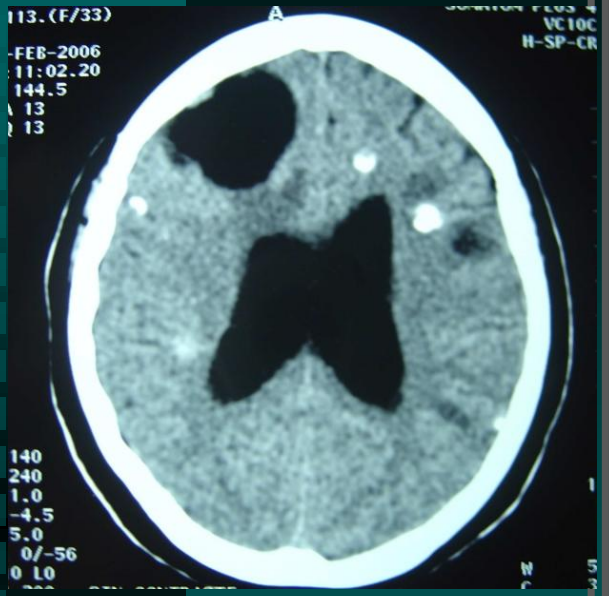
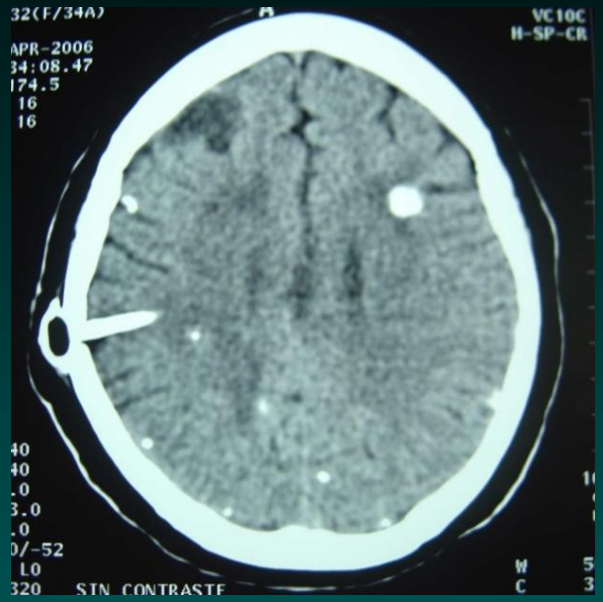
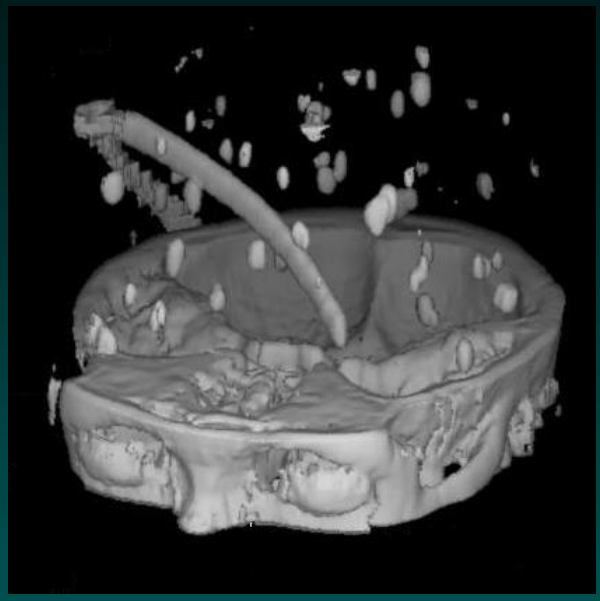






NCC Calcificada

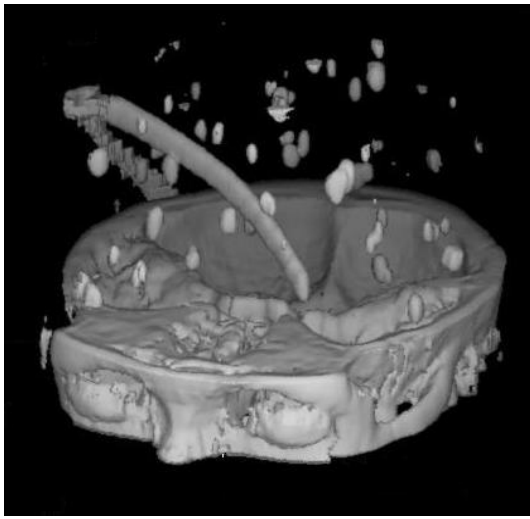
Resultados

Study variables		Univariate models		Multivariate model 1		Multivariate model 2	
		RR (95% CI)	*p* value	RR (95% CI)	*p* value	RR (95% CI)	*p*/value
CYST LEVEL							
Cyst size	<15 mm	Ref.		Ref.		Ref.	
	≥15 mm	1.35 (1.14-1.60)	<0.001	1.30 (1.07-1.57)	0.007	1.34 (1.02-1.75)	0.035
Cyst edema	No	Ref.		Ref.		Ref.	
	Yes	1.37 (1.17-1.62)	<0.001	1.36 (1.16-1.59)	<0.001	1.39 (1.05-1.85)	0.023
PATIENT LEVEL							
Disease time	≤24 months	Ref.				Ref.	
	>24 months	1.17 (1.13-1.21)	<0.001			1.25 (1.08-1.46)	0.003
EITB bands	≥4 bands	Ref.	.			Ref.	
	≤3 bands	1.21 (1.14-1.28)	<0.001			1.14 (1.02-1.27)	0.020
APT scheme	ABZ+PZQ	Ref.				Ref.	
	Standard ABZ	1.09 (0.84-1.41)	0.525			1.04 (0.71-1.51)	0.861
	Increased ABZ	1.27 (1.18-1.36)	<0.001			1.26 (1.14-1.39)	<0.001
Dose of DXM	>6.5 mg /day	Ref.	.			Ref.	
	≤6.5 mg /day	1.26 (1.04-1.52)	0.018			1.36 (1.02-1.81)	0.037
Cyst cure and re-treatment	Incomplete cure and re-treated	Ref.	.			Ref.	
	Complete cure and not re-treated	1.41 (1.21-1.63)	<0.001			1.48 (1.29-1.71)	<0.001
	Incomplete cure and not re-treated	1.33 (1.16-1.53)	<0.001			1.45 (1.08-1.93)	0.012

Conclusiones

- La inflamación juega un rol muy importante en el proceso de calcificacion.

