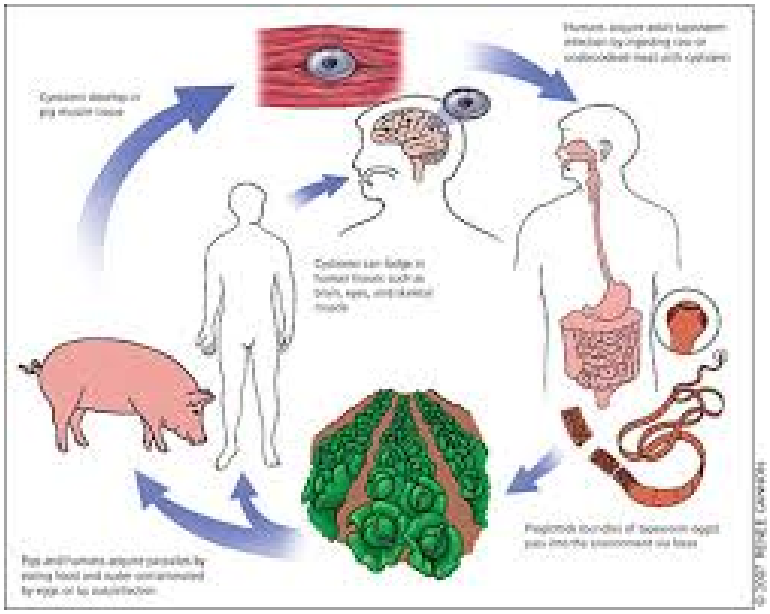
BIBLIOGRAFI CYSTICERCOSIS



PERPUSTAKAAN BALAI BESAR PERAKITAN DAN MODERNISASI VETERINER

BADAN PERKITAN DAN MODERNISASI PERTANIAN

KEMENTERIAN PERTANIAN

2025

Daftar Isi

1. **Seroprevalence and risk factors for Taenia spp infection in pigs in Kongwa and Songwe districts, Tanzania: A cross-sectional study,**Christina Wilson, Robinson Hammerthon Mdegela, Hezron Emmanuel Nonga, George Makingi, Ayubu Jacob Churi, Dominik Stelzle, Ernatus Martin Mkupasi, Veronika Schmidt, Hélène Carabin, Andrea Sylvia Winkler, Helena Aminiel Ngowi,Food and Waterborne Parasitology,Volume 33,2023,e00215,https://doi.org/10.1016/j.fawpar.2023.e00215.

Abstract:

Taenia solium porcine cysticercosis (PCC) is widespread in many low- and middle-income countries (LMICs) where free-range pig rearing is common and hygienic standards are subpar. A cross-sectional survey was conducted in 42 villages between June and September 2019 (14 in Songwe district, southwest Tanzania, and 28 in Kongwa district, central Tanzania). Using a commercial Ag-ELISA kit (apDia, Belgium), circulating antigens of Taenia spp in pig serum were identified and used to calculate the PCC seroprevalence. The study recruited 692 randomly selected households, sampling one pig per household. The relationship between each risk factor and the seroprevalence of PCC at the household and village levels was analysed using mixed logistic regression models. The findings showed that approximately 28% of the pigs were reared in free-range settings, the proportion of households with latrines across the districts was 92%. Twenty-seven percent of households with latrines had water and soap available for hand washing. Sixty-seven (9.7%) tested positive for PCC based on Ag-ELISA. The overall seroprevalence in Kongwa and Songwe districts was 7.3% and 14.0% respectively. In addition, the overall village Ag-ELISA positivity was 9.3%, with an interquartile range (IQR) of 4.6% – 14.1%. Increasing the age of the pig (OR = 3.13 95% CI = 1.48 – 6.60; p = 0.003), pig originating from outside the household (OR = 0.5 95% CI = 0.25 – 0.99; p = 0.05), and pigs kept in a household that practised deworming (OR = 2.23 95% CI = 1.08 – 4.61; p = 0.03) were important risk factors associated with PCC positivity. Therefore, the high seroprevalence of PCC, up to 14%, calls for rapid and effective control actions such as vaccination and treatment of pigs against PCC, and public health education emphasises on indoor pig rearing, hygienic practices and regular use of latrines. Our findings also point to a potential danger of Taenia. spp infection indicating the possibility of people carrying the adult parasite Taenia solium not only in the rural communities of Kongwa and Songwe districts but also in the urban areas of Tanzania, where pigs from these areas are transported for consumption. To develop effective management measures, further research on taeniasis and cysticercosis in the human population is required.

Keywords: Foodborne disease; Taenia solium; Ag-ELISA; Risk factor; Mixed logistic regression models - fixed and random effects; Tanzania

2. **Development and evaluation of an immunochromatography-based point-of-care test kit for a rapid diagnosis of human cysticercosis,**Lakkhana Sadaow, Patcharaporn Boonroumkaew, Rutchanee Rodpai, Penchom Janwan, Oranuch

Sanpool, Tongjit Thanchomnang, Yasuyuki Morishima, Marcello Otake Sato, Yasuhito Sako, Kaoru Kobayashi, Misako Iwai, Wanchai Maleewong, Hiroshi Yamasaki, Pewpan M. Intapan,Food and Waterborne Parasitology,Volume 33,2023,e00211,https://doi.org/10.1016/j.fawpar.2023.e00211.

Abstract:

Human cysticercosis is a life-threatening zoonotic disease caused by infection with larvae (cysticerci) of the pork tapeworm, Taenia solium. This can affect the nervous system causing chronic headache and intracranial hypertension, potentially leading to epileptic seizures and paralysis. The disease is found in developing countries, especially in Southeast and South Asia, Sub-Saharan Africa, and Central and South America where porcine cysticercosis is endemic and people have a habit of eating undercooked pork. An immunochromatography-based test (ICT) kit, using T. solium cyst fluid as antigen, was manufactured to detect anti-T. solium IgG antibodies in human serum. To evaluate the kit, we used 187 serum samples including 24 from proven/confirmed cysticercosis cases, 133 from cases with other parasitosis and 30 healthy controls. Diagnostic efficiencies were calculated. The sensitivity, specificity, and accuracy were 83.3%, 92.0%, and 90.9%, respectively. Moreover, the ICT was positive before treatment but became negative after treatment, implying that this kit is also useful for follow-up monitoring post-treatment. In conclusion, we have successfully developed and present preliminary evaluation of an easy-to-handle rapid diagnostic tool for human cysticercosis in the form of an ICT platform using as antigen fluid from T. solium cysticerci.

Keywords: Human cysticercosis; Taenia solium; Immunochromatography; Antibody detection; Diagnostics; A point-of-care test

3. **Wildlife-transmitted Taenia and Versteria cysticercosis and coenurosis in humans and other primates,**Peter Deplazes, Ramon M. Eichenberger, Felix Grimm,International Journal for Parasitology: Parasites and Wildlife,Volume 9,2019,Pages 342-358,https://doi.org/10.1016/j.ijppaw.2019.03.013.

Abstract:

Wild mustelids and canids are definitive hosts of Taenia and Versteria spp. while rodents act as natural intermediate hosts. Rarely, larval stages of these parasites can cause serious zoonoses. In Europe, four cases of Taenia martis cysticercosis have been diagnosed in immunocompetent women, and two cases in zoo primates since 2013. In North America, a zoonotic genotype related but distinct from Versteria mustelae has been identified in 2014, which had caused a fatal infection in an orangutan and liver- and disseminated cysticercoses in two severely immune deficient human patients in 2018, respectively. Additionally, we could attribute a historic human case from the USA to this Versteria sp. by reanalysing a published nucleotide sequence. In the last decades, sporadic zoonotic infections by cysticerci of the canid tapeworm Taenia crassiceps have been described (4 in North America, 8 in Europe). Besides, 3 ocular cases from North America and one neural infection from Europe, all in immunocompetent patients, 6 cutaneous infections were described in severely

immunocompromised European patients. Correspondingly, besides oral infections with taeniid eggs, accidental subcutaneous oncosphere establishment after egg-contamination of open wounds was suggested, especially in cases with a history of cutaneous injuries at the infection site. Taenia multiceps is mainly transmitted in a domestic cycle. Only five human coenurosis cases are published since 2000. In contrast, T. serialis coenurosis (1 human case since 2000) is primarily transmitted by wild canids. The etiological diagnosis of exotic cysticercoses is challenging. Usually, clinical material does not allow for a morphological identification, and serological tests are not available. These limitations have partly been overcome by molecular tools. Without claiming any dramatic emergence of cysticercoses and coenuroses transmitted by wild carnivores, further sporadic cases of such 'exotic' infections have to be expected.

Keywords: Taenia crassiceps; Taenia martis; Taenia serialis; Versteria sp.; Mustelids; Wild canids

4. **Herculean appearance due to disseminated cysticercosis: Case report,** Sunil Kumar, Shraddha Jain, Shivali Kashikar,Asian Pacific Journal of Tropical Medicine,Volume 5, Issue 12,2012,Pages 1007-1008,https://doi.org/10.1016/S1995-7645(12)60192-8.

Abstract:

Cysticercosis is a common tropical disease. Disseminated form is one of the uncommon manifestations and a rare complication of this disease. We report an immunocompetent patient with disseminated cysticercosis who had involvement of the brain and skeletal muscles giving rise to Herculean appearance.

Keywords: Cysticercosis; Disseminated; Subcutaneous nodule; Muscle hypertrophy

5. **Effectiveness of a community-based educational programme in reducing the cumulative incidence and prevalence of human Taenia solium cysticercosis in Burkina Faso in 2011–14 (EFECAB): a cluster-randomised controlled trial,** Hélène Carabin, Athanase Millogo, Helena A Ngowi, Cici Bauer, Veronique Dermauw, Assana Cissé Koné, Ida Sahlu, Alicia L Salvator, Pierre-Marie Preux, Télesphore Somé, Zékiba Tarnagda, Sarah Gabriël, Rabiou Cissé, Jean-Bosco Ouédraogo, Linda D Cowan, Marie-Paule Boncoeur-Martel, Pierre Dorny, Rasmané Ganaba,The Lancet Global Health,Volume 6, Issue 4,2018,Pages e411-e425,https://doi.org/10.1016/S2214-109X(18)30027-5.

Abstract:

Summary

Background

The effectiveness of drug-free interventions in controlling human cysticercosis is not well known. We aimed to estimate the effectiveness of a community-based educational intervention in reducing the frequency of human cysticercosis in Burkina Faso.

Methods

We did a cluster-randomised controlled trial between 2011 and 2014. 60 eligible villages from three provinces (Boulkiemdé, Sanguié, and Nayala) were randomly allocated to the intervention or control group. Villages raising pigs, that were not a regional capital or located on a main road, that were more than 20 km from Ouagadougou or 5 km from one another, were eligible. In each village, 60 participants were asked for blood samples at baseline, 18 months later (before randomisation), and 18 months after randomisation. Villages were block randomised (1:1) by pig-raising department immediately after the pre-randomisation visit. The intervention aimed to improve knowledge of Taenia solium transmission and control through screening and structured discussion of a 52-min movie, and to increase community self-efficacy through a Self-esteem, Associative strengths, Resourcefulness, Action planning, Responsibility (SARAR) approach via the Participatory Hygiene and Sanitation Transformation (PHAST) model. The primary outcome was active cysticercosis, defined as the presence of circulating antigens detected by use of B158/B60 ELISA. Effectiveness measured at the village level was estimated by use of three Bayesian hierarchical models. This study is registered with ClinicalTrials.gov, number NCT0309339.

Findings

Two villages in the same randomisation block were excluded, resulting in a final sample size of 58 villages. Overall, the intervention tended towards a decrease in the cumulative incidence of active cysticercosis from baseline to after randomisation (adjusted cumulative incidence ratio 0·65, 95% Bayesian credible interval [95% CrI] 0·39–1·05) and a decrease in active cysticercosis prevalence from baseline to after randomisation (adjusted prevalence proportion ratio 0·84; 95% CrI 0·59–1·18). The intervention was shown to be effective in Nayala and Sanguié but not in Boulkiemdé.

Interpretation

Community-engaged participatory interventions can be effective at reducing the incidence and prevalence of cysticercosis in some low-resource settings.

