

Imaging Features of Neurocysticercosis, a radiologic-clinical correlation.

Poster No.: C-0754
Congress: ECR 2017
Type: Scientific Exhibit
Authors: E. Campos¹, S. A. Rivadeneira², D. Paez³, R. salinas¹; ¹QUITO/EC, ²Buenos Aires/AR, ³Murcia/ES
Keywords: Infection, Diagnostic procedure, MR, CT, Neuroradiology spine, Neuroradiology brain
DOI: 10.1594/ecr2017/C-0754

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.

As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method is strictly prohibited.

You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys' fees, arising from or related to your use of these pages.

Please note: Links to movies, ppt slideshows and any other multimedia files are not available in the pdf version of presentations.

www.myESR.org

Aims and objectives

The analysis of neurocysticercosis (NCC) has improved by the institution of computed tomography (CT) and magnetic resonance imaging (MRI). These methods establish the number and topography of lesions, their stage of evolution, and the degree of inflammatory response of the host against the parasites.

In this study, we are contrasting the abilities between CT and MRI in diagnosing neurocysticercosis. As has been established, MRI has shown to be superior in the recognition of neurocysticercosis in both parenchymal and ventricular forms; while, CT is good for the screening of calcifications from the end stage of parenchymal neurocysticercosis.

One of the main reasons for this study is because globalization has triggered the spread of the disease around the world outside of its endemic regions. With no specific clinical symptoms of the disease, medical imaging plays a vital role in the diagnosis of neurocysticercosis. The first objective of our study is to gain knowledge from the imaging findings that may help greatly in early diagnosis, appropriate treatment decision, and follow-up of patients with neurocysticercosis.

Twenty-two patients from Quito, Ecuador, helped us to illustrate the most common radiological features of human neurocysticercosis, describing the recurrent locations and stages of the parasite in the CNS in order to help us launch the possible clinical manifestations.

Images for this section:

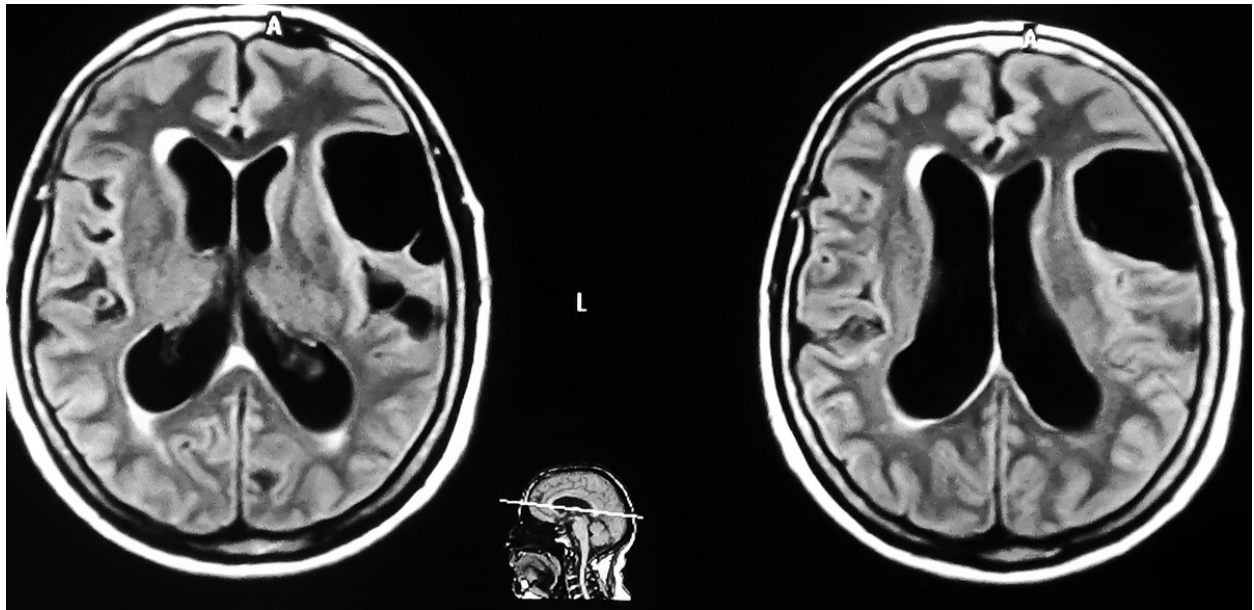


Fig. 1: Vesicular stage. 60 years old woman, with recurrent headache. FLAIR-MRI shows a hypointense cyst in the Fronto-temporo-parietal lobes, with mass effect.