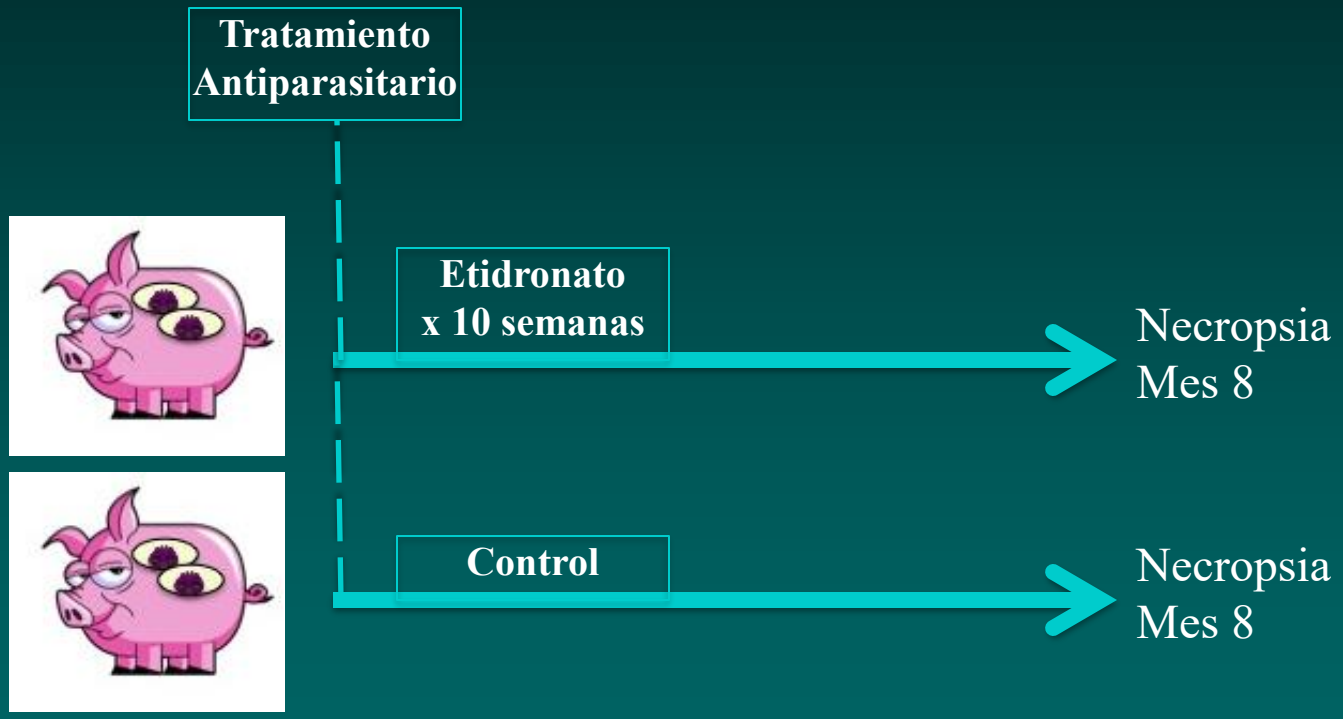
- Existen tres potenciales intervenciones que pueden reducir la proporción de calcificaciones
  - Tratamiento combinado ABZ-PZQ
  - Altas dosis de corticosteroides
  - Re-tretratamiento antiparasitario temprano



Estudio de la calcificación en modelos animales

Evaluación del efecto del Bisfosfonato

Seguimiento post-tratamiento antiparasitario



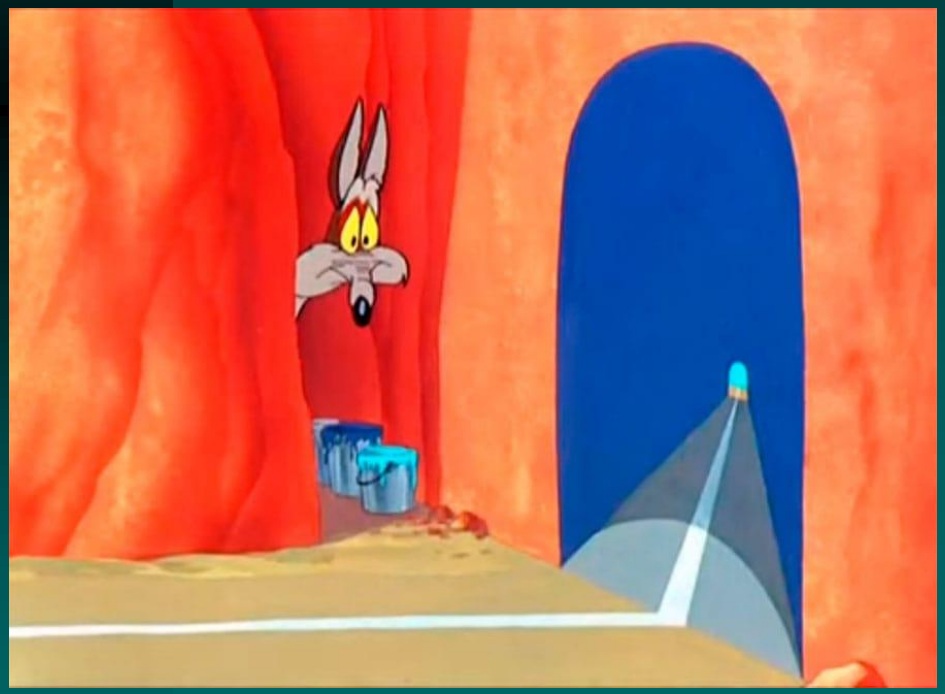
Resultados preliminares (Número de calcificaciones)

- Etidronato 5 cerdos
  - 49.62% (67/137)
- Control 7 cerdos
  - 77.67% (80/103)

Riesgo relativo 0.62 p < 0.00

Podemos reducir el proceso de calcificación?

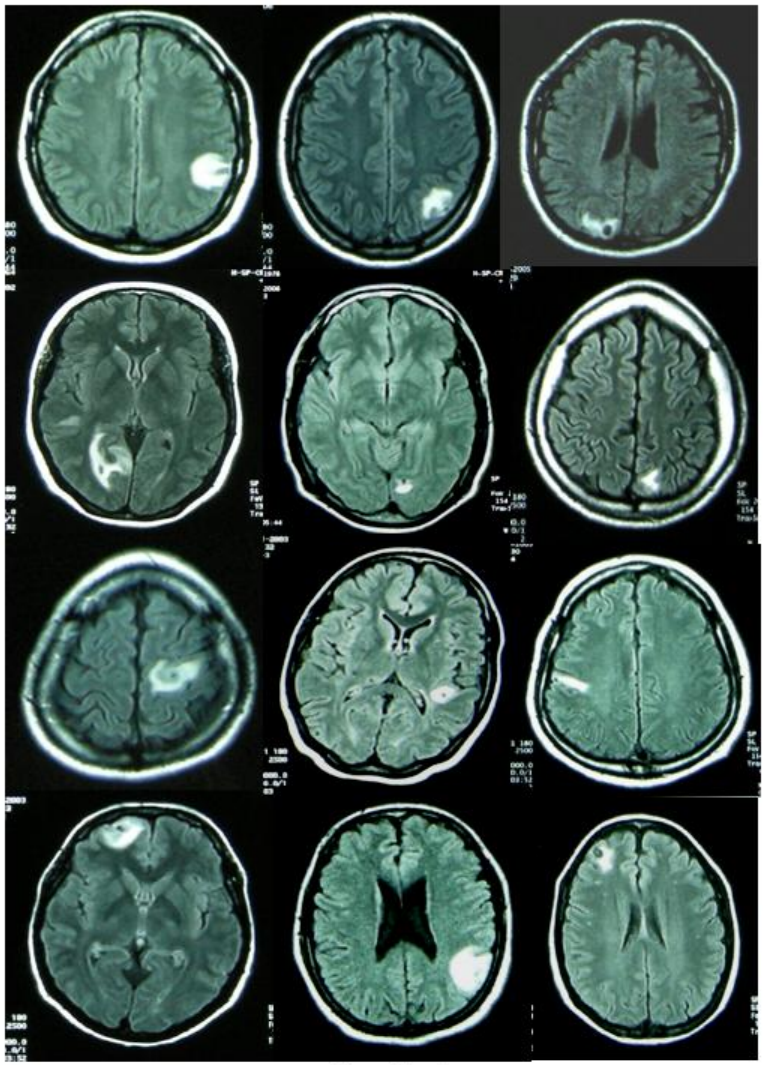
“Hay luz al final del túnel”



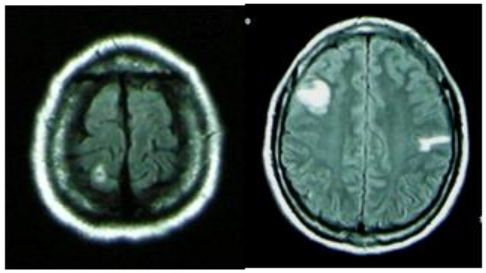
- Usar dosis incrementadas de albendazole
- Incrementar la terapia con inmunosupresora (corticoides)
- Dar cursos de retratamiento
- Uso de Etidronato después del tratamiento antiparasitario

Edema
Peri-calcificación

Cases



Controls



Control, el objetivo final

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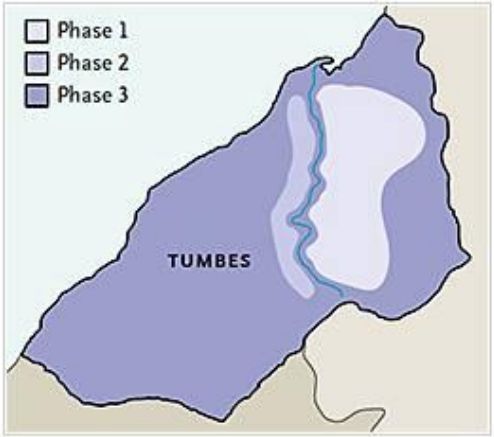


ORIGINAL ARTICLE

Taenia solium Transmission in Northern Peru

June 16, 2016 | H.H. Garcia and Others

Zoonotic infections can be controlled by interceding in the animal host. This report describes elimination of *T. solium* infection from a region in Peru through intervention in the pig–human cycle; such intervention should diminish complications from cysticercosis in the future.