Funding

US National Institutes of Health (National Institute of Neurological Disorders and Stroke, Fogarty International Center, and National Institute of General Medical Sciences).

6. **Production and evaluation of a new set of recombinant antigens for the serological diagnosis of human cysticercosis**,Jihen Melki, Thierry-Borel N'dri Kouadio, Mireille Nowakowski, Zara Razafiarimanga, Man-Koumba Soumahoro, Stephane Peltres, Ronan Jambou,Experimental Parasitology,Volumes 263–264,2024,108803,https://doi.org/10.1016/j.exppara.2024.108803.

Abstract:

Human cysticercosis caused by Taenia soliun (T. soliun) is endemic in certain areas of Latin America, Asia and Sub-Saharan Africa. Neurocysticercosis (NCC) is mainly diagnosed by neuroimaging, which, in most cases, is unavailable in endemic areas. Due to their high sensitivity and specificity, serological tests such as enzyme-linked immunosorbent assay (ELISA) and Western blot (WB) based on the glycosylated fraction of the cyst CS50 are widely used for the detection of the anti-cysticercus IgG antibodies despite their significant cost and the need of cysticercus material. Given their cost-effectivess and simplicity, immunoassays based on recombinant proteins could provide new alternatives for human cysticercosis diagnosis: such tests would be aimed at screening those people living in remote areas who need further examination. To date, however, no test using recombinant antigens is commercially available. Herein, five recombinant proteins (R14, R18, R93.1, R914.1, and R915.2) were produced, three of which (R93.1, R914.1, and R915.2) were newly identified from the cyst fluid. Evaluation of the diagnostic performance of these recombinant antigens by ELISA was done using sera from 200 epileptic and non-epileptic individuals in comparison with the WB-CS50 as the reference serological method. Recombinant proteins-based ELISA showed a level of diagnostic performance that is inferior than the reference serological method, but similar to that of the native antigen ELISA for human cysticercosis (commonly used for screening). Further optimization of expression conditions is still needed in order to improve proteins solubility and enhance diagnostic performance for human cysticercosis detection. However, this preliminary evaluation of the recombinant antigens has shown their potential valuable use for screening cysticercosis in patients with epilepsy attending dispensaries in remote areas. Future studies should be conducted to evaluate our recombinant antigens in a large group of patients with different stages of NCC, and in correlation with imaging findings.

Keywords: Recombinant antigens; Diagnostic; Human cysticercosis; Neurocysticercosis

7. **Synergetic effect of Egyptian propolis in immunization of BALB/c mice against bovine cysticercosis,**Omnia Mohamed Kandil, Somia Ayesh Nassar, Soad Mohamed Nasr, Hatem Abdel Mawgoud Shalaby, Seham Hendawy, Faragalla Mohamed El Moghazy,Asian Pacific Journal of Tropical Biomedicine,Volume 5, Issue 4,2015,Pages 324-330,https://doi.org/10.1016/S2221-1691(15)30352-X.

Abstract:

ABSTRACT

Objective

To evaluate the synergetic effect of an ethanolic extract of Egyptian propolis in immunization of BALB/c mice with Taenia saginata (T. saginata) crude antigen against bovine cysticercosis, with reference to its effects on liver and kidney functions.

Methods

Sixty female mice BALB/c strain weighing 20 to 25 g and 6-8 weeks old were randomly allocated into six groups of ten mice each. Mice in groups 1 and 2 (G1 and G2) were immunized intraperitoneally with 100 µg of T. saginata crude antigen in 100 µL phosphate buffer saline emulsified in Freund's adjuvant. Besides, the mice in G2 were administered with propolis extract simultaneously with immunization. Control mice were either administered with propolis extract (G3) or injected with the same volume of phosphate buffer saline emulsified in Freund's adjuvant (G4). The mice in G5 were non-immunized infected control while, those in G6 were non-immunized non-infected control. Two weeks after the last immunization, each mouse was challenged intraperitoneally with 5 000 oncospheres except those of G6. Ethanolic extract of propolis was prepared at a dose 50 mg/kg body weight.

Results

After 24 weeks of challenge, the mice in G2 showed the highest level of protection (100%), with no cyst being detected rather than mice in G1 (33.3% protection). Additionally, the ELISA results, in this study, showed higher antibody titer in G2 with reduction the alteration in liver and kidney functions compared to G1.

Conclusions

Egyptian propolis could increase the level of protection against experimental challenge infection with T. saginata eggs when administered simultaneously with immunization. Furthermore, it could enhance the production of antibodies to immunized antigen and decrease the alteration in liver and kidney functions.

Keywords: Taenia saginata; Vaccine; BALB/c mice; ELISA; Serum biochemistry

8. **A preliminary analysis of some epidemiological factors involved in porcine cysticercosis in Bafut and Santa subdivisions, North West Region of Cameroon,**Nchang Allo Nicoline Ngwing, J Wabo Poné, Mpoame Mbida, A Zoli Pagnah, H Njakoi, CF Bilong Bilong,Asian Pacific Journal of Tropical Medicine,Volume 5, Issue 10,2012,Pages 814-817,https://doi.org/10.1016/S1995-7645(12)60149-7.

Abstract:

Objective

To examine the magnitude and some risk factors of porcine cysticercosis in Bafut and Santa, two sub-divisions noted for pig farming in the North West Region of Cameroon.

Methods

A total of 499 pigs in 300 households were examined by tongue inspection and serologically by Ag-ELISA. Information was sought on the age and sex of the animals, prevailing husbandry systems, types of feed, the state of each pen and the state of toilets. Futhermore, a questionnaire was administered to the farmers to determine their awareness on taeniasis/cysticercosis and related factors.

Results

The prevalence of the disease was significantly higher in Santa (10.2%) than in Bafut (4.2%), although there was a higher level of awareness in both localities (62.3%). Age of pigs, traditional rearing systems (roaming, tethered, earth floor pen, raised floor pen), faecal disposal in the environment and poor sanitation significantly influenced the seroprevalence of porcine cysticercosis in both localities. Most farmers (79.7%) used a combination of concentrate, grass and kitchen waste to feed pigs. Financial loss from porcine cysticercosis was estimated at 346 900 CFA representing 2% of total income.

Conclusions

Control measures advanced here include sensitization campaigns, periodic examination and treatment of infected pigs by veterinarians, improved husbandry systems, proper use of standard latrines regularly inspected by sanitary officers, and sound hygienic and sanitary practices.

Keywords: Cameroon; Cysticercosis; Pig; Prevalence; Seroprevalence; Taeniasis

9. **Oral cysticercosis–a rare presentation,**Sunita Singh, Sonia Chhabra, Garima Aggarwal, Rajnish Kalra, Amrita Duhan, Rajeev Sen,Asian Pacific Journal of Tropical Medicine,Volume 4, Issue 7,2011,Pages 587-588,https://doi.org/10.1016/S1995-7645(11)60151-X.

Abstract:

Cysticercosis is a condition that occurs when man is infected with larvae of Taenia solium. Oral cysticercosis is a rare event, and it represents difficulty in clinical diagnosis. A case of oral cysticercosis in 11 year old girl is presented which complained of painless swelling for 6 months. A FNAC was performed which revealed bluish pink fibrillary material and interspersed nuclei and fragments of wall of larvae. Patient was treated with antihelminthic.

Keywords: Oral cysticercosis; Taenia solium; Cysticercus cellulosae

10. **Successful immunization of naturally reared pigs against porcine cysticercosis with a recombinant oncosphere antigen vaccine,**César M. Jayashi, Craig T. Kyngdon, Charles G. Gauci, Armando E. Gonzalez, Marshall W. Lightowlers,Veterinary Parasitology,Volume 188, Issues 3–4,2012,Pages 261-267,https://doi.org/10.1016/j.vetpar.2012.03.055.

Abstract:

Taenia solium causes cysticercosis in pigs and taeniasis and neurocysticercosis in humans. Oncosphere antigens have proven to be effective as vaccines to protect pigs against an experimental infection with T. solium. A pair-matched vaccination trial field, using a combination of two recombinant antigens, TSOL16 and TSOL18, was undertaken in rural

villages of Peru to evaluate the efficacy of this vaccine under natural conditions. Pairs of pigs (n=137) comprising one vaccinated and one control animal, were allocated to local villagers. Animals received two vaccinations with 200μg of each of TSOL16 and TSOL18, plus 5mg Quil-A. Necropsies were performed 7 months after the animals were distributed to the farmers. Vaccination reduced 99.7% and 99.9% ($p<0.01$) the total number of cysts and the number of viable cysts, respectively. Immunization with the TSOL16–TSOL18 vaccines has the potential to control T. solium transmission in areas where the disease is endemic, reducing the source for tapeworm infections in humans.

Keywords: Neurocysticercosis; Cysticercosis; Taeniasis; TSOL16; TSOL18; Vaccine; Immunization; Pigs; Field trial

11. **Evaluation of activity of triclabendazole against Taenia solium metacestode in naturally infected pigs,** Ana Vargas-Calla, Luis A. Gomez-Puerta, Juan Calcina, Omar Gonzales-Viera, Cesar Gavidia, Maria T. Lopez-Urbina, Hector H. Garcia, Armando E. Gonzalez,Asian Pacific Journal of Tropical Medicine,Volume 9, Issue 1,2016,Pages 23-26,https://doi.org/10.1016/j.apjtm.2015.12.005.

Abstract:

Objective

To assess the efficacy of triclabendazole (TCBZ) in porcine cysticercosis.

Methods

Eighteen naturally infected cysticercosis pigs were divided into 3 groups of 6 individuals each. The first group was treated orally with TCBZ at a single dose of 30 mg/kg of body weight, the second group was treated orally with oxfendazole at a single dose of 30 mg/kg of body weight and the third group received a placebo (control group). All animals were kept under the same management conditions. The pigs were euthanized 17 wk post-treatment and the number of surviving cysts in muscles was assessed and compared between groups.

Results

All pigs treated with oxfendazole had only degenerated cysts in their carcasses. In contrast, TCBZ had very little effect against the parasitic cysts. Cysts from pigs in the TCBZ group looked apparently normal after treatment. However, histological evaluation showed a mild to moderate degree of inflammation.

Conclusions

TCBZ is not an efficacious drug against Taenia solium cysticercosis in swine using a single dose.

Keywords: Taenia solium; Cysticercosis; Triclabendazole; Oxfendazole; Treatment

12. **Spatiotemporal distribution and economic loss associated with bovine cysticercosis and human taeniasis in Ethiopia**,Adem Hiko, Belayneh Seifu,Parasite Epidemiology and Control,Volume 4,2019,e00078,https://doi.org/10.1016/j.parepi.2018.e00078.

Abstract:

A metacestode stage (bovine cysticercosis) and adult stage Taenia saginata, accounted for zoonotic and economic losses from organ contamination and treatment cost. The objective of this paper is to assess the spatiotemporal distribution and economic loss from bovine cysticercosis and human taeniasis with treatment approach in different parts of Ethiopia. All available published research articles from Ethiopia on the disease were collected. The data were assessed using the current regional administrative, the locality and chronology of the reports for prevalence and economic loss with treatment trend. Prevalence ranging from 1.9% at Addis Ababa City to as high as of 26.3% Hawasa-SNNPR using postmortem examination. However, one study confirmed 92.7% of 41 isolates as bovine cysticercosis using polymerase chain reaction (PCR) method. Teaniasis was ranged from 7.8% in Modjo-Oromia to as high as 89.4% in Addis Ababa City. Except for 17.9% at Addis Ababa City, 29.0% at Mekele-Tigray and 19.0% at Halaba Kulito –SNNPR teaniasis in Ethiopia were greater than 30% over 2001–2018 years. Questionnaire survey and retrospective data were the major tools used for teaniasis reporting either pharmaceutical and/or traditional (herbs) medicines were used for teaniasis treatments. Niclosamide, mebendazole and praziquantel were pharmaceutical teaniacidal drugs used in Ethiopia until the years of 2009, uses of albendazole begins from 2011 to date (2018 year). Hagenica abyssinia “Kosso/Heto” flowers is still widely used in Ethiopia in that it contains Kosso-toxin, closely related to folic acid, are responsible for some cases of hepatic carcinoma and blindness. Only few data (reports) were available on spatiotemporal economic loss associated with bovine cysticercosis and Taenia saginata in Ethiopia showing an overall 4,052,278.16 ETB (212,202.76 USD) from five reports. Highest economic loss (88,500.00 USD) was registered at Yirgalem-SNNPR [2005–2009]. Study at Kombolcha-Amhara region during 2016 accounted 1,841,311.00ETB (73,652.44 USD) from C. bovis and teaniasis treatment cost. Total cost for the used pharmaceutical drugs accounted 921,112.00ETB over 2005–2016. The maximum drug expenditure was reported during the year 2013. Thus, bovine cysticercosis and Taenia saginata in Ethiopia indicating the health and economic challenges. It needs to Taenia saginata cycle interruption via stopping human open defecation with assessing the dynamics of the disease in the country.