© Department of Radiology-Neurology, General Hospital Eugenio Espejo. / Quito 2016

Methods and materials

Definition

Cysticercosis is an infection with larvae of the pork tapeworm. This disease occurs predominantly in Africa, Asia and Central and South America, but more rarely in Southern and Eastern Europe.¹ The eggs or larvae are absorbed with the infected raw pork over the mouth and pass through the intestinal wall into the human organism.¹⁻²

Causes

The pork tapeworm, *Taenia solium*, is the agent of cysticercosis. Humans can either be infected, after eating raw pork or by fecal-oral transmission.³ If the eggs ingested orally they can further develop in the intestine into larvae, which may get through the wall of the intestine before reaching the blood stream. From the blood stream, the larvae can then infect several organs such as skeletal muscles, heart, eyes, and brain. After, it develops and degrades in calcifications after several months.³⁻⁴

Introduction

When the brain is affected (Neurocysticercosis - NCC), experiences chronic inflammation, which give rise a spectrum of clinical features, that depend on the number of the cysticerci, growth - stage, anatomical location and the immunity of the host.⁴⁻⁵

NCC is a chronic infectious disease with signs and symptoms that become pronounced over months or years after infection. The most common are seizures, headaches, hydrocephalus, and focal neurological deficits. The etiopathogenie is due to viable cysts that can cause mass effect on the cerebral parenchyma.⁵⁻⁶ In the case of colloidal and granular cysticercus the cause is the inflammatory reaction; and in calcified lesions, gliosis around dead parasites and sclerosis may explain the epileptogenic activity. **(See Table 1).** It is assumed that calcifications persist unchanged over the years.⁷ The fact that the presence of cysticercus in the CNS is frequently **asymptomatic** must also be considered.⁸

Materials and Methods

Patients

twenty-two patients with NCC from the General Hospital Eugenio Espejo in Quito-Ecuador were initially referred to the Neurology department between December 2015 and June 2016. These patients were diagnosed on the basis of fulfillment of the "Definitive Diagnosis" according to the International Symposium of Neurocysticercosis held in Lima, Peru, in 2000.

Criteria

The *Inclusion criteria* were the patient, who want to take part in the study.

The *Exclusion criteria* were any simultaneous CNS diagnostics, particularly co-infections, and the unwillingness to take part in the current revision.

These patients were 12 women, and 10 men, of ages ranged from 45 to 70 years (mean age, 55 years).

MR and CT Imaging Analysis

The study focused on infratentorial imaging features. MR and CT imaging examinations were grouped based on the Pathological stage (Escobar's classification: Vesicular, Colloidal, Granular and Nodular Calcified), anatomical location and the clinical symptoms of each patient.

Images for this section:

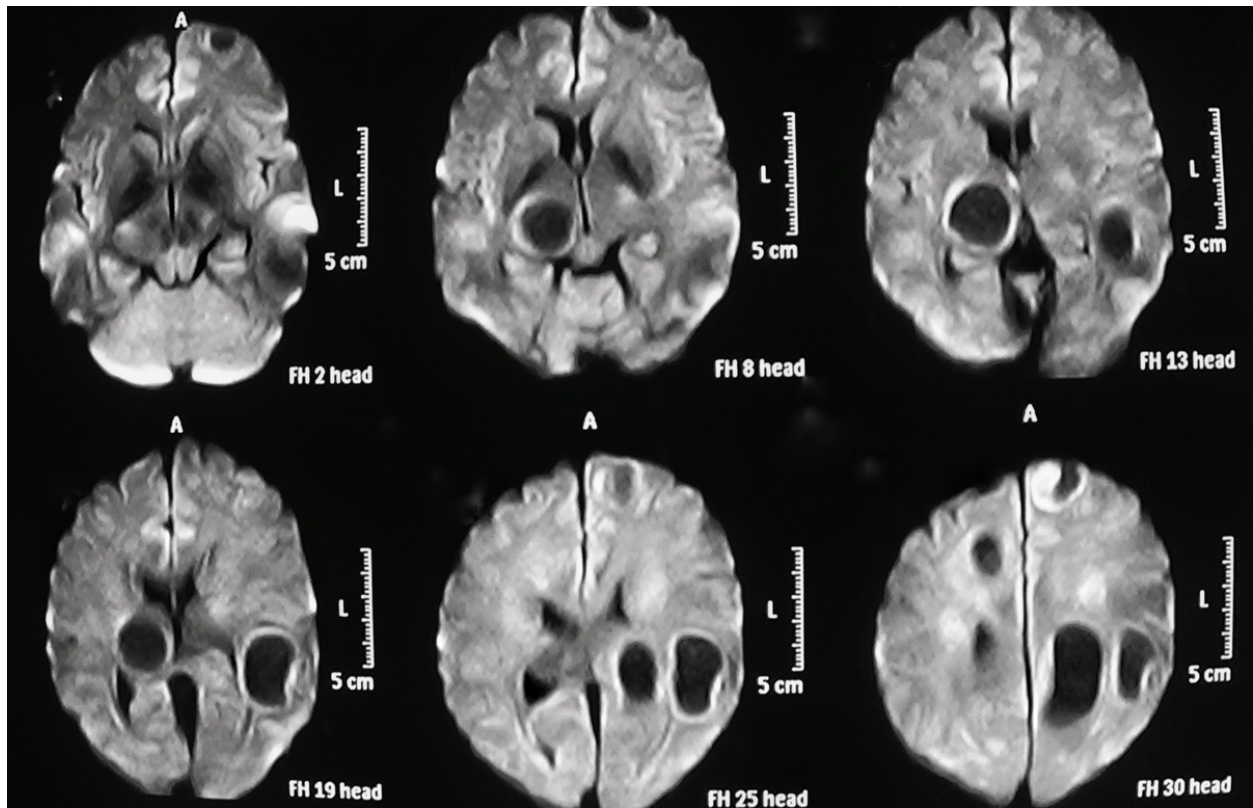


Fig. 2: Vesicular stage. 49 years old man, with seizures. FLAIR-MRI shows hypointense cysts. One in the left frontal lobe with an scolex inside, another cyst in the right temporal lobe and two cysts in the left temporo-parietal lobe.