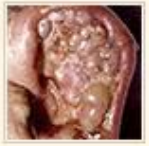
Free Full Text
Quick Take

SPECIALTY
Infectious Disease

QUICK TAKE VIDEO

Eradicating Pork Tapeworm Transmission

IMAGE CHALLENGE

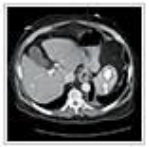


What is the most likely diagnosis in a man with acute skin eruptions?

Submit Answer

More Image Challenges

IMAGE OF THE WEEK



Chronic Splenic Brucellosis

This 86-year-old man presented with fever, dyspnea, and new-onset confusion.

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ORIGINAL ARTICLE ONLINE FIRST

Zika Virus Disease in

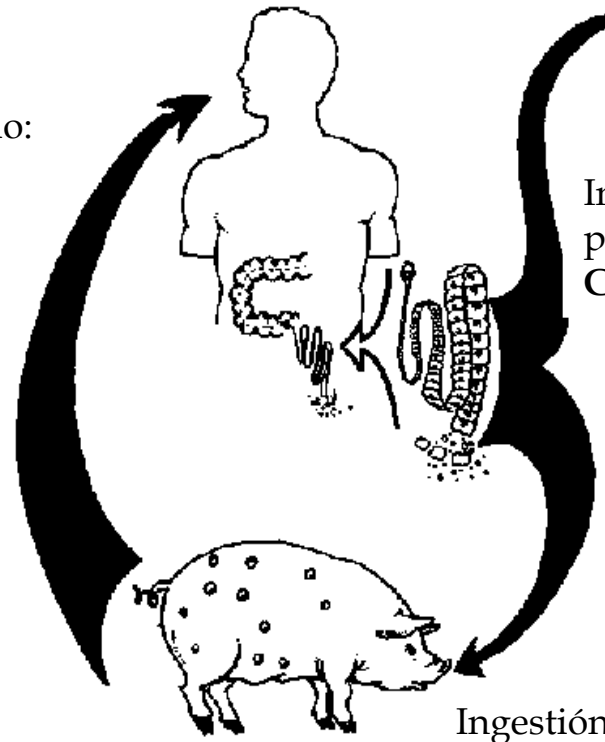
ORIGINAL ARTICLE

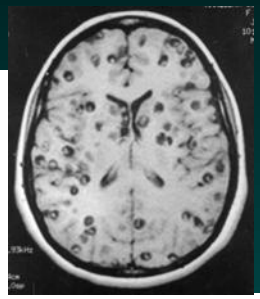
Tenofovir to Prevent Mother-

Recordando el Ciclo

Humano
(Hospedero Definitivo)

Ingestión de cerdo infectado, mal cocido:
Teniasis

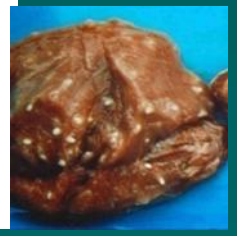




Ingestión de huevos de *T. solium* por contaminación fecal:
Cisticercosis Humana

Cerdo
(Hospedero Intermediario)

Ingestión de huevos o proglótidos de *T. solium:*
Cisticercosis Porcina




SOMATOM
Emotion

Figure 1. Regions of Tumbes, Peru, Covered during Each Phase of the Cysticercosis Elimination Demonstration Program.

Phase 3 covered the entire region of Tumbes, including those areas covered previously in phases 1 and 2.

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Elimination of *Taenia solium* Transmission in Northern Peru

Hector H. Garcia, M.D., Ph.D., Armando E. Gonzalez, D.V.M., Ph.D., Victor C.W. Tsang, Ph.D., Seth E. O'Neal, M.D., M.P.H., Fernando Llanos-Zavalaga, M.D., M.P.H., Guillermo Gonzalvez, M.D., M.P.H., Jaime Romero, D.V.M., Ph.D., Silvia Rodriguez, M.Sc.,* Luz M. Moyano, M.D., Viterbo Ayvar, D.V.M., Andre Diaz, D.V.M., Allen Hightower, M.S., Philip S. Craig, Ph.D., Marshall W. Lightowlers, Ph.D., Charles G. Gauci, Ph.D., Elli Leontsini, Ph.D., and Robert H. Gilman, M.D., D.T.M.H., for the Cysticercosis Working Group in Peru†

Table 2. Characteristics of Human and Pig Populations during Each Phase of the Cysticercosis Elimination Demonstration Program.*

Characteristic	Phase 1						Phase 2				Phase 3
	Mass Treatment	Minimal Mass Treatment	Strategic Treatment	Mass Screening	Prevention Education	Pig Replacement	Mass Treatment with Vaccine	Mass Treatment without Vaccine	Mass Screening with Vaccine	Mass Screening without Vaccine	Mass Treatment with Vaccine
Villages — no.	7	7	7	7	8	6	3	6	3	5	107
Humans — no.	2651	2127	2285	1660	1554	476	3418	2323	1756	2883	81,170
Male sex — %	51.3	52.6	53.8	51.8	53.0	52.7	51.1	54.6	50.2	51.1	51.4
Median age (IQR) — yr	27 (13–44)	26 (13–42)	25 (13–44)	27 (13–44)	26 (13–45)	24 (10–43)	26 (14–43)	27 (15–46)	28 (14–44)	28 (15–48)	25 (12–42)
Pigs — no.	3557	2909	3478	3441	3253	464	3255	3485	2874	3874	55,638
Male sex — %	42.7	45.7	44.7	46.2	46.4	42.2	44.9	43.4	42.3	43.9	NA
Median age (IQR) — mo	6 (2–12)	6 (3–12)	6 (3–12)	6 (3–12)	5 (2–12)	7 (3–18)	6 (3–10)	6 (3–10)	6 (3–10)	6 (3–10)	NA
Baseline prevalence of cysticercosis — %†	44.6	34.7	45.7	41.0	50.2	42.9	24.5	47.8	47.3	28.1	NA

* The groups differed significantly only with regard to antibody prevalence. NA denotes not assessed.
† Prevalence was assessed by enzyme-linked immunoelectrotransfer blot antibody testing.