Keywords: Bovine cysticercosis; Economic loss; Treatment trend; Taeniasis

13. **An epidemiological survey of porcine cysticercosis in Nyasa District, Ruvuma Region, Tanzania**,Seria M. Shonyela, Ernatus M. Mkupasi, Sikasunge C. Sikalizyo, Evance M. Kabemba, Helena A. Ngowi, Isaac Phiri,Parasite Epidemiology and Control,Volume 2, Issue 4,2017,Pages 35-41,https://doi.org/10.1016/j.parepi.2017.09.002.

Abstract:

Porcine cysticercosis (PC) caused by Taenia solium larvae is continuing being important zoonotic disease in many developing countries. It poses a serious public health risk and leads to economic losses to pig production industry. This study was carried out to determine the prevalence and risk factors associated with PC transmission in Nyasa District. To establish the prevalence of PC, a cross-sectional survey was conducted involving 698 pigs by tongue examination, 330 pigs by Ag-ELISA test and 22 pigs by meat inspection. A questionnaire survey was administered to a member of selected households to gather information on pig management and other potential factors that could explain the prevalence of PC in the area. Results showed that 44 pigs were positive by tongue examination (6.3%, 95% C.I. 4.5–8.1%), 110 tested positive for Ag-ELISA (33.3%, 95% C.I. 28.22–38.38%) and meat inspection detected four infected pigs (18.2%, 95% C.I. 2.08–34.32%). Risk factors associated with PC transmission in Nyasa District were free ranging of pigs (p=0001), sex of pig (p=0.011), source of pork (p=0.0001) and outdoor defecation (0.0001). The present findings indicate that PC is endemic in Nyasa District and that free-ranging of pigs in conjunction with limited use of latrines contributes significantly to PC transmission. Therefore, mandatory pig confinement, together with use of latrine/toilets should be considered in controlling PC in Nyasa District.

Keywords: Taenia solium cysticercosis; Prevalence; Risk factors; Pig management; Nyasa, Tanzania

14. **Taeniosis and cysticercosis in Serbia, 1990–2018: Significance of standard of living,** Milena Stopić, Branko Bobić, Zorica Dakić, Jelena Srbljanović, Tijana Štajner, Neda Konstantinović, Katarina Srećković, Ivana Klun, Miloš Korać, Olgica Djurković-Djaković, International Journal of Infectious Diseases, Volume 86, 2019, Pages 135-141, https://doi.org/10.1016/j.ijid.2019.07.010.

Abstract:

Objectives

As is the case for all of Southeast Europe, Serbia is an area traditionally endemic for Taenia saginata and Taenia solium infections. This study was performed to analyse the epidemiological data on taeniosis and cysticercosis in Serbia for the period 1990–2018.

Methods

Data on cases of T. saginata and T. solium infection were collected via a systematic search of published articles, the grey literature, and official reports, as well as by performing clinical observational studies of patients treated in the departments for infectious diseases of hospitals and university clinics in Serbia.

Results

A total of 212 cases of taeniosis were reported, all between 1997 and 2004 when taeniosis was notifiable (incidence range 0.04–0.9/100 000 population/year). From 1990 to 2018, 170 cases of cysticercosis (all but one of neurocysticercosis), were registered (incidence range 0–0.29/100 000 population/year), with a strong decrease since 2000 and a single case in the last

9 years. The annual number of cases of both taeniosis (Pearson's r = 0.914, p = 0.001) and cysticercosis (Pearson's r = 0.582, p = 0.014) correlated with the consumer price index.

Conclusions

In Serbia, T. saginata and T. solium infections are autochthonous but occur only sporadically. However, the potential for re-emergence exists, depending on the socio-economic state of the country.

Keywords: Taenia saginata; Taenia solium; Taeniosis; Cysticercosis; Epidemiology; Serbia

15. **Protection from murine cysticercosis by immunization with a parasite cysteine protease,**Salman Baig, Raymond T. Damian, Jorge Morales-Montor, Amr Ghaleb, Amjed Baghdadi, A. Clinton White,Microbes and Infection,Volume 8, Issues 12–13,2006,Pages 2733-2735,https://doi.org/10.1016/j.micinf.2006.08.002.

Abstract:

Central nervous system infection by Taenia solium cysts causes neurocysticercosis, a common neurological infection in the Third World. We have previously isolated cysteine proteases from Taenia crassiceps and T. solium. In this study, we immunized BALB/c mice with the purified T. solium cysteine protease and challenged them with Taenia crassiceps. Immunized mice had a 72% reduction in parasite burden compared to mice that received no immunization. Immunized mice developed antigen specific lymphocyte proliferation. These data support further studies of the T. solium cysteine protease as a vaccine candidate.

Keywords: Taenia; Neurocysticercosis; Vaccine

16. **Evaluation of the protective potential of a Taenia solium cysticercus mimotope on murine cysticercosis,**Janaína Capelli-Peixoto, Carlos Chávez-Olórtegui, Daniele Chaves-Moreira, João Carlos Minozzo, Juarez Gabardo, Kádima Nayara Teixeira, Vanete Thomaz-Soccol, Larissa Magalhães Alvarenga, Juliana de Moura,Vaccine,Volume 29, Issue 51,2011,Pages 9473-9479,https://doi.org/10.1016/j.vaccine.2011.10.027.

Abstract:

An NC-1 mimotope from Taenia solium cysticerci can help identify patients with neurocysticercosis through immunoassay. After chemical synthesis, an NC-1 peptide was coupled to bovine serum albumin (NC-1/BSA) for used as an immunogen in murine Taenia crassiceps cysticercosis, which is an experimental model of cysticercosis caused by T. solium. NC-1/BSA immunisation decreased parasitaemia by inducing 74% protection compared to the 77% protection obtained with T. crassiceps crude antigen. The influence of immunisation was also observed on the size and stage of development of the parasite. Antibodies from NC-1/BSA-immunised mice recognised proteins from the tegument and from the buddings, and intense immunostaining was observed in the final stage of the metacestode. The capacity of

NC-1/BSA to induce protective antibodies which are reactive to proteins from the tegument of the metacestode suggests that this mimotope is a potential candidate for a vaccine against human and animal cysticercosis.

Keywords: Mimotope; Synthetic peptide; Immunoprotection; Taenia solium; Taenia crassiceps; Cysticercosis

17. **CHANGING TRENDS IN OCULAR CYSTICERCOSIS OVER TWO DECADES: AN ANALYSIS OF 118 SURGICALLY EXCISED CYSTS**,S Madigubba, K Vishwanath, GBKG Reddy, GK Vemuganti,Indian Journal of Medical Microbiology,Volume 25, Issue 3,2007,Pages 214-219,https://doi.org/10.1016/S0255-0857(21)02108-3.

Abstract:

Purpose:

To evaluate the frequency of ocular cysticercosis and to demonstrate the changing trends in localisation of ocular cysticercosis along with a brief review of literature. Methods: A retrospective analysis of histology proven ocular cysticercosis cases seen over a period of 20 years (1981 through 2000) was done. The pathology record forms were reviewed for demographics, clinical features with specific reference to the location of cysts in four subgroups: subconjunctival; intraocular orbit and eyelid. The distribution of cases in four five-year periods namely group A: 1981-1985, group B: 1986-1990, group C: 1991-1995 and group D: 1996-2000 and the changing trends in the location of cysts was evaluated. Results: One hundred eighteen cysts from 118 patients aged 4-72 (mean 17.1) years were submitted to the pathology service of S D Eye Hospital, Hyderabad. Male to female ratio was 1: 1.2. Total number of cases in groups A, B, C and D were 33, 41, 16 and 25 respectively. Location of cysts was subconjunctival – 74 (62.7%); intraocular-31 (26.3%); orbital-8 (7%) and lid-5 (4%). In last 20 years, significant decrease (P=0.0001) was noted in subconjunctival cases (85% vs. 28%) with a significant rise (P=0.0001) in intraocular cysticercosis (6% vs. 60%). Conclusions: Frequency of surgically excised ocular cysticercosis remained constant over last two decades with an increasing manifestation of intravitreal cysticercosis in the recent years. This could imply either improved diagnostic modalities, available expertise in vitreo-retinal surgery or ineffective medical treatment for intraocular parasitic infection. The relative decrease in extraocular cysticercosis is probably due to the increased preference and success with medical management.

Keywords: Subconjunctival; Inrtavitreal cysticercosis; T. solium; ocular cysticercosis

18. **Herd-level seroprevalence and associated risk factors for bovine cysticercosis in the State of Paraíba, Northeastern Brazil**,Amanda R.A. Maia, Leise G. Fernandes, Paulo S.A. Pinto, Rafaella P.M. Guimarães-Peixoto, Letícia F. Silva, Carolina S.A.B. Santos, Clebert J. Alves, Inácio J. Clementino, Sérgio S. Azevedo,Preventive Veterinary

Medicine,Volume 142,2017,Pages 51-57,https://doi.org/10.1016/j.prevetmed.2017.05.008.

Abstract:

This study focused on estimating the herd-level and animal-level prevalences, and identifying risk factors associated with bovine cysticercosis in the State of Paraíba, Northeastern Brazil. The state was divided into three sampling strata: Sertao, Borborema and Zona da Mata/Agreste. For each sampling stratum, herd-level and animal-level prevalences were estimated by a two-stage sampling survey. First, a pre-established number of herds (primary sampling units) were randomly selected; second, within each herd a pre-established number of cows aged ≥24months were systematically selected (secondary sampling units). Ten animals were sampled in herds with up to 99 cows aged over 24 months; 15 animals were sampled in herds with 100 or more cows aged over 24 months; and all animals were sampled in those with up to 10 cows aged over 24 months. In total, 2382 animals were sampled from 474 herds. Serological diagnosis was initially performed by the indirect ELISA, and positive sera were confirmed by immunoblot. A herd was deemed positive if it included at least one positive animal in herds of up to 29 females, and two positive animals in herds with more than 29 females. The herd-level prevalence in the State of Paraíba was 10.8% (95% CI=8.1%–14.1%), 10.3% (95% CI=6.4%–16.1%) in the region of Sertão, 6.9% (95% CI=3.9%–12.1%) in Borborema, and 13.8% (95% CI=9.3%–20.2%) in Agreste/Zona da Mata. The animal-level prevalence was 2.3% (95% CI=1.6%–3.3%) in the State of Paraíba, 1.4% (95% CI=0.8%–2.5%) in Sertão, 3.6% (95% CI=1.7%–7.4%) in Borborema, and 3.2% (95% CI=1.9%–5.4%) in Agreste/Zona da Mata. The risk factors identified were as follows: animal purchasing (OR=2.19) and presence of flooded pastures (OR=1.99). Our findings suggest that bovine cysticercosis herd-level seroprevalence in the State of Paraíba, Northeastern Brazil, is high, and support the idea that prevention measures should be applied at herd level and farmers should restrict the access of their cattle to flooded pastures.

Keywords: Cysticercosis; Bovine; Epidemiology; Control; Northeastern Brazil

19. **Bovine cysticercosis epidemiology and the economic impact of the triceps brachii incision in a South African export abattoir,** Matthys Uys, Geoffrey T. Fosgate, Alessandro Seguino,Preventive Veterinary Medicine,Volume 220,2023,106050,https://doi.org/10.1016/j.prevetmed.2023.106050.