© Department of Radiology-Neurology, General Hospital Eugenio Espejo. / Quito 2016

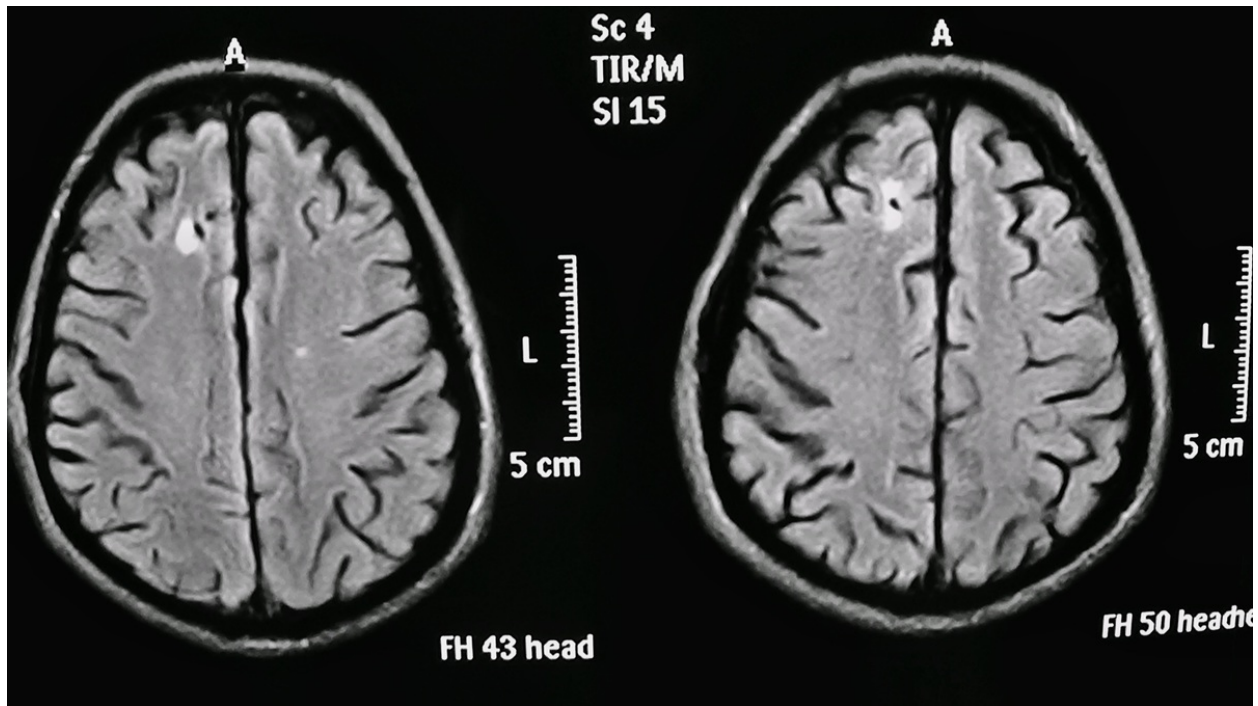


Fig. 3: Granular nodular stage. 67 years old woman, with recurrent headache. FLAIR - MRI shows in the right frontal lobe, a hyperintense lesion in the frontal lobe (Edema) with a hypointense small lesion inside (Calcified).

© Department of Radiology-Neurology, General Hospital Eugenio Espejo. / Quito 2016