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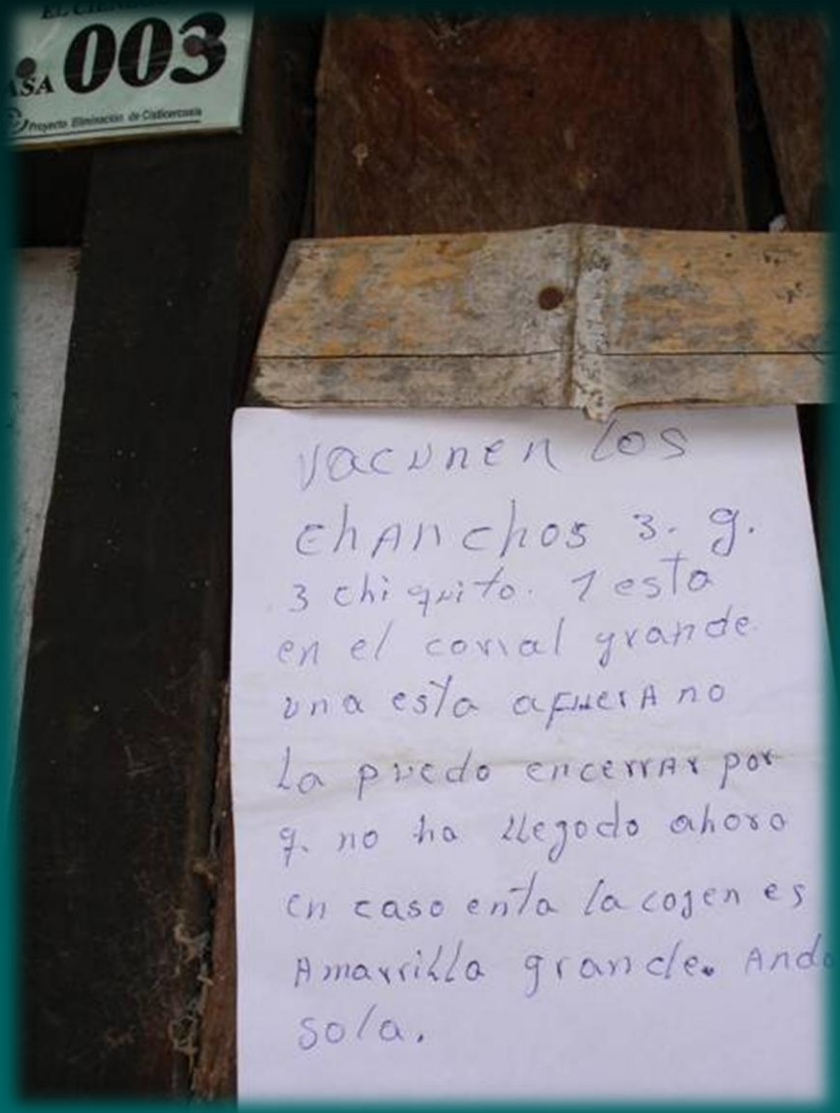
Participación comunitaria

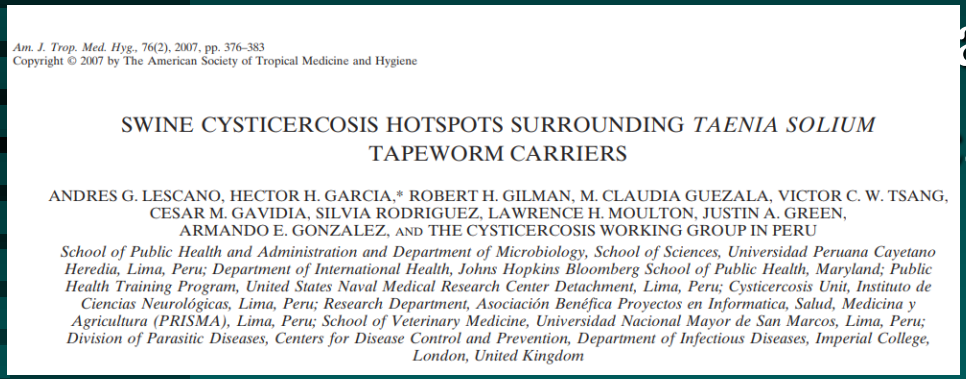


Esquema final

- Oxfendazol en cerdos, 5 veces (meses 0, 2, 4, 6 y 8)
- Niclosamida en humanos, 3 veces (mes 1, 5 y 9)
- Coproantígeno (detección de Ag en heces, ELISA) después del tratamiento con NSM
- Vacunas en cerdos, 2 veces (mes 4 and 8)

Otros enfoques

- Se desarrollaron otros estudios, que tratan de explicar la probable agrupación de la



Am. J. Trop. Med. Hyg., 76(2), 2007, pp. 376–383
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SWINE CYSTICERCOSIS HOTSPOTS SURROUNDING *TAENIA SOLIUM* TAPEWORM CARRIERS

ANDRES G. LESCANO, HECTOR H. GARCIA,* ROBERT H. GILMAN, M. CLAUDIA GUEZALA, VICTOR C. W. TSANG, CESAR M. GAVIDIA, SILVIA RODRIGUEZ, LAWRENCE H. MOULTON, JUSTIN A. GREEN, ARMANDO E. GONZALEZ, AND THE CYSTICERCOSIS WORKING GROUP IN PERU

School of Public Health and Administration and Department of Microbiology, School of Sciences, Universidad Peruana Cayetano Heredia, Lima, Peru; Department of International Health, Johns Hopkins Bloomberg School of Public Health, Maryland; Public Health Training Program, United States Naval Medical Research Center Detachment, Lima, Peru; Cysticercosis Unit, Instituto de Ciencias Neurológicas, Lima, Peru; Research Department, Asociación Benéfica Proyectos en Informatica, Salud, Medicina y Agricultura (PRISMA), Lima, Peru; School of Veterinary Medicine, Universidad Nacional Mayor de San Marcos, Lima, Peru; Division of Parasitic Diseases, Centers for Disease Control and Prevention, Department of Infectious Diseases, Imperial College, London, United Kingdom

PLOS | NEGLECTED TROPICAL DISEASES

RESEARCH ARTICLE

GPS Tracking of Free-Ranging Pigs to Evaluate Ring Strategies for the Control of Cysticercosis/Taeniasis in Peru

Ian W. Pray[1], Dallas J. Swanson[1], Viterbo Ayvar[2], Claudio Muro[2], Luz M. Moyano[2,3,4], Armando E. Gonzalez[5], Hector H. Garcia[2,6], Seth E. O'Neal[1,2]*, Cysticercosis Working Group in Peru[2]

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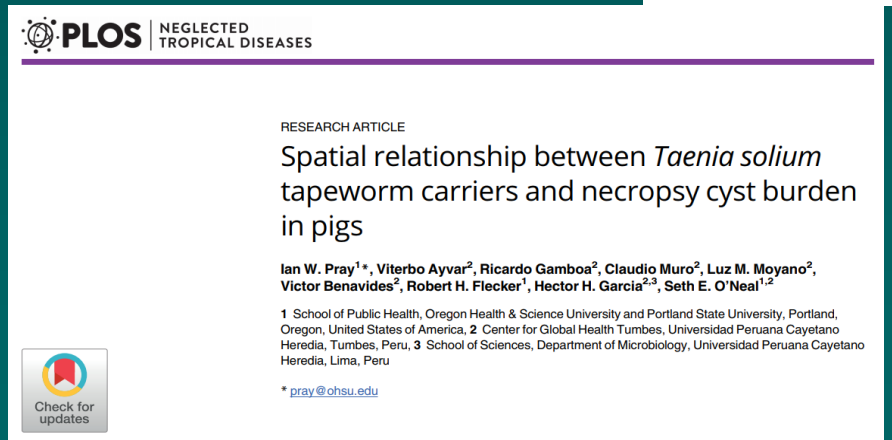
* oneals@ohsu.edu



PLOS | NEGLECTED TROPICAL DISEASES

RESEARCH ARTICLE

Spatial relationship between *Taenia solium* tapeworm carriers and necropsy cyst burden in pigs

Ian W. Pray[1]*, Viterbo Ayvar[2], Ricardo Gamboa[2], Claudio Muro[2], Luz M. Moyano[2], Victor Benavides[2], Robert H. Flecker[1], Hector H. Garcia[2,3], Seth E. O'Neal[1,2]

1 School of Public Health, Oregon Health & Science University and Portland State University, Portland, Oregon, United States of America, **2** Center for Global Health Tumbes, Universidad Peruana Cayetano Heredia, Tumbes, Peru, **3** School of Sciences, Department of Microbiology, Universidad Peruana Cayetano Heredia, Lima, Peru

* pray@ohsu.edu

Otros enfoques

- *Cisticercosis porcina al rededor de portadores de Taenia solium (Lescano 2007)*

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SWINE CYSTICERCOSIS HOTSPOTS SURROUNDING *TAENIA SOLIUM* TAPEWORM CARRIERS

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School of Public Health and Administration and Department of Microbiology, School of Sciences, Universidad Peruana Cayetano Heredia, Lima, Peru; Department of International Health, Johns Hopkins Bloomberg School of Public Health, Maryland; Public Health Training Program, United States Naval Medical Research Center Detachment, Lima, Peru; Cysticercosis Unit, Instituto de Ciencias Neurológicas, Lima, Peru; Research Department, Asociación Benéfica Proyectos en Informatica, Salud, Medicina y Agricultura (PRISMA), Lima, Peru; School of Veterinary Medicine, Universidad Nacional Mayor de San Marcos, Lima, Peru; Division of Parasitic Diseases, Centers for Disease Control and Prevention, Department of Infectious Diseases, Imperial College, London, United Kingdom

Los cerdos que viven en la casa de un portador de solitaria tienen cuatro veces mas chances de seroexposición comparado con otros cerdos ($P<0.005$).