Abstract:

Taenia saginata is a zoonotic tapeworm of humans with bovines as its intermediate host (bovine cysticercosis). Traditional meat inspection is the main measure to identify the larval stage in carcasses and prevent human infection, but has a notoriously low sensitivity, especially in low prevalence settings. The legislation in multiple African countries mandates an incision in both triceps brachii muscles to detect the parasite as part of the normal post-mortem inspection, but this has an economic cost and is not universally mandated in other countries. The primary aim of this study was to investigate the epidemiology of bovine

cysticercosis at an export abattoir in South Africa and determine the validity and cost of the triceps incision. Risk factors were investigated, and the effect of additional heart incisions on the current inspection. Four incisions were made into the heart in addition to the normal post-mortem inspection in 3353 carcasses. The proportion of positive animals with and without the cardiac and triceps incisions were compared using McNemar's chi-square tests, while risk factors were assessed using binary logistic regression. The economic impact of the triceps incision was estimated using a stochastic economic cost model. Thirty-three positive carcasses were identified for an apparent prevalence of 0.98 % (95 %CI, 0.69–1.36 %), while the true prevalence was estimated at 6.6 % (95 %CI, 4.3–8.8 %). All cysts were confirmed as T. saginata on histopathology with 70 % (95 %CI, 53–83 %) located in the heart. The additional cardiac incisions resulted in the detection of significantly more cases compared to the normal inspection method prevalence of 0.72 % (95 %CI, 0.47–1.05 %; $P < 0.001$). The apparent prevalence of T. saginata when omitting the triceps incision was not significantly lower compared to the prevalence when included in the inspection ($P = 0.480$). External feedlots (OR= 4.17, 95 %CI: 2.04–8.54, $P < 0.001$) and older animals (OR=3.90, 95 %CI: 1.17–13.03, $P = 0.027$) were associated with a positive detection. The current median annual financial cost to the food business operator from the triceps incision was estimated at $30387 (95 %CI: $0-$130696), with the proportion of deboned meat exported identified as the most important factor affecting cost (Spearman's rho=0.853). The identification of risk factors could aid in the development of a more effective risk-based inspection system. The current inspection should be modified to increase exposure of the heart and remove the triceps incisions. The latter should especially be considered given the minimal contribution to cysticercosis detection, the unsupported requirement for its inclusion specifically in Africa, and its economic impact, especially as beef exports increase.

Keywords: Taenia saginata; Cysticercus bovis; Meat inspection; Risk factors; Economics

20. **Tapeworms, Meat and Man: A Brief Review and Update of Cysticercosis Caused by Taenia Saginata and Taenia Solium**,D.W. Hird, M.M. Pullen,Journal of Food Protection,Volume 42, Issue 1,1979,Pages 58-64,https://doi.org/10.4315/0362-028X-42.1.58.

Abstract:

Three species of tapeworms may be transmitted to man by ingestion of animal flesh: Taenia saginata, Taenia solium, and Diphyllobothrium latum. The first two are the subject of this brief review which concentrates on recent studies in the field and emphasizes concepts of importance in detection, control, and prevention of cysticercosis. T. saginata cysticercosis in beef (beef measles) continues to be a concern in developed countries such as the United States, as well as in developing areas such as East Africa where the infection is widespread. The high standards of meat inspection in the United States have not succeeded in eliminating beef cysticercosis which is seen primarily in feedlot cattle originating in the southwestern U.S. However, it should not be viewed as a strictly regional problem, due to the widespread movement of animals and meat within the United States. Beef cysticercosis is costly due to

the special treatment required of infected carcasses; serious effects on human health are rare. In contrast, T. solium cysticercosis in swine (pork measles) is rarely reported in areas such as the U.S., Canada, and most European countries, but is still a definite human health concern in Mexico, some other Latin American nations and parts of Africa and Asia. In addition to being a financial burden, T. solium is a serious public health threat in those countries where it is prevalent.

21. **Knowledge, attitudes and practices regarding porcine cysticercosis control among smallholder pig farmers in Kongwa and Songwe districts, Tanzania: A cross-sectional study,**C. Wilson, H.E. Nonga, R.H. Mdegela, A.J. Churi, E.M. Mkupasi, A.S. Winkler, H.A. Ngowi,Veterinary Parasitology: Regional Studies and Reports,Volume 44,2023,100912,https://doi.org/10.1016/j.vprsr.2023.100912.

Abstract:

Taenia solium taeniasis/cysticercosis (TSTC) is a parasitic zoonotic disease that is endemic in several developing countries, causing serious public health and economic impacts. A cross-sectional study was conducted to assess knowledge, attitudes and practices (KAP) related to porcine cysticercosis (PCC) transmission, prevention and control among smallholder pig farmers in Kongwa and Songwe Districts in Tanzania. A semi-structured questionnaire was administered to 692 smallholder pig farmers from randomly selected households. STATA software version 17 was used to analyse quantitative data, summarize farmers' KAP about PCC and calculate performance scores. Nearly half (42%) of the respondents had little knowledge regarding PCC, only 17% of the respondents had good practices towards prevention/control of PCC and 72% had a positive attitude towards PCC- prevention/control measures. The majority (73%) of smallholder pig farmers admitted deworming their pigs regularly, whereas 76% reported deworming themselves and their family members regularly. Albendazole and ivermectin are the most commonly used medications for deworming people and pigs, respectively. According to the findings, the majority of smallholder pig farmers in Kongwa and Songwe Districts showed a good attitude towards PCC prevention/control measures but had limited knowledge of the PCC life cycle and control. In addition, only one in five farmers was engaged in good practices. The findings revealed further that farmers are engaged in risky behaviours that aid the spread and perpetuation of the T. solium parasite in the study area. It is recommended that farmers should be given proper health education on the T. solium transmission cycle and preventive/control practices to limit PCC transmission.

Keywords: Neglected zoonotic disease; Knowledge; Awareness; Practices; Tanzania

22. **Cysticercosis by Taenia pisiformis in Brown Hare (Lepus europaeus) in Northern Italy: Epidemiologic and pathologic features,**Laura Stancampiano, Silvia Ravagnan, Gioia Capelli, Gianfranco Militerno,International Journal for Parasitology: Parasites and Wildlife,Volume 9,2019,Pages 139-143,https://doi.org/10.1016/j.ijppaw.2019.04.004.

Abstract:

In Northern Italy, a hastening of hare population decline was noticeable from 2008. In the same year hunters reported a sudden increase of hares infected by Taenia sp. larvae, whose morphology was consistent with T. pisiformis cysticerci. The aim of the survey was: i)to identify the parasites through morphological features and molecular techniques; ii)to quantify the prevalence and abundance of cysticerci in hunted hares; iii)to describe pathological aspects of parasite-induced lesions; iv)to evaluate the short-term trend of the infection comparing two different hunting seasons; v)to highlight possible relationship between T. pisiformis infection and hare-related variables. In 2013, 2015 the viscera of 54 and 61 hares legally hunted in agro-ecosystems of the Po Plain were collected. Peritoneum, liver and lungs were examined for cysticercosis; abundance was estimated counting superficial parasites in liver; parasites were microscopically identified by shape and measure of both large and small hooks. One cysticercus from each hare was analized by a PCR targeting Taeniid species and then sequenced. Frozen liver, lungs and gastrointestinal peritoneum were macroscopically observed and, after thawing, representative samples from the available organs were collected for histologic examination to verify parasitic cysts and the subsequent damage of the involved organs. Sex, weight and age class of the animals were recorded. Generalized linear models were used for statistical analysis. T. pisiformis was isolated in 8 hares in 2013 (prevalence 14.8%; abundance range: 0–400; mean abundance 17.8) and in 2 hares in 2015 (prevalence 3.28%; abundance range: 0–180; mean abundance 3.22). Identification was confirmed morphologically and by PCR. The DNA sequencing confirmed T. pisiformis in all samples. The sequences were all identical each-other. Infection was significantly related with adult age class, sampling year and low full-weight. Epidemiological and pathological pattern suggest both a possible role on host population health and a tendency toward host-parasite equilibrium.

Keywords: Lepus europaeus; Taenia pisiformis; Cysticercosis; Pathological findings; Epidemiology

23. **Lack of specificity of a single positive 50-kDa band in the electroimmunotransfer blot (EITB) assay for cysticercosis**,S.J. Furrows, J. McCroddan, W.J. Bligh, P. Chiodini,Clinical Microbiology and Infection,Volume 12, Issue 5,2006,Pages 459-462,https://doi.org/10.1111/j.1469-0691.2006.01381.x.

Abstract:

Diagnosis of the parasitic infection cysticercosis is usually confirmed by serological assays. The electroimmunotransfer blot (EITB) for cysticercosis is a sensitive and specific assay, which uses six glycoprotein antigens on a strip to detect antibodies to Taenia solium cysticerci. Although the appearance of bands at any of these six sites is considered to be a positive result, a growing body of evidence suggests that the presence of a single 50-kDa band in this assay may not indicate infection. An audit of 984 samples tested over a 3-year period showed that only two (15.4%) of 13 samples with a single 50-kDa band were associated with a diagnosis of cysticercosis. Possible reasons for this include technical problems, cross-reactivity with other

parasites or other diseases, or the presence of a non-specific band. The results suggest that the finding of a single 50-kDa band should be interpreted with caution.

Keywords: Cysticercosis; diagnosis; immunoblot; immunodiagnosis; neurocysticercosis; Taenia solium

24. **Protective immunity against Taenia crassiceps murine cysticercosis induced by DNA vaccination with a Taenia saginata tegument antigen,**Gabriela Rosas, Gladis Fragoso, Teresa Garate, Beatriz Hernández, Patricia Ferrero, Mildred Foster-Cuevas, R.Michael E. Parkhouse, Leslie J.S. Harrison, Sergio López Briones, Luis Miguel González, Edda Sciutto,Microbes and Infection,Volume 4, Issue 14,2002,Pages 1417-1426,https://doi.org/10.1016/S1286-4579(02)00025-4.

Abstract:

This study investigated the protective capacity of the recombinant Taenia saginata Tso18 antigen administered as a DNA vaccine in the Taenia crassiceps murine model of cysticercosis. This Tso18 DNA sequence, isolated from a T. saginata oncosphere cDNA library, has homologies with Taenia solium and Echinococcus sp. It was cloned in the pcDNA3.1 plasmid and injected once intramuscularly into mice. Compared to saline-vaccinated control mice, immunization reduced the parasite burden by 57.3–81.4%, while lower levels of non-specific protection were induced in control mice injected with the plasmid pcDNA3.1 (18.8–33.1%) or a plasmid with irrelevant construct, pcDNA3.1/3D15 (33.4–38.8%). Importantly, significant levels of protection were observed between the pcDNA3.1/Tso18 plasmid and pcDNA3.1/3D15 plasmid immunized mice. Mice immunized with pTso18 synthesized low levels of, primarily IgG1 sub-class, antibodies. These antibodies were shown to recognize a 66 kDa antigen fraction of T. crassiceps and T. solium. Splenocytes enriched in both CD4+CD8– and CD4–CD8+ T cells from these vaccinated mice proliferated in vitro when exposed to antigens from both T. solium and T. crassiceps cestodes. Immunolocalization studies revealed the Tso18 antigen in oncospheres of T. saginata and T. solium, in the adult tapeworm and in the tegument of T. solium cysticerci. The protective capacity of this antigen and its extensive distribution in different stages, species and genera of cestodes points to the potential of Tso18 antigen for the possible design of a vaccine against cestodes.

Keywords: DNA immunization; Vaccination; Cysticercosis; Taenia solium; Taenia crassiceps; Taenia saginata

25. **Seroprevalence and awareness of porcine cysticercosis across different pig production systems in south-central Cambodia,**Aderosoye Adenuga, Ana Mateus, Chhay Ty, Khieu Borin, Davun Holl, Sorn San, Victoria Duggan, Madeleine Clark, Gavin J.D. Smith, Richard Coker, Andrew Vaughn, James W. Rudge,Parasite Epidemiology and Control,Volume 3, Issue 1,2018,Pages 1-12,https://doi.org/10.1016/j.parepi.2017.10.003.

Abstract:

Background

Taeniasis/cysticercosis, caused by the pork tapeworm Taenia solium, represents an important public health and economic burden in endemic countries. However, there is a paucity of data on infection among pigs in many parts of Southeast Asia, particularly Cambodia. We aimed to estimate seroprevalence of porcine cysticercosis, and investigate husbandary practices and knowledge of the disease among livestock workers, across different pig sector units in south-central Cambodia.