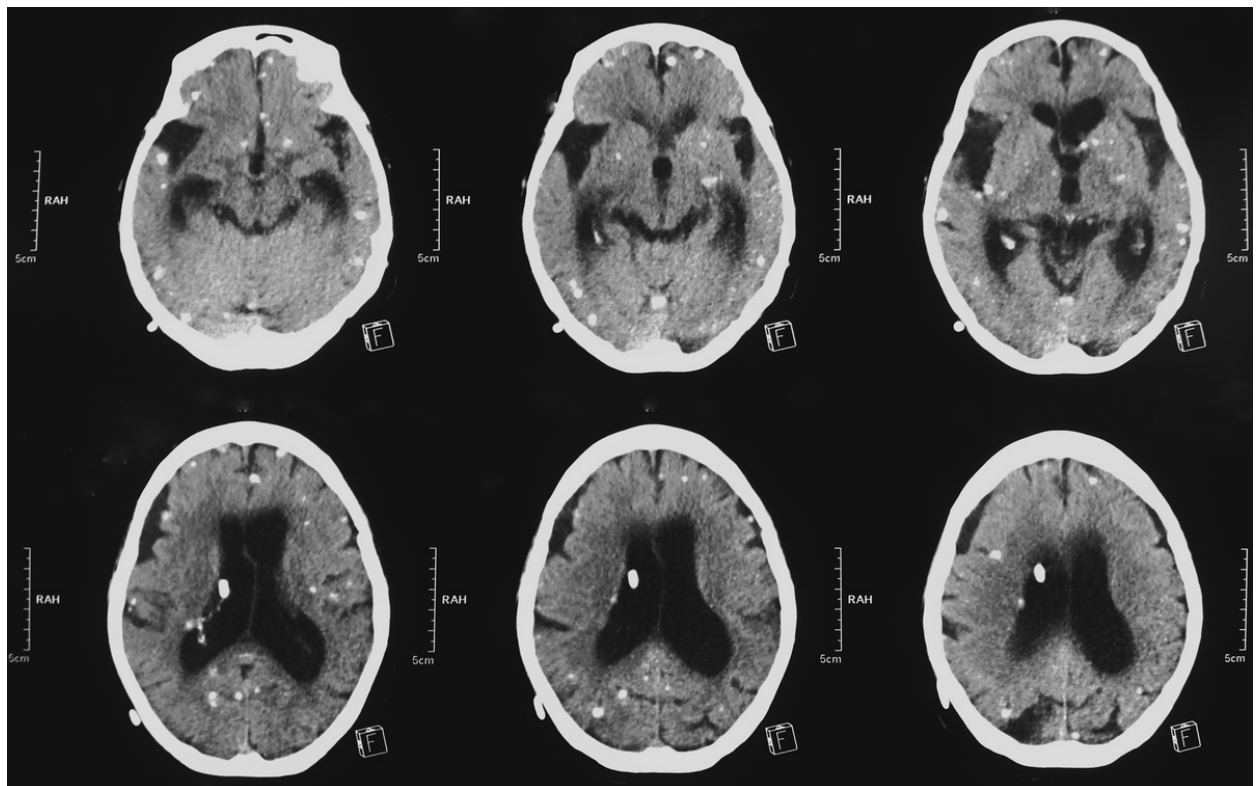


Fig. 4: Nodular calcified. 54 years old man. headache complaining. CT shows Multiple, punctual, high-attenuation areas.

© Department of Radiology-Neurology, General Hospital Eugenio Espejo. / Quito 2016