Nuestros estudios

- *Cisticercosis porcina al rededor de portadores de Taenia solium (Lescano 2007)*

Lescano, concluye:

Los cerdos que viven en la casa de un portador de solitaria tienen cuatro veces mas chances de seroexposición comparado con otros cerdos ($P<0.005$).

En las zonas rurales, **la cisticercosis porcina ocurre en mayormente alrededor de los portadores de *Taenia Solium***.

Eliminacio: Otros enfoques

- *Rastreo GPS de cerdos de rango libre para evaluar estrategias de anillo para el*

PLOS | NEGLECTED TROPICAL DISEASES

RESEARCH ARTICLE

GPS Tracking of Free-Ranging Pigs to Evaluate Ring Strategies for the Control of Cysticercosis/Taeniasis in Peru

Ian W. Pray[1], Dallas J. Swanson[1], Viterbo Ayvar[2], Claudio Muro[2], Luz M. Moyano[2,3,4], Armando E. Gonzalez[5], Hector H. Garcia[2,6], Seth E. O'Neal[1,2]*, Cysticercosis Working Group in Peru[2]

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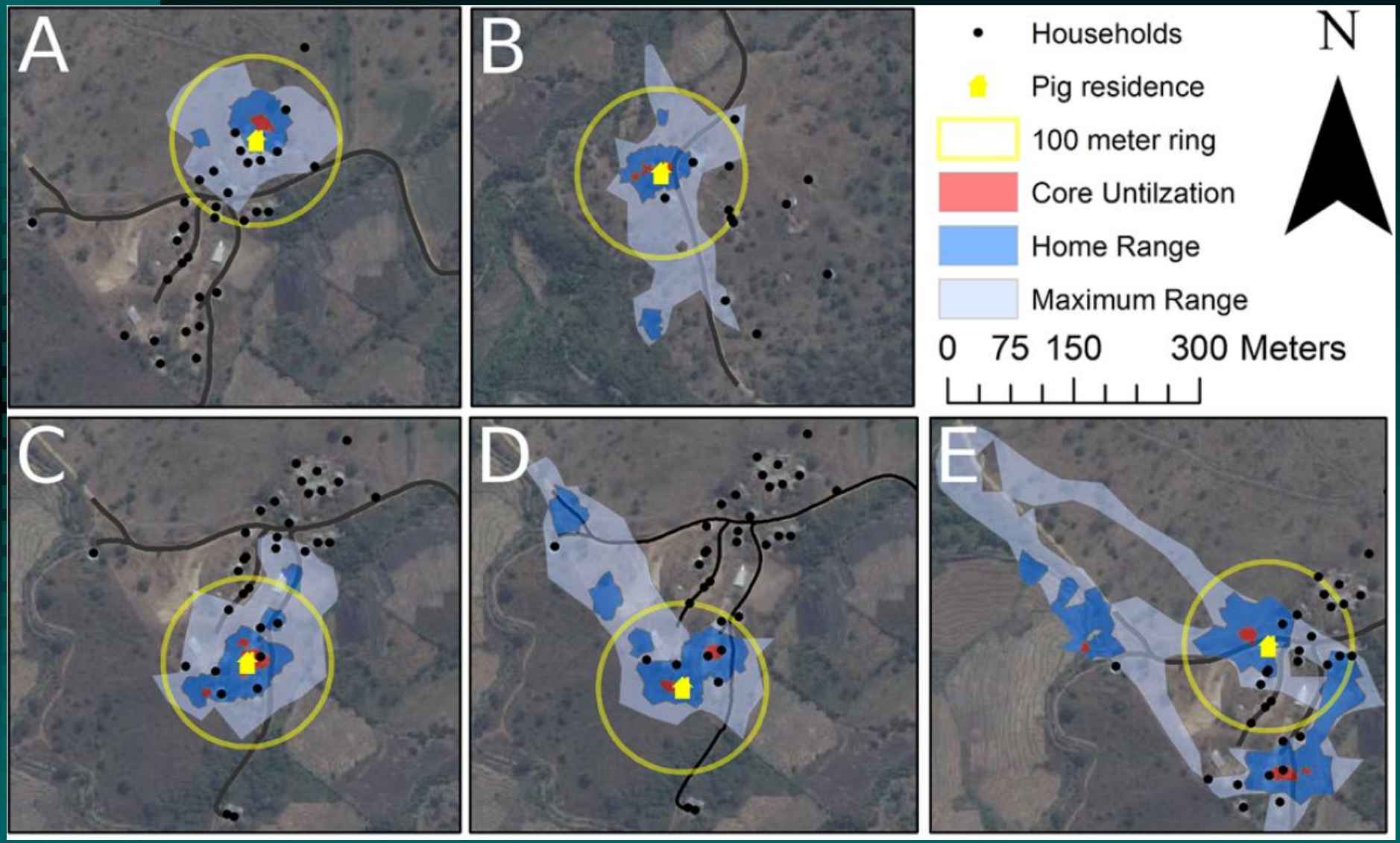
Fig 2. GPS device secured properly to pig upon capture.


A
B
C
D
E
Households
Pig residence
100 meter ring
Core Untilzation
Home Range
Maximum Range
N
0 75 150 300 Meters