Methods

A cross sectional survey was conducted among pig smallholders, commercial farms, slaughterhouses and traders/middlemen from south-central Cambodia, selected through multistage sampling in proportion to local pig populations sizes. Questionnaires were administered to 163 pig workers to obtain data pig production, trading and slaughtering practices. Sera from 620 pigs were tested for Taenia antigens using a commercial ELISA-based test. Associations between seroprevalence and pig husbandry practices were assessed using generalised linear mixed models, adjusting for random-effects at herd-level.

Results

Of 620 pigs sampled, 29 (4.7%) tested positive for Taenia antigens. Seropositivity was associated with type of pig sector unit (P=0.008), with the highest seroprevalence among pigs sampled from traders/middlemen (16.7%; 95% CI: 4.4%–37.8%), smallholders (7.6%; 95% CI: 3.8%–14.1%) and slaughterhouses (4.1%; 95% CI: 2.0%–7.5%), while none of the pigs sampled from small/medium or large commercial farms tested positive. Although the vast majority of pigs were penned, practices that might facilitate human-to-pig transmission, such as use of household waste and surface water sources to feed pigs, were prevalent among smallholders. However these were not found to be significantly associated with infection. Of 163 interviewed pig workers, 115 (70.5%) were aware of porcine cysticercosis, and 78 (47.8%) also knew it could affect humans. Twenty-six (16.0%) reported having noticed lesions typical of cysticercosis in their pigs.

Conclusions

Despite most pigs being kept confined in pens rather than raised in free-roaming systems, porcine cysticercosis appears to be endemic in south-central Cambodia and is associated with smallholder production. Further investigation is needed to identify which Taenia species are causing infections among pigs, and how seroprevalence and zoonotic risk may vary across the country, to understand the risks to public health and assess where interventions might be needed.

Keywords: Porcine cysticercosis; Taenia; Livestock production; Zoonosis; Pigs; Cambodia

26. **Spatial analysis on the risk of bovine cysticercosis occurrence in the state of Espírito Santo, Brazil**,Barbara Rauta de Avelar, Lazaro Corrêa Marcelino, Rafael Ferraço de Campos, Alexandre Rosa dos Santos, Isabella Vilhena Freire Martins,Parasite Epidemiology and Control,Volume 1, Issue 2,2016,Pages 116-123,https://doi.org/10.1016/j.parepi.2016.04.003.

Abstract:

A map of the risk of bovine cysticercosis occurrence was developed for the state of Espírito Santo, Brazil, and it was based in a mathematic model based on following variables: inadequate sewage, bovine population by county, use and occupation of the land and flood risks in GIS environ by means of the ArcGIS/ArcINFO 10.1 program. The work aims to spatially analyze the risk of bovine cysticercosis occurrence in the state of Espírito Santo, by means of risk factors related to cysticercosis and compare with the prevalence obtained from slaughterhouses in the same area. The map of risk showed areas high risk and very high risk located mainly in Ecoporanga, Linhares, counties, where the prevalence from slaughterhouses are low, and in two counties of south macro-region, Presidente Kennedy and Itapemirim, where prevalence from slaughterhouses are higher.

Keywords: Cysticercus bovis; Epidemiology; GIS

27. **Optimal control analysis of Taenia saginata bovine cysticercosis and human taeniasis**,Joshua A. Mwasunda, Jacob I. Irunde, Damian Kajunguri, Dmitry Kuznetsov,Parasite Epidemiology and Control,Volume 16,2022,e00236,https://doi.org/10.1016/j.parepi.2021.e00236.

Abstract:

Bovine cysticercosis and human taeniasis are neglected food-borne diseases that pose challenge to food safety, human health and livelihood of rural livestock farmers. In this paper, we have formulated and analyzed a deterministic model for transmission dynamics and control of taeniasis and cysticercosis in humans and cattle respectively. The analysis shows that both the disease free equilibrium (DFE) and endemic equilibrium (EE) exist. To study the dynamics of the diseases, we derived the basic reproduction number R0 by next generation matrix method which shows whether the diseases die or persist in humans and cattle. The diseases clear if R0<1 and persist when R0>1. The normalized forward sensitivity index is used to derive sensitive indices of model parameters. Sensitivity analysis results indicate that human's and cattle's recruitment rates, infection rate of cattle from contaminated environment, probability of humans to acquire taeniasis due to consumption of infected meat, defecation rate of humans with taeniasis and the consumption rate of raw or undercooked infected meat are the most positive sensitive parameters whereas the natural death rates for humans, cattle, Taenia saginata eggs and the proportion of unconsumed infected meat are the most negative sensitive parameters in diseases' transmission. These results suggest that control measures such as improving meat cooking, meat inspection and treatment of infected humans will be effective for controlling taeniasis and cysticercosis in

humans and cattle respectively. The optimal control theory is applied by considering three time dependent controls which are improved meat cooking, vaccination of cattle, and treatment of humans with taeniasis when they are implemented in combination. The Pontryagin's maximum principle is adopted to find the necessary conditions for existence of the optimal controls. The Runge Kutta order four forward-backward sweep method is implemented in Matlab to solve the optimal control problem. The results indicate that a strategy which focuses on improving meat cooking and treatment of humans with taeniasis is the optimal strategy for diseases' control.

Keywords: Human taeniasis; Bovine cysticercosis; Basic reproduction number; Effective reproduction number; Optimal control; Numerical simulation

28. **Porcine Cysticercosis Sero-prevalence and Factors Associated with its Occurrence in Southern Highlands, Tanzania,** Flora Kajuna, Beda John Mwang'onde, Christine Holst, Bernard Ngowi, Felix Sukums, Josef Noll, Andrea Sylvia Winkler, Helena Ngowi,Scientific African,Volume 17,2022,e01382,https://doi.org/10.1016/j.sciaf.2022.e01382.

Abstract:

Porcine cysticercosis is endemic in Tanzania, especially in the Southern Highlands, Central areas and Northern Highlands regions of the country. It is a condition that reduces pork quality and suitability for human consumption and hence affecting public health and the pig industry. The prevalence and possible associated factors for porcine cysticercosis occurrence were investigated to assist in the planning for sustainable control measures. This study was conducted in three wards of Iringa region, southern Tanzania. A blood sample was collected from 346 pigs in 88 households and analysed using an enzyme-linked immunosorbent assay (ELISA), to detect Taenia solium antigens (Ag). A questionnaire administered to farmers and an observational checklist tool assisted the researcher in collecting household information on pig management, sanitation and hygiene practices. On average, 22.3±3.44 per cent of pigs was seropositive for porcine cysticercosis in the three wards, and 53.4 per cent of the surveyed households had at least one seropositive pig. Statistically, porcine cysticercosis was associated with the scavenging pig rearing method (OR=2.426; p≤0.05) and poor quality pig housing (OR=1.75; p≤0.05). This means that scavenging pigs and those living in poor-quality pens had two times higher chances of being infected. Having more than half studied pig units with positive case(s) indicates limited inputs in pig feeding and sheltering thus exposing them to infection vulnerability. The poor-quality pens allowed pigs to escape and/or scavenge on T. solium eggs contaminated environment. Training and sensitising on improved pig management using locally available resources is essential. Also emphasising regular latrine use, hygiene and sanitation practices can support control.

Keywords: Porcine cysticercosis; Sero-prevalence; Risk factors; Health education; Pig

29. **Seroprevalence of cysticercosis in North Indian population,**Nitin Shukla, Nuzhat Husain, Vimala Venkatesh, Jamal Masood, Mazhar Husain,Asian Pacific Journal of Tropical Medicine,Volume 3, Issue 8,2010,Pages 589-593,https://doi.org/10.1016/S1995-7645(10)60144-7.

Abstract:

Objective

To estimate the seroprevalence, morbidity of Taenia solium (T. solium) cysticercosis and its relationship to socio-economic, sanitary parameters.

Methods

Using multistage stratified random sampling, 2 500 subjects from urban (n=1 250) and rural population (n = 1 250) of Lucknow, India were registered. Blood, stool samples, socioeconomic and demographic data were collected. Serum enzyme-linked-immunosorbent-assay (ELISA) was used to detect anticysticercus IgG and IgM antibodies. Microscopic examination of stool samples after processing by concentration method was done to observe taeniasis and other intestinal parasites. CT scan of seropositive cases presenting with seizures was done for confirmation of neurocysticercosis.

Results

The overall, urban and rural seroprevalence of T. solium cysticercosis was 3.48%, 4.64% and 2.32%, respectively. The risk factors significantly associated with the disease were pig rearing in both study populations, unsanitary waste disposal in urban, vegetarian diet and open defecation in rural population. One case of intestinal taeniasis was observed. Twenty-six of 30 cases undergoing CT scan were diagnosed as neurocysticercosis.

Conclusions

Seroprevalence of cysticercosis is high in the study community. Prevalence of cysticercosis is related to roaming pigs and behavioral and environmental practices in local community. Health education and identification of tapeworm carriers seems promising control strategy.

Keywords: Cysticercosis; Community; Seroprevalence; North India; Taenia solium; ELISA

30. **Seroprevalence of porcine cysticercosis in traditional farms in South-Eastern Côte d'Ivoire,**Kouassi Eugene Koffi, Man-Koumba Soumahoro, Kouadio Borel N'Dri, Mireille Nowakowski, Cataud Marius Guédé, O. Marcel Boka, Jihen Melki, Offianan André Touré, Joseph Djaman, Jacques Bellalou, K. Eliezer N'Goran, Ronan Jambou,Parasite Epidemiology and Control,Volume 22,2023,e00311,https://doi.org/10.1016/j.parepi.2023.e00311.

Abstract:

Background

Porcine cysticercosis is an endemic parasitic zoonosis in many developing countries. The objective of this study was to estimate the seroprevalence of porcine cysticercosis in traditional pig farms in the departments of Dabou, Aboisso and Agboville.

Methods

Blood samples were taken from pigs and analyzed by ELISA (IgG) and western blot. Data on farming practices and pig characteristics were collected. Multivariate logistic regression models were constructed to identify risk factors.

Results

A total of 668 pigs were sampled from 116 farms and 639 samples were analyzed. The seroprevalence of cysticercosis was estimated at 13.2%. Overweight [OR = 2.6; 95%CI (1.3–4.9)] and fat pigs [OR = 2.3; 95%CI (1.0–4.8)] were twice as likely to be seropositive for cysticercosis. This risk was increased in farms using well water for drinking [OR = 2.5; 95%CI (1.0–6.3)] as well as those reporting veterinary care of the animals (OR = 2.9; 95%CI (1.2–7.3)).

Conclusions

This study demonstrated the circulation of Taenia solium in pig farms in southern Côte d'Ivoire.

Keywords: Taenia solium; Seroprevalence; Porcine cysticercosis; Côte d'Ivoire

31. **Symptomatic orbital cysticercosis: Patterns of positive imaging findings on CT**,Fei Wang, Matthew Sondag, Wangsheng Chen, Feng Chen, Jianjun Li, Meng Law, Chi-Shing Zee,Radiology of Infectious Diseases,Volume 4, Issue 3,2017,Pages 108-112,https://doi.org/10.1016/j.jrid.2017.08.001.

Abstract:

Background

Orbital cysticercosis is a common disease in the developing world. Although previous studies reported the spectrum of imaging findings of orbital cysticercosis and variable involvement of the extraocular muscles, the relationship between the lesion and the extraocular muscle (within the muscle or on the surface), as well as its distribution within the muscle (muscle belly or the tendinous insertion) was uncertain.

Purpose

To characterize the predominant imaging findings of orbital cysticercosis on computed tomography (CT) and assess the relationship between orbital infection and extraocular muscles.

Methods and Methods

A cohort of 35 patients with orbital cysticercosis was included in the analysis. All patients underwent CT examination, whereas 6 underwent magnetic resonance imaging.

Results

52 lesions were visualized on CT. The nodular calcified stage was rather common, followed by the colloidal vesicular or granular nodular stage and vesicular stage. Approximately, two-thirds of the lesions were presented as a cyst with/without an intramural nodule and the remaining as calcification. The extraocular muscle involvement consisted of a single, two, and three lesions, respectively; these were predominantly located within the extraocular muscles, whereas 12 lesions were attached to the extraocular muscles. The lesions were frequently within or adjacent to the muscle belly and less frequently associated with the tendinous insertion. The lateral rectus was frequently involved. The intracranial or extra-orbital involvement was found in 12 patients.