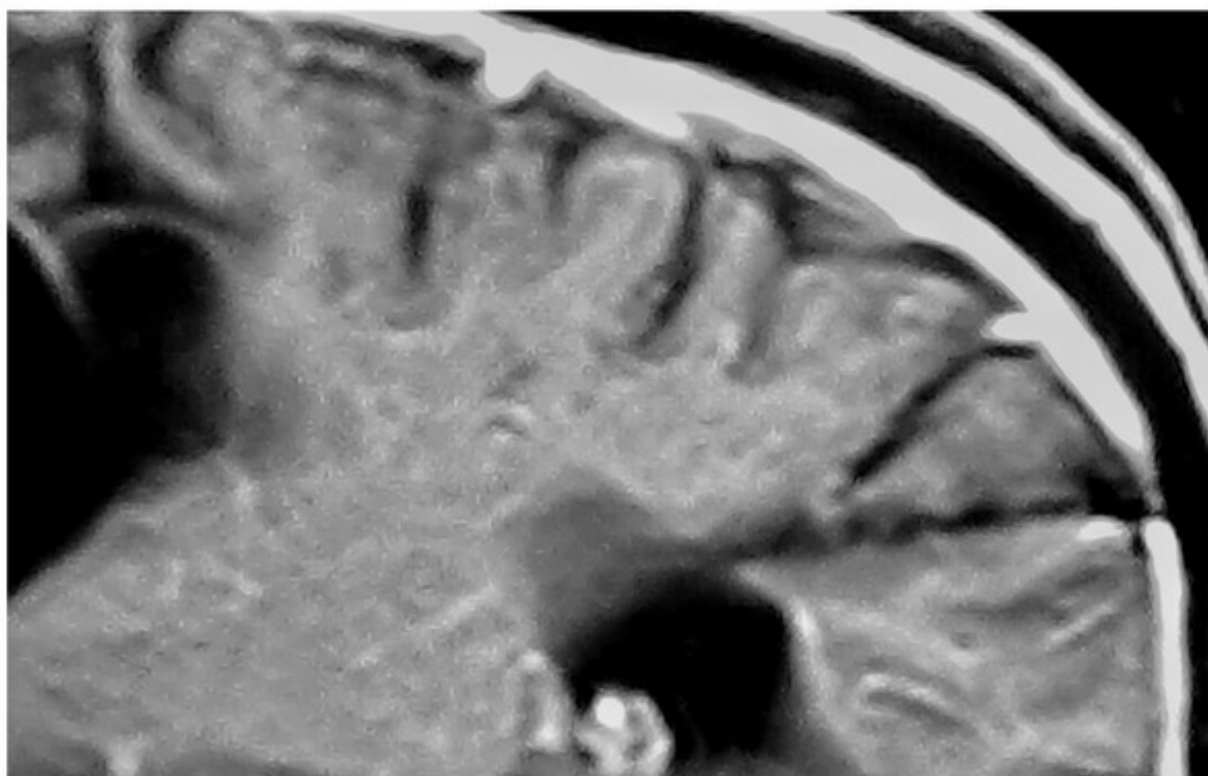
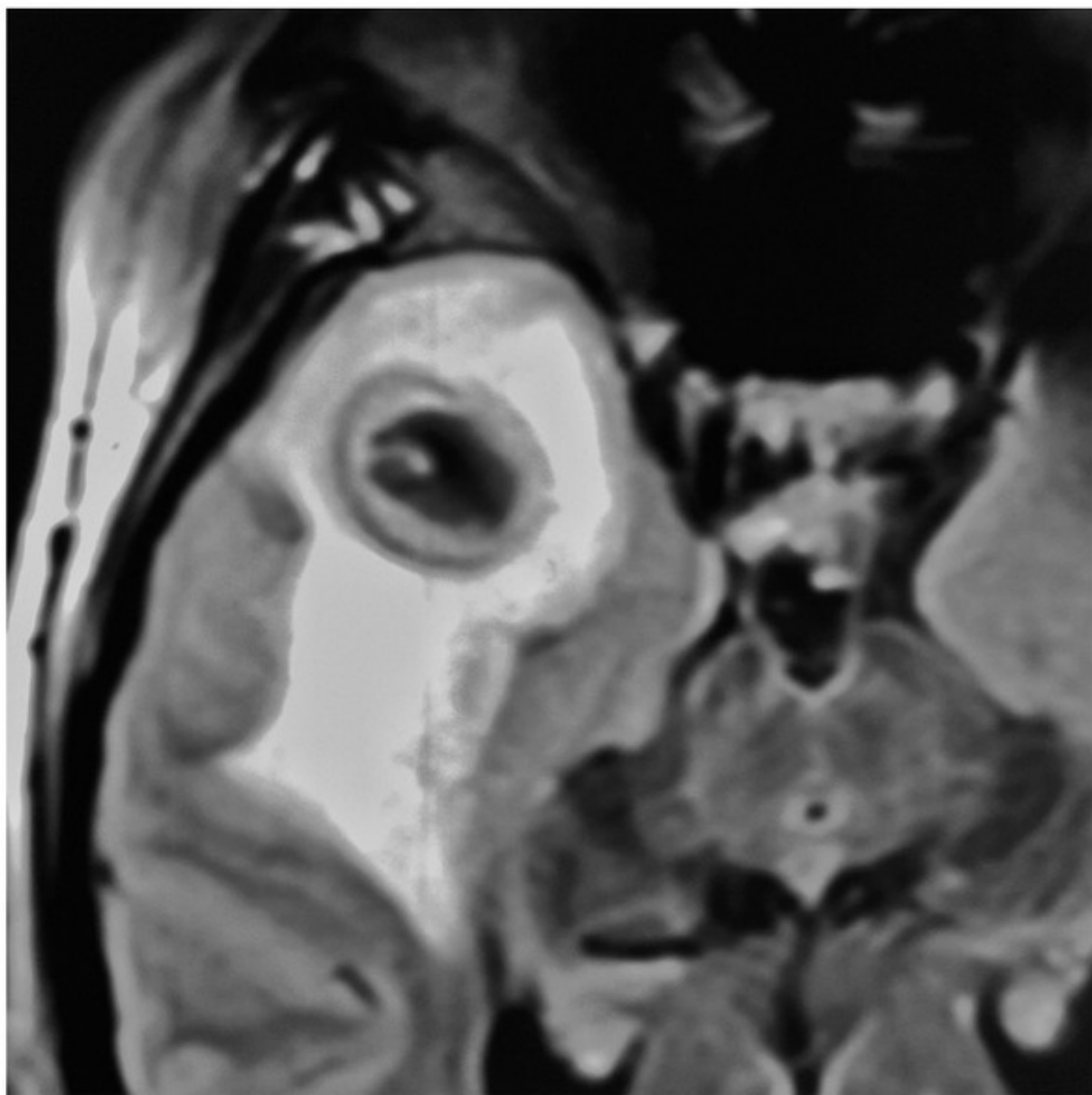


Fig. 7: Scolex images. Superior: 65 years old woman with seizures. T1-MRI with contrast. It shows intense high-signal edema around the cysticercus. The tiny 3-mm scolex is visible within the cyst located in the uncus. (temporal) Inferior: 58 years old woman with headache. FLAIR sequence MRI showing presence of a cyst (hypointense) with a scolex inside (hyperintense) with surrounding edema in right occipital-parietal fissure.

© Department of Radiology-Neurology, General Hospital Eugenio Espejo. / Quito 2016