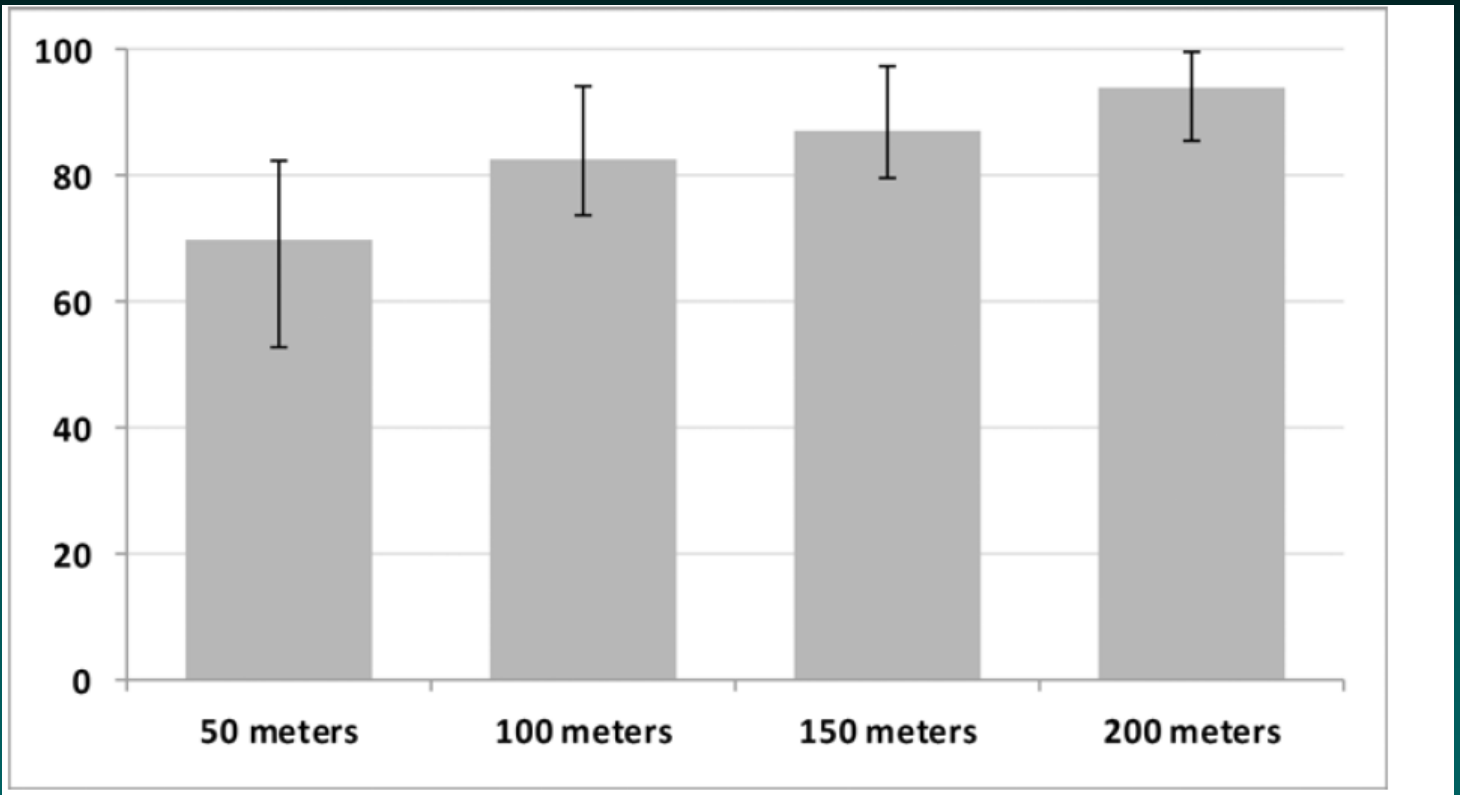


Fig 4. Percent of tracking period within 50, 100, 150, and 200 meters of pig residence, (median [IQR]).

doi:10.1371/journal.pntd.0004591.g004

Eliminacion: otros enfoques

- *Rastreo GPS de cerdos de rango libre para evaluar estrategias de anillo para el control de cisticercosis/teniasis en Perú*
- *(Pray 2016)*

Conclusiones/Importancia

Estos resultados indican que los anillos de 100 metros de radio alrededor de los cerdos gravemente infectados capturan adecuadamente el área de deambulación promedio de los cerdos (es decir, el área de distribución) y **representan un área donde ocurre la gran mayoría de la exposición a las heces humanas**.

Nuestros estudios

- *Relación espacial entre portadores de Taenia y la carga del quiste post necropsia en cerdos (Pray 2017)*

PLOS | NEGLECTED TROPICAL DISEASES

RESEARCH ARTICLE

Spatial relationship between *Taenia solium* tapeworm carriers and necropsy cyst burden in pigs

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RESEARCH ARTICLE

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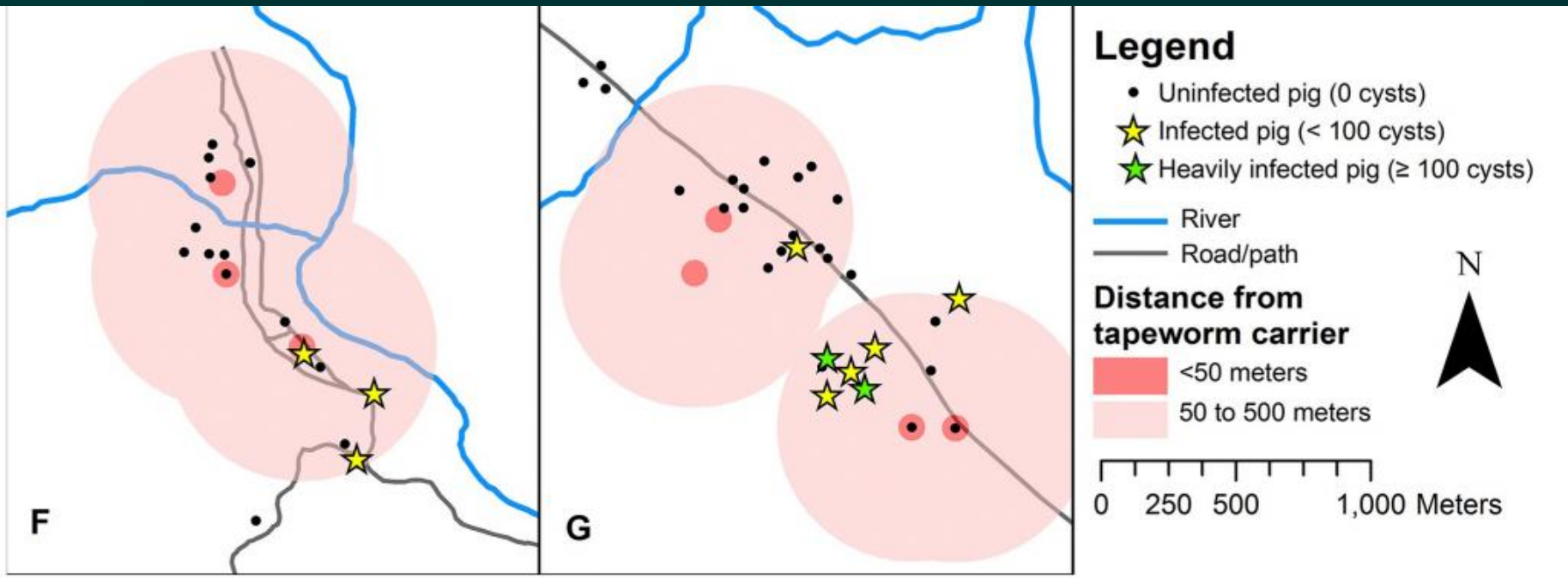

Fig 1. Map of *Taenia solium* tapeworm carriers and infected pigs in study villages. (A) Culqui, (B) Cachaco, (C) Puente Quiroz, (D) Tomopampa de Cardal, (E) Algodonal, (F) Buenos Aires, (G) La Saucha.

Nuestros estudios

- *Relación espacial entre portadores de Taenia y la carga del quiste post necropsia en cerdos (Pray 2017)*

Pray I, concluye: Los portadores de *Taenia* y los cerdos con infección viable se correlacionan geográficamente en áreas endémicas.

Este hallazgo apoya las estrategias de control que tratan a los seres humanos y a los cerdos basándose en su cercanía con otros individuos infectados.

Nos lleva a pensar:

- García (2016) concluye que el tratamiento masivo es una buena estrategia para controlar la transmisión del binomio teniasis cisticercosis.
- Pray (2016), Lescano (2007) y Pray (2017); sugieren que el radio de acción del cerdo es 100 metros alrededor de la vivienda.
- Ante los hallazgos O'Neal (2011-2012), planteó:
- Examinar las lenguas de todos los cerdos de una comunidad cada 4 meses para detectar nódulos característicos de la cisticercosis.
- Tras la identificación de un cerdo lengua positiva, evaluamos a todos los residentes que viven a menos de 100 metros de cualquier cerdo con lengua positiva mediante el uso de un ELISA para detectar antígenos de Taenia en las heces.