Conclusion

Orbital cysticercosis mainly presented as a cyst containing an intramural nodule and frequently residing within an extraocular muscle, with a predilection for the muscle belly.

Keywords: Cysticercosis; Orbit; Computed tomography; Magnetic resonance imaging

32. **Low seroprevalence of systemic cysticercosis among patients with epilepsy in Kerala – South India**,Ajith Cherian, U.K. Syam, D. Sreevidya, T. Jayaraman, Anna Oommen, Vedantam Rajshekhar, Kurupath Radhakrishnan, Sanjeev V. Thomas,Journal of Infection and Public Health,Volume 7, Issue 4,2014,Pages 271-276,https://doi.org/10.1016/j.jiph.2013.08.005.

Abstract:

Purpose

Neurocysticercosis (NCC) is considered to be rare in Kerala state, India, although it is an important cause of epilepsy in many other parts of India. Our objective was to test this notion by determining the seroprevalence of cysticercosis (CC) in an unselected sample of persons with epilepsy and comparing it to that of persons without epilepsy living in Kerala.

Methods

Individuals with active epilepsy (AE) who had never resided outside Kerala state for more than one month and were attending our center for epilepsy care constituted the cases. Sex-matched persons without epilepsy who had never resided outside Kerala state for more than one month constituted the controls. The demographic details, occupation, and food habits (for the cases and controls), as well as clinical characteristics and imaging (for cases only) were recorded. Sera separated from blood drawn by venipuncture from the cases and controls were assayed for cysticercal antibodies by enzyme-linked immunoelectrotransfer blot (EITB).

Results

Of the 80 persons with AE, 12 were seropositive for cysticercus antibodies (15%; 95% CI: 8.8–24.4); among the 68 controls, 7 were seropositive (10.3%; 95% CI: 5.1–19.8). The odds ratio

(OR) for seropositivity in the epilepsy group (1.54) was not statistically significant (95% CI: 0.6–4.2). Among the 69 patients who had a brain computed tomography (CT) scan or magnetic resonance imaging (MRI), none had features diagnostic of NCC. Gender, diet (vegetarian vs non-vegetarian, consumption of raw vegetables), drinking water status (clean vs unclean), residence (rural vs urban), exposure to manure, and animal rearing including pigs did not have any association with seropositivity.

Conclusion

Among the residents of Kerala, most epilepsy is not related to cysticercosis.

Keywords: Active epilepsy; Kerala state; Neurocysticercosis; Seroprevalence; Tape worm disease

33. **Aggregation of Taenia solium cysticerci in pigs: Implications for transmission and control**,Mwemezi L. Kabululu, Maria V. Johansen, Marshall Lightowlers, Chiara Trevisan, Uffe C. Braae, Helena A. Ngowi,Parasite Epidemiology and Control,Volume 22,2023,e00307,https://doi.org/10.1016/j.parepi.2023.e00307.

Abstract:

Parasite aggregation within hosts is a fundamental feature of parasite distributions, whereby the majority of parasites are harboured by a minority of hosts. Parasite aggregation can influence their transmission and hence control. In this narrative review, possible sources of aggregation of Taenia solium cysticerci in pigs are discussed, along with implications for control of the parasite. While heavy T. solium infections in pigs could most likely be associated with ingestion of high doses of infective parasite eggs, consistent with coprophagic behaviour of pigs, lighter infections indicate a role of indirect routes of transmission to pigs, mostly from lower infection doses. Light infections are likely to be missed by commonly used diagnostic methods - tongue examination or meat inspection - and end up in the food chain. Hence, they entail a 'hidden' risk and are of a particular public health concern, especially in areas where meat is consumed raw or undercooked. To be effective and sustainable, control strategies against T. solium likely require a broader understanding of, and consideration for parasite transmission dynamics. More importantly, a holistic One Health approach incorporating interventions on humans, pigs and the environment will likely have a larger, more successful and sustainable impact.

Keywords: Taenia solium; Cysticercosis; Transmission; Control

34. **Disseminated cysticercosis incidentally diagnosed in a patient of low backache: A case report and concise review of literature**,Mohammad Nasim Akhtar, Sharat Agarwal,Asian Pacific Journal of Tropical Medicine,Volume 5, Issue 7,2012,Pages 582-586,https://doi.org/10.1016/S1995-7645(12)60103-5.

Abstract:

Disseminated cysticercosis is an uncommon presentation of a common disease. Asymptomatic disseminated cysticercosis is rarely reported in literature. Here, we are reporting a case of asymptomatic disseminated cysticercosis incidentally diagnosed in a patient of low backache. Magnetic resonance imaging of lumbosacral spine and neuroimaging done subsequently during the course of evaluation revealed diffuse cysticercosis involving abdominal, paraspinal, pelvic and gluteal muscles along with neurocysticercosis. Such a disseminated cysticercosis was diagnosed incidentally in this patient of low backache with right sciatica and radiculopathy at L5-S1 prolapsed intervertebral disc and was subsequently managed by L5-S1 interlaminar fenestration and discectomy.

Keywords: Disseminated cysticercosis; Taenia solium infestation; Neurocysticercosis; Human cysticercosis

35. **Mass chemotherapy with niclosamide for the control of Taenia solium: population-based safety profile and treatment effectiveness**,Melissa T. Wardle, Samantha E. Allen, Ricardo Gamboa, Percy Vilchez, Seth E. O'Neal, Claudio Muro, Andrés G. Lescano, Luz M. Moyano, Guillermo E. Gonzalvez, Armando E. González, Robert H. Gilman, Héctor H. García, Manuela R. Verastegui, Javier A. Bustos, Mirko Zimic, Isidro Gonzales, Herbert Saavedra, Sofia S. Sanchez, Manuel Martinez, Yesenia Castillo, Luz Toribio, Gianfranco Arroyo, Miguel A. Orrego, Nancy Chile, Holger Mayta, Monica Pajuelo, Saul Santivañez, Eloy Gonzalez-Gustavson, Luis Gomez-Puerta, Cesar M. Gavidia, Ana Vargas-Calla, Maria T. Lopez, Theodore E. Nash, Sukwan Handali, John Noh, Jon Friedland,The Lancet Regional Health - Americas,Volume 38,2024,100876,https://doi.org/10.1016/j.lana.2024.100876.

Abstract:

Summary

Background

Mass drug administration (MDA) with niclosamide (NSM) can be used to control taeniasis, the cause of neurocysticercosis. NSM is 84.3% effective against taeniasis and is considered safe as it is not absorbed from the intestinal tract. However, information on its safety and effectiveness during MDA is limited. We evaluated the effectiveness of NSM and reported adverse events (AEs) during a cysticercosis elimination program in Tumbes, Peru.

Methods

Three rounds of NSM at 4-month intervals were offered to 77,397 eligible residents. We revisited all participants in their homes 72 h after each round to collect information regarding AEs. We also collected post-treatment stool samples to diagnose taeniasis after the first round, followed by a second sample at 30 days from those infected to evaluate NSM's effectiveness.

Findings

During implementation, 68,751 individuals were administered at least one dose of NSM (mean age 29 years, SD 20; 52% male), and 65,551 (95.3%) were visited post-treatment. 988 (1.5%) reported experiencing at least one AE. Almost all AEs (99.2%) were of mild intensity, with no severe AEs recorded. Of 211 participants diagnosed with taeniasis, 188 provided a follow-up stool sample 30-days after treatment and 141 were cured (treatment effectiveness 75.0%). Older age and higher coproantigen levels were significantly associated with treatment failure.

Interpretation

MDA with NSM is safe in Taenia solium endemic settings. However, the effectiveness following one dose is lower than expected, which suggests additional treatment may be necessary to enhance the infection control efforts.

Funding

The Bill and Melinda Gates Foundation.

Keywords: Niclosamide; Effectiveness; Adverse events

36. **Prevalence of Taenia solium cysticercosis in domestic pigs following albendazole deworming intervention in rural communities of Mbulu district, Tanzania**,Vedasto Bandi, Bernard Ngowi, Emmanuel Mpolya, Andrew Martin Kilale, John-Mary Vianney,Food and Waterborne Parasitology,Volume 36,2024,e00234,https://doi.org/10.1016/j.fawpar.2024.e00234.

Abstract:

Taeniosis and cysticercosis are infections caused by cestodes, Taenia solium is among them. T.solium neurocysticercosis accounts for 30% of acquired epilepsy in human in developing countries. This study was carried out to determine the prevalence of cysticercosis among domestic pigs in Mbulu district following deworming intervention. The study was conducted among three rural communities monitoring community intervention in Mbulu district between March 2020 and September 2021. Live pigs were diagnosed by lingual examination for the presence of T. solium cysticerci, and pig-rearing practices were recorded. Logistic regression was performed to determine the role of risk factors on pig infection outcome. We conveniently sampled 510 pigs; 267 (52.4%) were sampled in the year 2020 and 243 (47.6%) in 2021. All pigs were examined by lingual examination for the presence of pork tapeworm larvae, and 43 (8.4%) pigs were found to be infected. Twenty-one (48.8%) of the infected pigs were males and 22 (51.2%) were females, and the overall annual prevalence of tapeworm larvae was 9% and 7.8% for 2020 and 2021, respectively. The pigs were twice more likely to be found infected during the rainy season compared to the dry season in 2020 (OR = 2.27, 95%CI of 1.16–7.22). The reported pig-rearing practices were free-range, penned, and tethered, 141 (52.8%), 64 (24%), and 62 (23.2%), respectively. Of the 94 visited households in 2020, 78 (83%) reported drinking water without boiling, and 59 (62.8%) household leaders reported having heard about taeniosis/cysticercosis. The prevalence of cysticercosis among

domestic pigs in this study was high, with seasonal variations. Despite the ongoing national school deworming and community deworming program, there was no significant change in the prevalence of cysticercosis over two consecutive years. The reported pig infections imply fecal-oral transmission with humans tapeworm eggs released from infected humans. Most households reported consuming unboiled drinking water that might be contaminated. Integrating pig vaccination and deworming, health education and school or community deworming along with improved pig management practice and general community water sanitation hygiene (WASH) are recommended to reduce the burden of pork tapeworm in the study communities.

Keywords: Anthelmintic; Deworming; Cysticercosis; Taenia solium; Pork tapeworm; Tanzania

37. **Cardiac cysticercosis and neurocysticercosis in sudden and unexpected community deaths in Lusaka, Zambia: a descriptive medico-legal post-mortem examination study,**Cordilia Himwaze, Luchenga Adam Mucheleng'anga, Victor Telendiy, Amos Hamukale, John Tembo, Nathan Kapata, Francine Ntoumi, Alimuddin Zumla,International Journal of Infectious Diseases,Volume 115,2022,Pages 195-200,https://doi.org/10.1016/j.ijid.2021.11.042.

Abstract:

Background

Cysticercosis is a World Health Organization designated neglected human zoonosis worldwide. Data on cardiac cysticercosis and its contribution to sudden and unexpected community deaths are scarce and require study.

Methods

A study was performed of cysticercosis-related deaths and other incidental cases of cysticercosis seen at forensic post-mortem examination over a period of 12 months, in individuals who died suddenly and unexpectedly in the community in Lusaka, Zambia. Whole-body post-mortem examinations were performed according to standard operating procedures for post-mortem examinations. Representative samples were obtained from all body organs and subjected to histopathological examination. Information was obtained on circumstances surrounding the death. Data were collated on patient demographics, history, co-morbidities, pathological gross and microscopic findings, and forensic autopsy cause(s) of death. The available literature on cardiac cysticercosis was also reviewed.

Results

Nine cases of cysticercosis were identified. Eight of the nine cases had cardiac cysticercosis. There was no prior history of cysticercosis before death. All were male, aged between 28 and 56 years, and from high population density and low socioeconomic communities. There was no community case clustering identified.

Conclusions

Cardiac cysticercosis and neurocysticercosis are important incidental findings in sudden and unexpected deaths in the community and can easily be missed antemortem. More investment in forensic autopsy services is required to define the undiagnosed burden of deaths due to treatable communicable diseases.