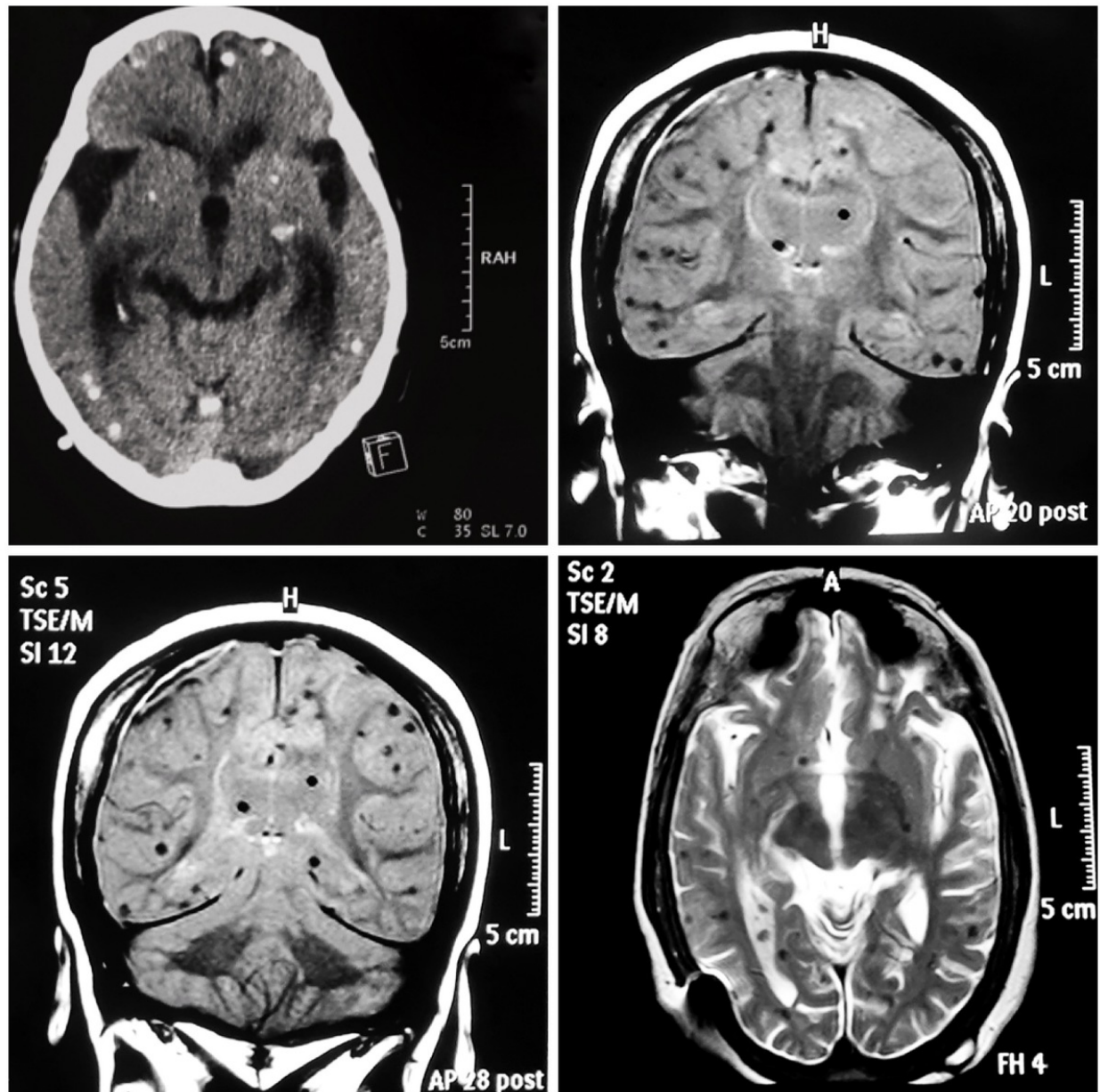


Fig. 8: Nodular calcified. 61 years old woman. Headache complaining. Showing multiple small cysts approximately 5 to 8-mm in size scattered throughout the cerebral hemispheres and basal ganglia. Left superior: CT - hyperdense calcifications. Right

superior and left inferior: GRE/MRI - hypointense calcifications. Right inferior: T2 - hypointense calcifications.

© Department of Radiology-Neurology, General Hospital Eugenio Espejo. / Quito 2016

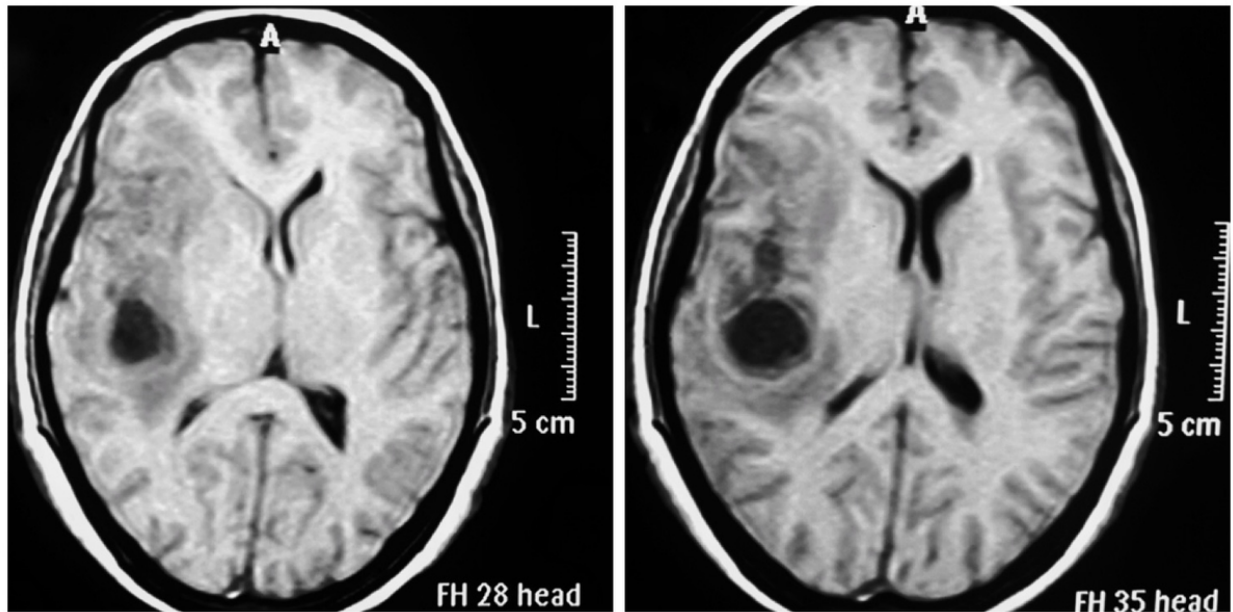


Fig. 9: Vesicular - colloidal stages. 52 years old woman with hemiparesis. T1-MRI. This stage is characterized by the death of the parasite, which triggers an inflammatory reaction by the release of metabolic products. This inflammatory reaction conditions an intense perilesional edema.