- *Anillo tamizaje para controlar la transmisión endémica de taenia solium (O'Neal 2014)*

OPEN ACCESS Freely available online

PLOS | NEGLECTED TROPICAL DISEASES

Ring-Screening to Control Endemic Transmission of *Taenia solium*

Seth E. O'Neal[1]*, Luz M. Moyano[2], Viterbo Ayvar[2], Silvia Rodriguez[3], Cesar Gavidia[4], Patricia P. Wilkins[5], Robert H. Gilman[6,7], Hector H. Garcia[2,3,7], Armando E. Gonzalez[4], for The Cysticercosis Working Group in Peru

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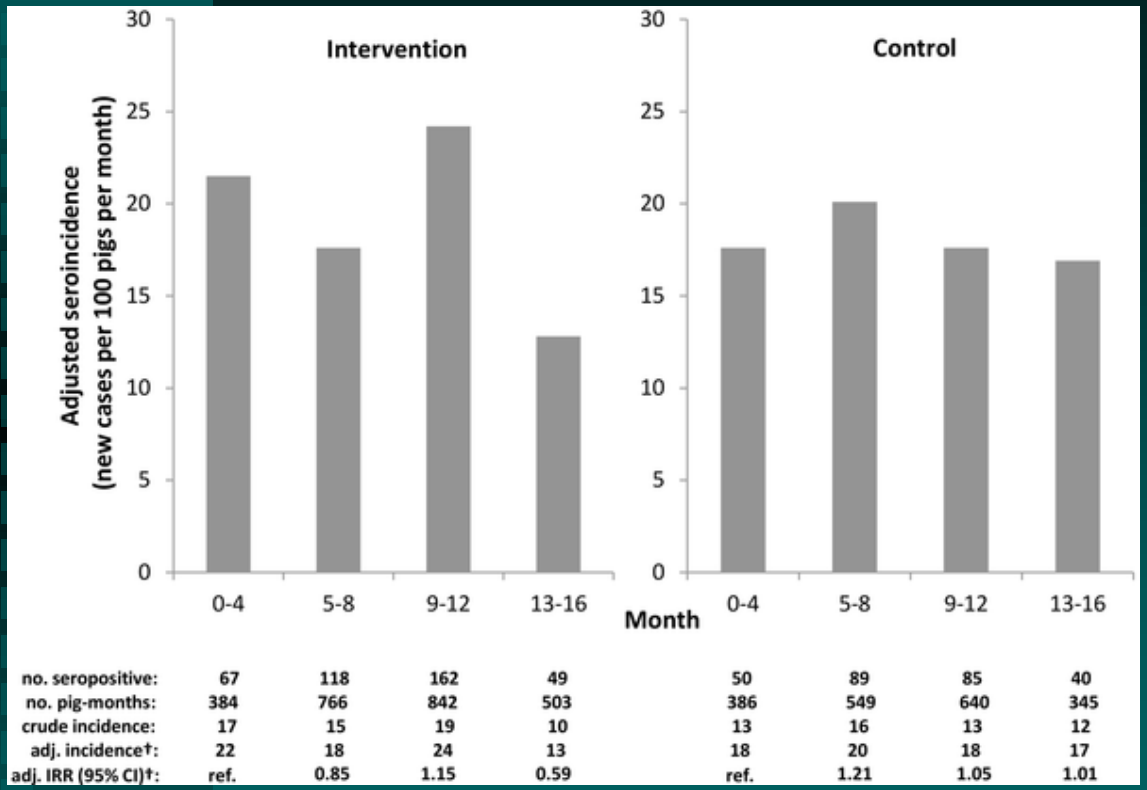
Anillo tamizaje para controlar la transmisión endémica de taenia solium (O'Neal 2014)



	Intervention				Control			
no. seropositive:	67	118	162	49	50	89	85	40
no. pig-months:	384	766	842	503	386	549	640	345
crude incidence:	17	15	19	10	13	16	13	12
adj. incidence†:	22	18	24	13	18	20	18	17
adj. IRR (95% CI)†:	ref.	0.85	1.15	0.59	ref.	1.21	1.05	1.01

Durante todo el período del estudio, la seroincidencia disminuyó 41% en la comunidad de intervención ***(tasa de incidencia [IRR] 0.59, 95% CI 0.41-0.87)*** y se mantuvo sin cambios en la aldea de control ***(IRR 1.01, 95% CI 0.70-1.47)***.

O'Neal SE, Moyano LM, Ayvar V, Rodriguez S, Gavidia C, et al. (2014) Ring-Screening to Control Endemic Transmission of Taenia solium. PLOS Neglected Tropical Diseases 8(9): e3125. https://doi.org/10.1371/journal.pntd.0003125
http://journals.plos.org/plosntds/article?id=10.1371/journal.pntd.0003125

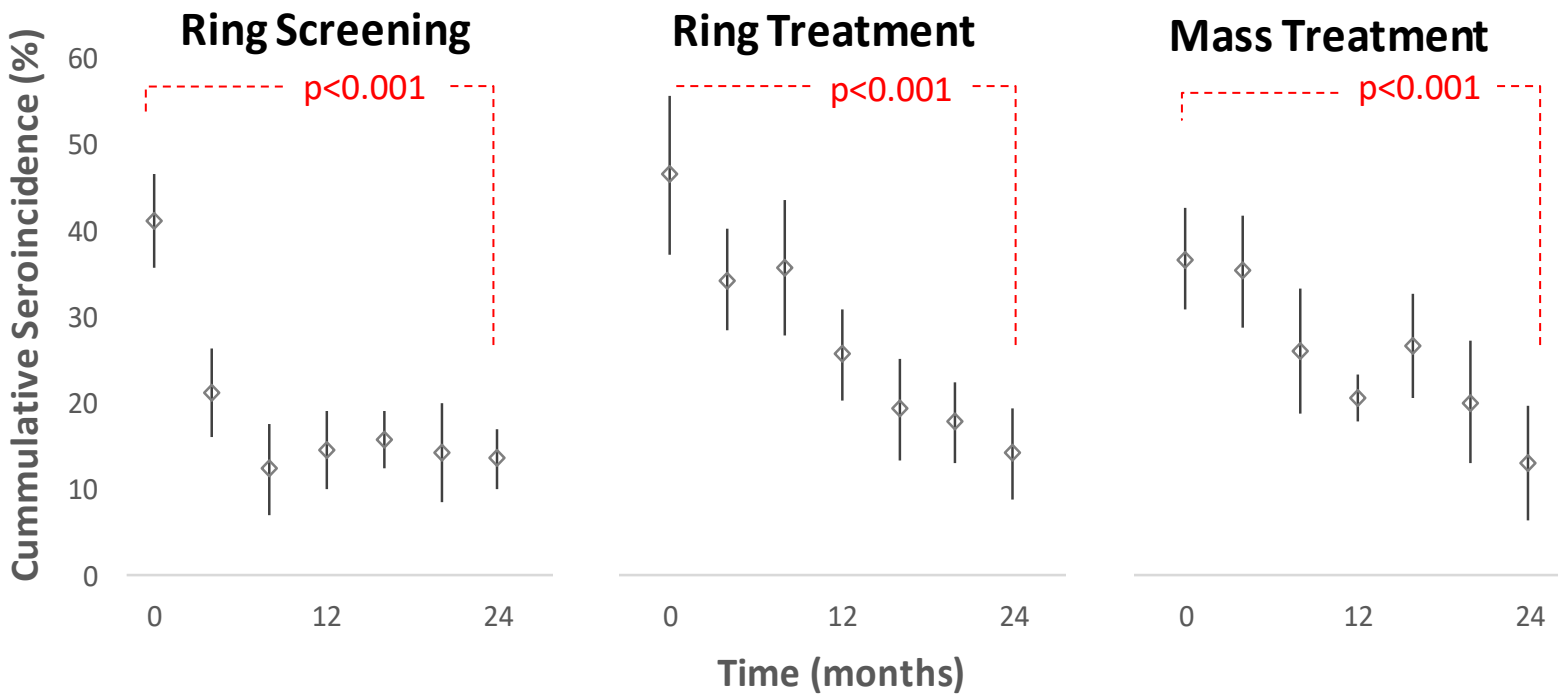
Anillo tamizaje para controlar la transmisión endémica de taenia solium (O'Neal 2014)

- Conclusión
- La detección de anillos redujo la transmisión de *T. solium* en este estudio piloto y puede proporcionar un enfoque efectivo y práctico para las regiones donde los recursos son limitados

Ante los hallazgos se desarrolla el estudio “Optimización de la detección de anillos para el control de la *taenia solium* – (Perú)”, plantea realizar un ensayo comunitario aleatorizado en 23 localidades (~10,000 personas y ~4,000 cerdos), se planteó la intervención en anillos, bajo dos modelos:

a) Brazo anillo tratamiento
b) Brazo anillo detección
c) Brazo tratamiento masivo