Keywords: Cysticercosis; Cardiac; Heart; Brain; Forensic autopsy; Community deaths; Neurocysticercosis; Cardiac cysticercosis; Zambia; Africa

38. **Effect of National Schistosomiasis Control Programme on Taenia solium taeniosis and porcine cysticercosis in rural communities of Tanzania**,Uffe Christian Braae, Pascal Magnussen, Wendy Harrison, Benedict Ndawi, Faustin Lekule, Maria Vang Johansen,Parasite Epidemiology and Control,Volume 1, Issue 3,2016,Pages 245-251,https://doi.org/10.1016/j.parepi.2016.08.004.

Abstract:

Taenia solium is found throughout sub-Saharan Africa and co-endemic with schistosomiasis in many regions. Taenia solium leads to taeniosis and neurocysticercosis - the leading cause of preventable epilepsy globally. This study aimed to assess the effects of the National Schistosomiasis Control Programme on prevalence of taeniosis and porcine cysticercosis over a four year period in Tanzania. School-based mass drug administration (MDA) of praziquantel was carried out based on schistosomiasis endemicity. Four human and five porcine cross-sectional surveys were carried out from 2012 to 2015 in Mbozi and Mbeya district in Tanzania. Three rounds of school-based MDA of praziquantel were delivered in Mbozi and two in Mbeya. The prevalence of taeniosis and porcine cysticercosis was estimated annually. Stool samples were collected from humans and prevalence of taeniosis estimated by copro-Ag-ELISA. Blood samples from pigs were collected to estimate cysticercosis prevalence by Ag-ELISA. “Track-and-treat” of taeniosis cases was carried out after each survey. In total 12082 stool samples and 4579 porcine serum samples were collected. Significantly fewer children (≤15) from Mbozi were infected throughout the study than children from Mbeya who showed a significant decrease in copro-Ag prevalence after the first treatment only. During the final survey in Mbozi the prevalence of taeniosis in adults (1.8%) was significantly lower (p=0.031, OR 0.40, CI: 0.17–0.89), compared to baseline (4.1%). The prevalence of porcine cysticercosis (8%) had also dropped significantly (p=0.002, OR 0.49, CI: 0.32–0.76) in this district compared to baseline (13%), whereas no significant difference was seen in Mbeya compared to baseline. The study suggests that three rounds of MDA targeting schistosomiasis in school-aged children combined with ‘track-and-treat’ contributed to a reduction in prevalence of T. solium in this population, and also had a spillover effect on adults in treated areas as well as reducing the prevalence of T. solium in the intermediate pig host population. Elimination of T. solium in this area would require a One Health approach.

Keywords: Taenia solium; Taeniosis; Mass drug administration (MDA); Cysticercosis; Preventive chemotherapy

39. **Validation of Meat Inspection Results for Taenia saginata Cysticercosis by PCR–Restriction Fragment Length Polymorphism**,Dirk Geysen, Kirezi Kanobana, Bjorn Victor, Richar Rodriguez-Hidalgo, Jean De Borchgrave, Jef Brandt, Pierre Dorny,Journal of Food Protection,Volume 70, Issue 1,2007,Pages 236-240,https://doi.org/10.4315/0362-028X-70.1.236.

Abstract:

Bovine cysticercosis is a zoonosis caused by the larval stage (cysticercus) of the human tapeworm Taenia saginata. Infected cattle is an important food safety issue besides an economic concern. Humans get infected by eating raw or under-cooked meat containing viable cysticerci. Visual meat inspection of bovines is the only public health measure implemented to control transmission to humans, but it lacks sensitivity and objectivity. It may underestimate the prevalence of the disease by a factor 3 to 10. Furthermore, the success of the method depends on the expertise of the meat inspector as well as on the stage of development of the cysticerci. The focus of this study was to develop and explore the usefulness of a PCR assay as an objective alternative to evaluate the meat inspector's visual inspection results. Hereto, a PCR was developed for the detection of T. saginata DNA in muscle lesions. Based on the laboratory classification of lesions, almost 97% of viable cysts were confirmed by PCR, while for dead cysts, the percentage was approximately 73%. Taken together, these data demonstrate the difficulties of visual meat inspection and their objective interpretation, emphasizing the need to improve current assays to strengthen the control of bovine cysticercosis.

40. **CYSTICERCOSIS OF THE EYE IN SOUTH INDIA – A CASE SERIES**,S Kaliaperumal, VA Rao, SC Parija,Indian Journal of Medical Microbiology,Volume 23, Issue 4,2005,Pages 227-230,https://doi.org/10.1016/S0255-0857(21)02526-3.

Abstract:

Purpose:

To study the clinical presentation and treatment outcome of patients with ocular cysticercosis in southern India. Methods: This study included 10 patients who were diagnosed to have ocular or adnexal cysticercosis over a period of one year in Pondicherry, India. The clinical presentation, results of investigation and treatment outcome of the cases were analysed retrospectively. Results: Age of these patients ranged from 12 to 55 years. Four presented with loss of vision, two with a swelling in the eyelid, one with proptosis, one with diplopia and two with conjunctival involvement. ELISA for cysticercus antibodies in serum was positive in all cases. Albendazole and prednisolone were given for the treatment of these cases. Two patients responded well to treatment and were completely cured of the disease. There was partial improvement in 6 cases. Surgery in the form of excision was performed in two cases following a course of medical therapy. There was no significant change in visual acuity in eyes with intraocular cysticercosis following treatment. Conclusion: Ultrasonography B scan and ELISA for anticysticercal antibodies help to establish the diagnosis of ocular cysticercosis. A

combination of oral albendazole and corticosteroids is found to be effective in confirmed cases. Intraocular cysticercosis is associated with a poor prognosis for vision.

Keywords: Ocular cysticercosis; orbital; subconjunctival; ELISA; diagnosis

41. Evaluation of imaging patterns of extra-cranial cysticercosis in North India,Nitin P. Ghonge, Disha Mittal,Radiology of Infectious Diseases,Volume 4, Issue 2,2017,Pages 49-57,https://doi.org/10.1016/j.jrid.2017.04.001.

Abstract:

Objectives

This prospective study was conducted to evaluate the site-specific incidence of extra-cranial cysticercosis and to study the imaging spectrum of cysticercosis at extra-cranial locations.

Material/Methods

The study included a total of 57 sites of involvement in 55 patients over a period of two years. All the patients with imaging-based diagnosis of cysticercosis at extra-cranial locations were studied to determine the imaging patterns.

Results

These extra-cranial locations included orbit (8.7% of all sites), extra-orbital skeletal muscles (19.44%), skin & subcutaneous tissue (5.2%), parotid gland (3.5%), and miscellaneous (1.75%). Visualization of a cyst with an eccentric nodule was present in 37.2%, while cyst without any definite eccentric nodule was seen at 62.8% extra-cranial sites. Rounded cyst morphology was seen at 24.4% sites, while 75.6% sites showed deformed cysts in extra-cranial cysticercosis.

Discussion

Cysticercosis is commonly seen at extra-cranial locations and often manifest with several common and uncommon patterns. Typical imaging morphology of cysticercosis is less common at extra-cranial locations, as compared to intra-cranial sites and probably account for diagnostic delays.

Keywords: Extracranial cysticercosis; Imaging patterns

42. Spatial and temporal distribution of Taenia solium and its risk factors in Uganda,Nicholas Ngwili, Derrick N. Sentamu, Max Korir, Moses Adriko, Prudence Beinamaryo, Michel M. Dione, Joyce Moriku Kaducu, Alfred Mubangizi, Pauline Ngina Mwinzi, Lian F. Thomas, Matthew A. Dixon,International Journal of Infectious Diseases,Volume 129,2023,Pages 274-284,https://doi.org/10.1016/j.ijid.2023.02.001.

Abstract:

Objectives

The lack of subnational mapping of the zoonotic cestode Taenia solium in endemic countries presents a major challenge to achieving intensified T. solium control milestones, as outlined in the "World Health Organization neglected tropical disease roadmap by 2030". We conducted a mapping study in Uganda, considered to be endemic, to identify subnational high-risk areas.

Methods

T. solium prevalence data, adjusted for diagnostic sensitivity and specificity in a Bayesian framework, were identified through a systematic review. Spatial autocorrelation and interpolation techniques were used to transform demographic and health survey cluster-level sanitation and poverty indicators, overlaid onto a pig density map for Uganda into modelled porcine cysticercosis (PCC) risk maps.

Results

A total of 16 articles (n = 11 PCC and n = 5 human cysticercosis (HCC) and/or human taeniasis) were included in the final analysis. The observed HCC prevalence ranged from 0.01% to 6.0% (confidence interval range: 0.004-11.4%), whereas the adjusted PCC ranged from 0.3 to 93.9% (uncertainty interval range: 0-99.8%). There was substantial variation in the modelled PCC risk factors and prevalence across Uganda and over time.

Conclusion

The high PCC prevalence and moderate HCC exposure estimates indicate the need for urgent implementation of T. solium control efforts in Uganda.

Keywords: Taenia solium; Risk factor mapping; Spatial statistics; One Health; Zoonotic diseases; Neglected tropical diseases

43. **Experimental infection model for Taenia solium cysticercosis in swine**,Manuela Verástegui, Armando González, Robert H. Gilman, César Gavidia, Néstor Falcón, Teresa Bernal, Hector Hugo Garcia,Veterinary Parasitology,Volume 94, Issues 1–2,2000,Pages 33-44,https://doi.org/10.1016/S0304-4017(00)00369-1.

Abstract:

A novel method for infecting pigs with Taenia solium using an intramuscular innoculum of oncospheres was investigated in a series of five experiments in 18 animals. The model is simple to perform, requires a minimal number of oncospheres, permits multiple infections per animal, and decreases the variation inherent in oral infection models. This intramuscular oncosphere assay (IMOA) may provide a valuable tool to evaluate therapeutic agents or potential vaccines for cysticercosis.

Keywords: Cysticercosis; Taenia solium; Oncosphere; Experimental infection

44. **A hyperendemic focus of Taenia solium transmission in the Banke District of Nepal,**Keshav Sah, Ishab Poudel, Suyog Subedi, Dinesh Kumar Singh, Jo Cocker, Peetambar Kushwaha, Angela Colston, Meritxell Donadeu, Marshall W. Lightowlers,Acta Tropica,Volume 176,2017,Pages 78-82,https://doi.org/10.1016/j.actatropica.2017.07.022.

Abstract:

Neurocysticercosis is a major cause of epilepsy in countries where Taenia solium is endemic and the parasite is a major cause of food-borne disease globally. Pigs are the natural intermediate host involved in transmission of the parasite. T. solium is known to be endemic in Nepal, however there is limited reliable data about the prevalence of the disease in Nepal. The aim of this study was to determine accurately the prevalence of porcine cysticercosis in slaughter age pigs in an area of Nepal where pigs are known to be free-roaming. Pigs were obtained from the Udaypur Village Development Committee (VDC) and Hirminiya & Betahani VDC of the Banke district in Nepal. One hundred and ten animals of slaughter age (approximately 8–16 months old) were purchased, slaughtered and the heart, liver, brain and half the body skeletal musculature were sliced using hand knives and the number and viability of T. solium cysts determined. Thirty two of the 110 animals were found to harbour T. solium cysticerci (29%), of which 30 (27%) were found to have viable cysticerci (93% of the infected animals). This is one of the highest prevalences of porcine cysticercosis that has been reported to date from the results of necropsy on randomly selected animals. This study highlights a high rate of transmission of T. solium in the Banke District of Nepal. It encourages further investigation of human and porcine cysticercosis in Nepal, as well as implementation of efforts to reduce transmission of the parasite and the associated human disease.