© Department of Radiology-Neurology, General Hospital Eugenio Espejo. / Quito 2016

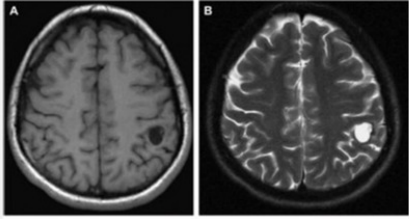
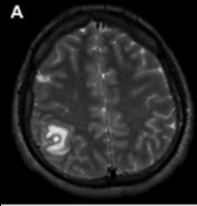
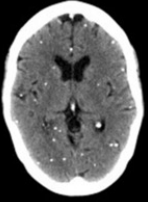
<p>Stage 1 Vesicular Nodule</p>	<p>Vesicular (after 3-12 months)</p>	<p>Larva fully-grown is seen as a marginal nodule projecting into a small marginal node into a small cyst containing fluid. Parasite is viable. Presence or no inflammatory response in the surrounding tissue.</p>	<ul style="list-style-type: none"> Well-defined wall. Rounded-ovoid lesion. Hypodense in CT. Hypointense in (T1 – clear Weighted images) -A- Hyperintense on (T2). -B- Not exhibition of any enhancement contrast. The mural nodule is the “Scolex” 	
<p>Stage 2 Granular Nodule</p>	<p>Granular degeneration (Begins calcification)</p>	<p>The cyst undergoes retraction. “Scolex” is transformed into a coarse mineralized granule and surrounding edema regresses gradually.</p>	<ul style="list-style-type: none"> “Target” or “bull-eye sign.” Non-contrast CT reveals an isodense cyst with hyperdense-calcified scolex and surrounding edema. Walls are hyperdense because of the calcium. (Granulomas are variable sizes, but even quite small) In MR, the cyst is typically isointense in T1 and iso-hypointense in T2. 	
<p>Stage 3 Calcified Nodule</p>	<p>Calcified Nodule</p>	<p>The cyst undergoes retraction. “Scolex” is transformed into a coarse mineralized granule and surrounding edema regresses gradually.</p>	<ul style="list-style-type: none"> “Target” or “bull-eye sign.” Non-contrast CT reveals an isodense cyst with hyperdense-calcified scolex and surrounding edema. Walls are hyperdense because of the calcium. (Granulomas are variable sizes, but even quite small) In MR, the cyst is typically isointense in T1 and iso-hypointense in T2. 	

Table 1: Escobar’s Stages of Neurocysticercosis. CT and MRI findings and Pathological features.

© - Buenos Aires/AR

Results

In this study, 54% of the patients were female and 72% were over 55 years old. The leading reasons for consultations were: headaches (50%), seizures(27%) and hemiparesis(14%).

27% presented with hydrocephaly as the main secondary complication.

Location

Parenchymal cysticerci are commonly located in the cortical- juxtacortical junction (68%), basal ganglia (18%) and Ventricular cysticerci were relatively rare with an incidence of 14% of our neurocysticercosis cases.

Escobar´s Stages

The first group of 45% was found in the vesicular stage, most of them located in the cortico-subcortical interface, 59% had Scolexes with an average size 13-17 mm. Secondly, 27% was in a colloidal stage and 9.5% were found in Glanular stage and 18.5% was calcified nodular was better detected by CT.

Secondly, 27% was in a colloidal stage with vasogenic edema with ringlike reaction, 9.5% were found in a Glanular stage, the begin of degrees, and 18.5% was calcified nodular was definitely better detected by CT.

Images for this section:

CLINICAL MANIFESTATION

Headache Seizures Hemiparesis

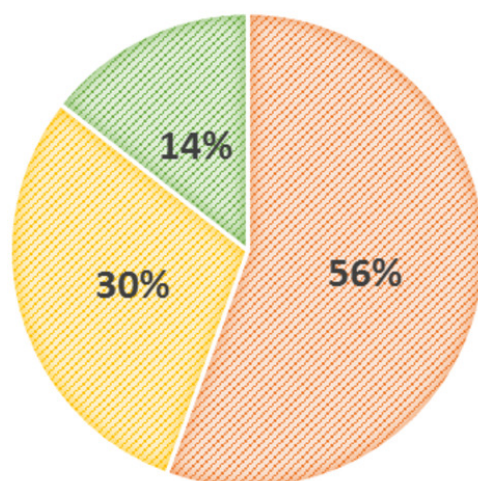


Fig. 5: Clinical manifestation. By leading consultant reason. (22 Patients diagnosed NCC).