Optimización de la detección de anillos para el control de la *t. solium*



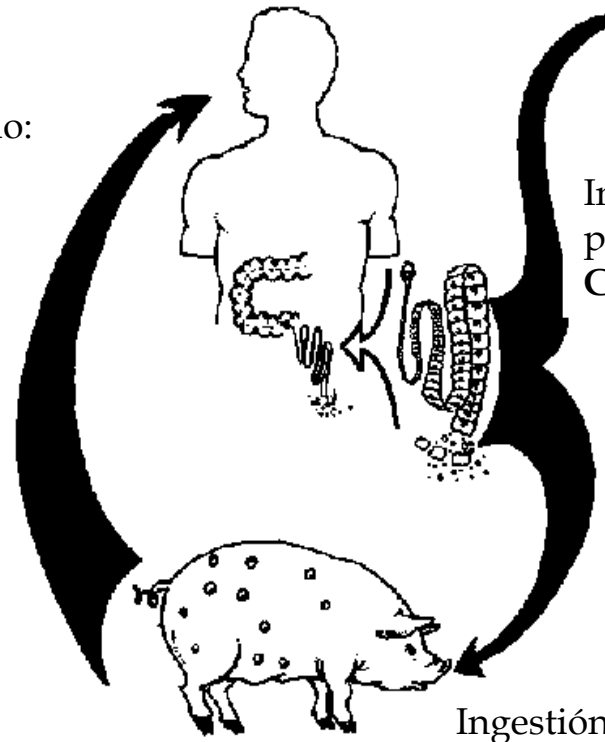
- **Disminución significativa en todos los brazos (T_0 vs. T_{24})**
  - ~65-70% disminución significativa luego de 2 años
  - Efecto más rápido en el brazo anillo detección (8 meses)
  - Transmisión residual vista en todos los brazos

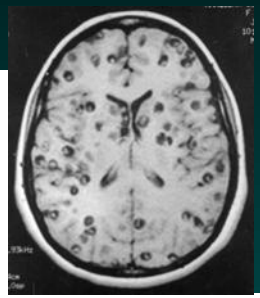
La NCC puede y debe ser erradicada

Recordando el Ciclo

Humano
(Hospedero Definitivo)

Ingestión de cerdo infectado, mal cocido:
Teniasis

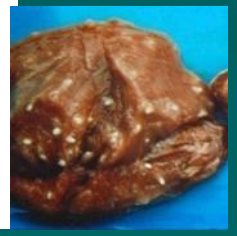




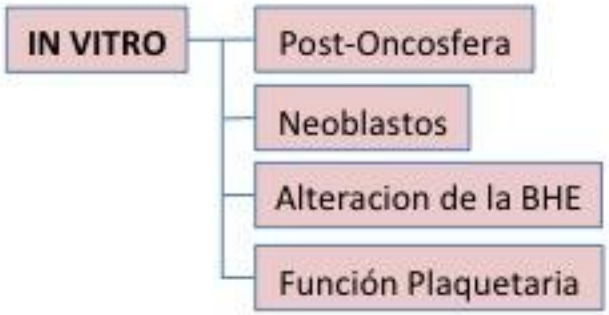
Ingestión de huevos de *T. solium* por contaminación fecal:
Cisticercosis Humana

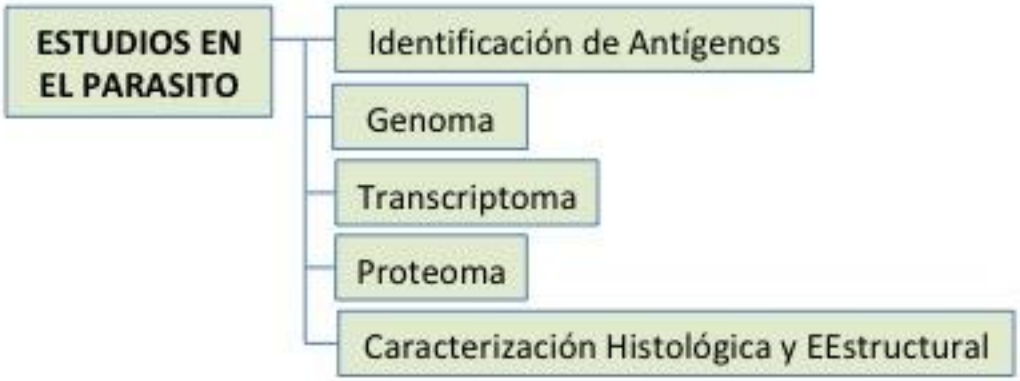
Cerdo
(Hospedero Intermediario)

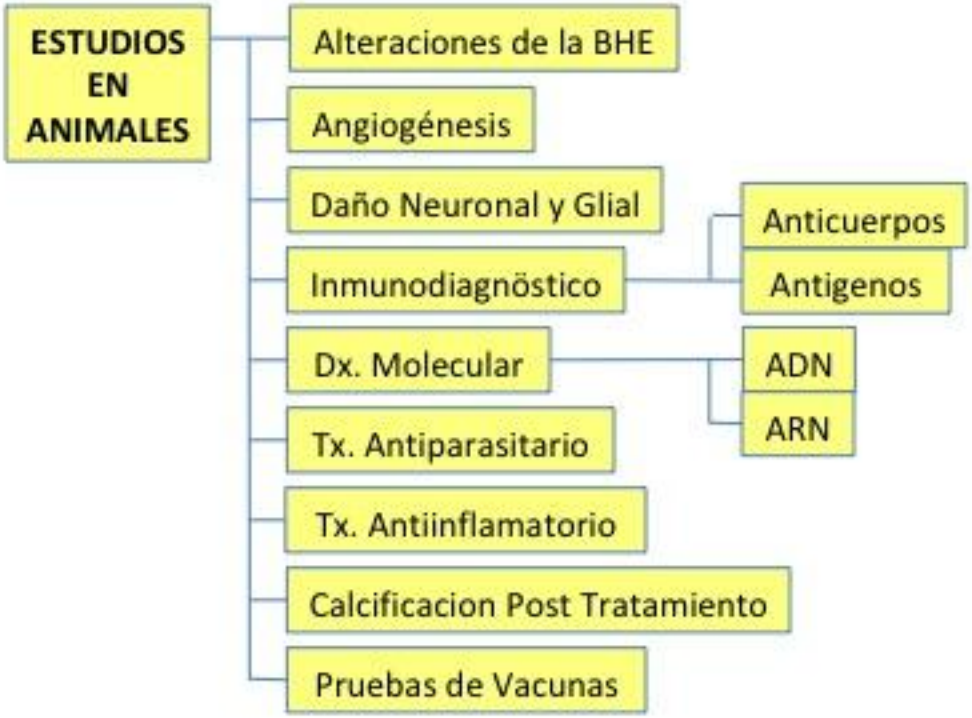
Ingestión de huevos o proglótidos de *T. solium:*
Cisticercosis Porcina

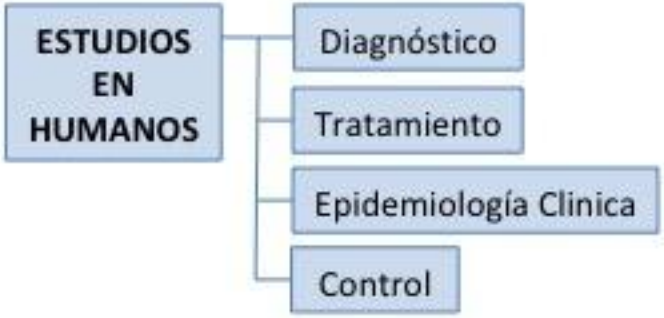


ESTUDIOS


IN VITRO
Post-Oncosfera
Neoblastos
Alteracion de la BHE
Función Plaquetaria


ESTUDIOS EN EL PARASITO
Identificación de Antígenos
Genoma
Transcriptoma
Proteoma
Caracterización Histológica y EEstructural


ESTUDIOS EN ANIMALES
Alteraciones de la BHE
Angiogénesis
Daño Neuronal y Glial
Inmunodiagnöstico
Anticuerpos
Antigenos
Dx. Molecular
ADN
ARN
Tx. Antiparasitario
Tx. Antiinflamatorio
Calcificacion Post Tratamiento
Pruebas de Vacunas


ESTUDIOS EN HUMANOS
Diagnóstico
Tratamiento
Epidemiología Clinica
Control

Gracias