Keywords: Taenia solium; Cysticercosis; Pig; Nepal; Banke; Necropsy

45. **Imported cysticercosis in Spain: A retrospective case series from the +REDIVI Collaborative Network,**Zaida Herrador, José A. Pérez-Molina, César Augusto Henríquez Camacho, Azucena Rodriguez-Guardado, Pau Bosch-Nicolau, Eva Calabuig, Angel Domínguez-Castellano, María Asunción Pérez-Jacoiste, M. Concepción Ladrón de Guevara, Ana Mena, Jose Manuel Ruiz-Giardin, Diego Torrús, Philip Wikman-Jorgensen, Agustín Benito, Rogelio López-Vélez, Paloma Aguilera, María Martínez Serrano, Magdalena García Rodriguez, Marta Díaz Menendez, Yolanda Meije, Joaquim Martínez-Montauti, Xavier Sanz, Isabel Pacheco Tenza, Inmaculada Gonzalez Cuello, Belén Martínez López, Jara Llenas-García, Mar Masiá, Sergio Padilla, Mónica Romero, José Manuel Ramos Rincón, Ines Suarez, Ana Perez-Ayala, Juan María Herrero, Manuel Lizasoain, Pablo Rojo, Mariano Matarranz, Carlos Zarco, Jonathan Fernández Suárez, Jose Antonio Boga Ribeiro, Josune Goikoetxea Aguirre, Miren Zuriñe Zubero Sulibarría, Juan Victor Sanmartín López, María Velasco Arribas, María Peñaranda Vera, Israel Molina, Adrián Sánchez Montalvá, Fernando Salvador, Begoña Monge-Maillo, Francesca Norman, Sandra Chamorro Tojeiro, Begoña Treviño-Maruri, Nuria Serre Delcor, Antonio Soriano-Arandes, Diana Pou Ciruelo,

Cristina Bocanegra,Travel Medicine and Infectious Disease,Volume 37,2020,101683,https://doi.org/10.1016/j.tmaid.2020.101683.

Abstract:

Background

Neurocysticercosis (NCC) is the most common parasitic neurological disease worldwide and a major cause of epilepsy. Spain is the country reporting the highest number of NCC imported cases in Europe.

Methodology

Retrospective case series of NCC patients registered in the +REDIVI Network from October 1, 2009 to July 2018. A specific questionnaire, including clinical and diagnostic characteristics, was created and sent to the collaborator centers.

Results

46 cases were included in the analysis. 55% were male, mean age of 40 years. 95.6% were migrants. The median duration since migration from an endemic area was 10 years. Predominant nationalities were Ecuadorians (50%) and Bolivians (30.4%). Frequent locations were parenchymal (87%), subarachnoid (26.1%) and intraventricular cysts (10.9%). Serological analysis was performed in 91.3%, being 54.8% positive. Most prevalent clinical manifestations were persistent headache (60.9%), epilepsy (43.5%) and visual changes (13%). Patients were mainly treated with albendazole (76.1%), corticosteroids (67.4%), and anticonvulsionants (52.2%). 82.5% had a favorable clinical outcome.

Conclusions

Most NCC cases were long-standing migrants. Few clinical differences were observed depending on the cysticerci location. The treatment was often not according to current recommendations, and no uniform criteria were followed when it came to the therapeutic regimen. NCC case management in Spain (including clinician awareness and laboratory capacity improvements) needs to be strengthened.

Keywords: Cysticercosis; Taenia solium; Travel medicine; Imported infectious diseases; Neglected diseases; Spain

46. **Stability and bifurcation analysis of a Taenia saginata model with control measures**,Joshua A. Mwasunda, Jacob I. Irunde,Results in Control and Optimization,Volume 13,2023,100311,https://doi.org/10.1016/j.rico.2023.100311.

Abstract:

Bovine cysticercosis and human taeniasis are neglected diseases caused by the beef tapeworm Taenia saginata. These diseases affect both human and animal health, rural livestock producers' livelihoods, and the economies of the nations. Bovine cysticercosis makes beef unfit for human consumption, thus decreasing the cattle market value. In this study, a

mathematical model for the dynamics of human taeniasis and bovine cysticercosis is examined in the context of diseases' control efforts. The analysis of the basic model shows that both disease free and endemic equilibria exist. The basic reproduction number R0 is computed by the next generation method. The disease free equilibrium is globally asymptotically stable (GAS) when R0<1 whereas the endemic equilibrium is GAS when R0>1. To determine parameters that drive the diseases, the normalized forward sensitivity index method is adopted. The findings demonstrate that human and animal recruitment rates, the probability of humans to contract taeniasis, the rate at which humans with taeniasis defecate in the environment and T. saginata eggs' natural mortality rate influence the diseases' dynamics. The effects of several interventions including vaccination of cattle, treatment of infected humans and cattle, proper beef cooking, enhanced hygiene and sanitation, and the use of chemicals to kill T.saginata eggs in the environment are evaluated. When such interventions are administered, the model exhibits forward bifurcation, and secondary infections reduce significantly with time. Therefore, to control the diseases we recommend that more efforts be directed to treat humans with taeniasis and proper beef cooking and meat inspection be encouraged.

Keywords: Bovine cysticercosis; Human taeniasis; Basic reproduction number; Effective reproduction number; Endemic equilibrium; Sensitivity indices; Lyapunov function

47. **Epilepsy and cysticercosis in North-West Cameroon: A serological study,** Irene Elliott, Ambanibe Jerome, Samuel A. Angwafor, Mary Lou Smith, Innocent Takougang, John Noh, Victor Tsang, Patricia Wilkins, Lynn Cockburn, Jay Keystone, Alfred K. Njamnshi, O. Carter Snead,Seizure,Volume 22, Issue 4,2013,Pages 283-286,https://doi.org/10.1016/j.seizure.2013.01.012.

Abstract:

Purpose

The prevalence of epilepsy in Cameroon is higher than that of the industrialized world and other developing countries. Neurocysticercosis due to Taenia solium infestation has been reported as a major cause of epilepsy in some parts of Cameroon although there are some conflicting data. The prevalence of epilepsy is especially high in the Momo division of the North-West Province of Cameroon. We hypothesized that individuals with epilepsy in this region have a higher percentage of seropositivity to T. solium than matched controls.

Methods

We conducted a case–control study in the Momo subdivision of Ngie. Individuals with epilepsy were recruited from the health centers in Ngie. Control subjects were selected from 19 Ngie villages. Potential cases of people with epilepsy (PWE) were identified through a questionnaire applied by trained field workers, using history of epileptic seizures as a key indicator. Blood samples were taken from all consenting individuals by finger prick, stored in StabilZyme Select, and assayed for antibodies to T. solium in an Atlanta based reference laboratory.

Results

We accrued 249 patients with epilepsy, of whom 237 met the inclusion criteria, and 245 age-matched controls. There was no significant difference in seropositivity to T. solium between those individuals with epilepsy (5%) and controls (4.9%).

Conclusions

Our data do not support the hypothesis that epilepsy is associated with seropositivity to T. solium. It is highly unlikely that cysticercosis plays a causative role in the high prevalence of epilepsy in this region of Cameroon.

Keywords: Taenia solium; Seropositivity; Seizures; Epilepsy; Cysticercosis; Case–control; Africa; Cameroon

48. **Epidemiological status of bovine cysticercosis and human taeniasis in Eastern Ethiopia**,Akalu Abera, Berhanu Sibhat, Ayalew Assefa,Parasite Epidemiology and Control,Volume 17,2022,e00248,https://doi.org/10.1016/j.parepi.2022.e00248.

Abstract:

Bovine cysticercosis and human taeniasis are among the leading cause of economic loss in Ethiopia due to organ condemnation and treatment costs. A cross-sectional study was conducted from September 2017 to July 2018 on randomly selected carcasses from Jigjiga, Babile and Dire Dawa town municipal abattoirs to estimate the prevalence of bovine cysticercosis. Besides, a questionnaire was administered to the human population of these towns to understand risk of human taeniasis. The overall prevalence of Cysticercus bovis was 27.3% (302/1108). Among the examined predilection sites, the highest prevalence was observed in the liver (9.6%), and the tongue (8.5%). From the total of 686C. bovis cysts collected, 289 (42.0%) were viable, while the other 397 (58.0%) were non-viable cysts. Three predictors, namely study location, age and body condition, were significantly associated with C. bovis ($p \leq 0.001$). Among the 900 respondents interviewed, 432 had contracted Taenia saginata infection. Risk factors like occupation, sex, marital status, educational status and raw beef consumption habit were significantly associated with T. saginata infection ($p \leq 0.001$). The findings of this study indicated the importance of bovine cysticercosis and taeniasis in the study areas. Therefore, attention should be given to public awareness and detailed meat inspection for the safety of the public and promotion of the country's meat industry.

Keywords: Cysticercosis; Taeniasis; Eastern Ethiopia; Prevalence

49. **Protein expression profile of Taenia crassiceps cysticerci related to Th1- and Th2-type responses in the mouse cysticercosis model**,Mariana Díaz-Zaragoza, LucíaLucía Jiménez, Magdalena Hernández, Ricardo Hernández-Ávila, Luz Navarro, Alicia Ochoa-Sánchez, Sergio Encarnación-Guevara, Pedro Ostoa-Saloma, Abraham Landa,Acta

Tropica,Volume
212,2020,105696,https://doi.org/10.1016/j.actatropica.2020.105696.

Abstract:

The intraperitoneal cysticercosis model with the Taenia crassiceps ORF strain in female BALB/cAnN mice has been widely used to study the immune response in cysticercosis. During early infection (2 weeks), the host develops a non-permissive Th1 response, whereas during late infection (8 weeks), molecules from the cysticerci induce a Th2 response that is permissive to parasite growth. The modulation of the Th2 response is induced by molecules excreted/secreted by the larval stage of the parasite. However, there is limited information regarding the response of cysticerci to the mouse immunological environment during infection. The proteomic profiles in T. crassiceps ORF cysticerci when faced with the mouse Th1 and Th2 responses were analyzed through two-dimensional gel electrophoresis (2DE), and the differential expression of proteins was evaluated. Thirteen proteins, whose differential expression varied between 70% and 100%, were selected randomly. Protein identification by MALDI-TOF MS and BLAST showed that the proteins were related to folding, signaling, enzymatic activities, cell-movement regulation, cell-cell interactions, motility, carbohydrate metabolism, detoxification, and redox regulation processes. Notably, some of the proteins can act as antigenic-protective molecules and elicit a weak Th1 response; however, most are involved in the avoidance of the immune system, which leads to a Th2 response, or apoptosis. The findings indicate the process by which T. crassiceps cysticerci responds based on the host environment and provides novel insights into the mechanism by which this facilitates its establishment and persistence in the mouse. Furthermore, these proteins could be used as targets for drug and vaccine development.

Keywords: Th1/Th2 response; 2DE; MALDI-TOF MS; Taenia crassiceps; cysticerci; Biological processes

50. **Food Safety and Regulatory Aspects of Cattle and Swine Cysticercosis**,Parmesh K. Saini, Donald W. Webert, Patrick C. Mccaskey,Journal of Food Protection,Volume 60, Issue 4,1997,Pages 447-453,https://doi.org/10.4315/0362-028X-60.4.447.

Abstract:

Using slaughter disposition data maintained by the Food Safety and Inspection Service (FSIS) of the U.S. Department of Agriculture, prevalence of cattle cysticercosis (Cysticercus bovis) for a l0-year period from 1985 through 1994 is reported. Out of an annual average of approximately 33 million slaughtered cattle, about 6,200 carcasses were identified with cysticercus lesions. In the five FSIS inspection regions in the United States, namely Western, Southwestern, Northeastern, Southeastern, and North Central, an average cattle cysticercosis prevalence of 0.0697, 0.0085,0.0012,0.0004, and 0.0003, respectively, is reported. The relevance of serological testing in lieu of, or as a supplement to, the current labor-intensive physical detection procedure in cattle is discussed, the latter being reported to miss close to one-third of the carcasses harboring cysticercus lesions. Out of a total of approximately 80

million swine slaughtered annually in the United States, the number of carcasses identified with cysticercus lesions (Cysticercus cellulosae) is extremely low, ranging from 1 through 44 during each of the 10 years. Swine cysticercosis (unlike cattle cysticercosis), with man being an alternate intermediate host, poses serious public health concerns with sometimes fatal consequences manifested through neurocysticercosis (Cysticercus cellulosae). Though human cysticercosis is still rare in the United States, recent reports have indicated an upturn in diagnosed cases. These are primarily the result of an increasing number of immigrants and international travel to and from endemic areas.

Keywords: Cysticercosis; cattle; swine; public health; slaughter inspection; prevalence