© - Buenos Aires/AR

ESCOBAR'S PATHOLOGICAL STAGES

Vesicular Colloidal Granular Nodular calcified

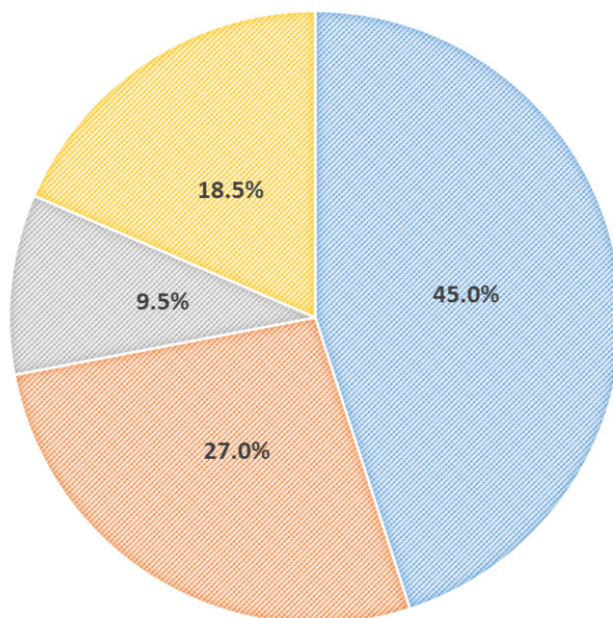


Fig. 6: Frequency by the Escobar's evolutive stages. (22 Patients diagnosed NCC).

© - Buenos Aires/AR

Conclusion

Current strategies for diagnosis of NCC must include neuroimaging studies due to a wide variety of neurologic disorders can be associated with the disease. As in this study, the most common symptoms were headaches, followed by seizures and focal neurological deficits. We can also conclude that MRI and CT imaging findings are fundamental and specific depending on the stage of evolution of the larva, and on the fact that a patient can present lesions in different stages of the disease simultaneously. In the current study, the most common stage found was the vesicular stage.

The sensitivity of MRI for the detection of calcified lesions is poor, and thus CT remains the best screening neuroimaging procedure for patients with suspected neurocysticercosis. Currently, MRI is the imaging modality of choice for the evaluation of patients with intraventricular cysticercosis, brainstem cysts and small cysts located on the convexity of cerebral hemispheres. MRI's better image definition suggests that it is superior to CT in the follow-up of the patients after therapy. It should be noted, however, that the costs of MRI are higher and the equipment is barely available in endemic countries.

Finally, as the main parasitic disease of the central nervous system and the most frequent cause of acquired seizures in developing countries, we must learn the different radiological findings of the disease and take it into account the differential diagnosis of multiple intracranial lesions, particularly in patients from endemic areas.

Personal information

- Edison Campos. M.D.

Staff, Neurology Department. Hospital General Eugenio Espejo. Quito - Ecuador

- Sebastián Rivadeneira Rojas. M.D.

Radiodiagnostic Medical Resident, Hospital Juan A. Fernández. Buenos Aires - Argentina.

- Diego Páez Granja. M.D.

Radiodiagnostic Medical Resident, Hospital Virgen de la Arrixaca. Murcia - España.

- Roberto Salinas. M.D.

Staff, Neurology Department. Hospital General Eugenio Espejo. Quito - Ecuador

References

1. Sarria Estrada, S. et al. 2013. "Imaging Findings in Neurocysticercosis." *Radiologia* 55(2): 130-41.
2. Xiao, Anqi et al. 2015. "Imaging Features of Neurocysticercosis: Analysis of Consecutive 57 Patients in 5 Years." *Turkish Neurosurgery*: 1-9.
3. Baird, Ruth Ann et al. 2013. "Evidence-Based Guideline: Treatment of Parenchymal Neurocysticercosis: Report of the Guideline Development Subcommittee of the American Academy of Neurology." *Neurology* 80(15): 1424-29.
4. Del Brutto, O H et al. 2001. "Proposed Diagnostic Criteria for Neurocysticercosis." *Neurology* 57(2): 177-83.
5. Del Brutto, Oscar H. 2012a. "Neurocysticercosis." *Continuum* 18(6 Infectious Disease): 1392-1416.
6. Garcia, Hector H., and Oscar H. Del Brutto. 2005. "Neurocysticercosis: Updated Concepts about an Old Disease." *Lancet Neurology* 4(10): 653-61.
7. Kimura-Hayama, Eric T et al. 2010. "Neurocysticercosis: Radiologic-Pathologic Correlation." *Radiographics : a review publication of the Radiological Society of North America, Inc* 30(6): 1705-19.
8. Lerner, Alexander et al. 2012. "Imaging of Neurocysticercosis." *Neuroimaging Clinics of North America* 22(4): 659-76.
9. Ramesh, V. G., and A. Parthiban. 2008. "Giant Parenchymal Cysticercosis with Unusual Imaging Features." *Journal of Clinical Neuroscience* 15(12): 1404-6.
10. Roy, B. et al. 2011. "Correlation of Phase Values with CT Hounsfield and R2* Values in Calcified Neurocysticercosis." *Journal of Magnetic Resonance Imaging* 34(5): 1060-64.