

Neurocysticercosis- Temporal Bone Changes on Computed Tomography - A Case Report

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ABSTRACT

Neurocysticercosis is the most common parasitic infection involving the central nervous system and is a major health problem in endemic regions. Bone changes in cysticercosis are rare with paucity of reported cases in both humans and animals. The reported changes are usually erosions, infarctions and necrosis, defects/lytic changes, and heterotopic bone formation. In this report, we present computed tomographic temporal bone changes characterized by thickening with increased density of both the inner and outer tables, a cystic lesion interposed between the thickened calvarium and a defect in the outer table of the right squamous temporal bone. Lesions were also seen in the brain parenchyma, subarachnoid space, and muscles with subcutaneous nodules. Radiologists in endemic areas should add this feature to their gamut of localized thickened cranial vault. This rare and important finding will help us understand the devastating multisystem effects of parasites.

Keywords: Computed Tomography, Neurocysticercosis, Nigeria, Temporal bone changes

INTRODUCTION

Taenia solium and *Taenia saginata* are the two common tapeworms that infest man. *Taenia solium* also called pig tapeworm is seen in people who consume infected pork and frequently involves the CNS, eyes, muscle, heart, fat tissue and skin. Taeniasis is endemic in Central and South America,

Mexico, Eastern Europe, Asia, Indonesia and Africa,¹ however the developed countries are not exempt due to immigration and travel to endemic places.

In West Africa, *Taenia solium* cysticercosis in both pigs and man had been reported in many countries although accurate data is unavailable, *Taenia solium* is thought to be endemic in most of the pig raising regions.² In some regions in Nigeria (South-East) the prevalence of human taeniasis is quite high (8.6%).³ Despite this high prevalence with epilepsy as a common association, very few cases of human cysticercosis have been reported².

Cysticercus cysts that develop in human tissues affect muscles the most and calcified cysts present a diagnostic picture of "calcified rice grains" scattered in the muscles or as oval / linear calcifications seen to run parallel to the plane of the muscle fibers.^{4,5}

Generally, symptoms and signs depend on size, number and location of lesions and they include headaches, Jacksonian epileptic seizures, focal neurological deficit, loss of vision, mental disturbances and neuropsychiatric problems. Meningitis, hydrocephalus, ischemic cerebrovascular disease, cerebellar ataxia, spinal cord compression and transient paralytic episodes may occur.⁶

Neurocysticercosis (NCC) is the most common parasitic infection involving the central nervous system (CNS) in developing countries. It is caused by the larval stage of the worm, and CNS involvement is reported to be 60-90%.^{5,7} Brain infestation is far less common than that of soft tissues, but can produce a characteristic picture of

scattered calcified nodules, however, these are unlike the rice or oat-shaped calcified muscle cysts, as only the scolex calcifies to appear as small (2-3mm) calcified nodules with or without associated surrounding edema.⁵ In the acute CNS infection, the larvae can incite an intense inflammatory reaction with cystic / ring-enhancing lesions seen on computed tomography scan (CT). In the chronic stage, lesions on CT appear as punctate calcifications with no enhancement or mass effect.¹ Neurocysticercosis may be located in the meninges, especially in the basal cisterns, brain parenchyma, ventricular system, and spinal cord or mixed.

Bone changes in cysticercosis are rare with paucity of reported cases in both humans and animals.⁸⁻¹³ These reported changes are usually erosions, infarctions and necrosis, defects/lytic changes, and heterotopic bone formation.

In this report, we presented a 32-year-old male with neurocysticercosis and temporal bone changes characterized by thickening and increased density of both the inner and outer tables, a cystic lesion interposed between the thickened calvarium and a defect in the outer table of the right squamous temporal bone. Lesions were also seen in the brain parenchyma, subarachnoid space, and muscles with subcutaneous nodules.

CASE REPORT

Our case was TA, a 32-year-old man from Michika town in Adamawa state, a pig raising area of North-East region of Nigeria. He was referred from Borno Medical Clinic as an in-patient to the Department of Radiology, University of Maiduguri Teaching Hospital for brain CT Scanning in September, 2006. He was being managed as a case of epilepsy prior to referral to our center for 2 years. The clinical presentation was a two-year history of headaches, convulsions, easy fatigability and pruritus but no hearing impairment. There was a history of passage of melaena stools, sometimes fatty stools and generalized subcutaneous nodules on the body which were increasing in size and number. Patient also admitted to eating pork regularly from the age of 5 years. Psychiatric evaluation was normal.

Physical examination showed multiple hard skin nodules of varying sizes on the upper limbs, chest and back region. Neurological examination revealed no focal neurological deficit.

Plain radiographs of the skull, right shoulder, right arm and chest showed multiple 'rice

grain-like' calcific opacities laid in the direction of the muscle fibres. Cranial CT scan with both soft tissue and bone windows revealed multiple hyperdense opacities with surrounding hypodensities involving the cerebral and cerebellar hemispheres and the subarachnoid space (Fig. 1). No ventricular lesions or dilatation was seen. Two soft tissue lesions were located in the right temporalis muscle and another in the left (Fig. 2). There was a rounded cystic lesion in the right squamous temporal bone with thickening of the inner and outer tables which showed increased density (Fig. 3). A defect was seen in the adjacent outer table (curved arrow). There were multiple areas of bone erosion involving the parietal bones bilaterally (Fig. 4).

Excisional tissue biopsy of the subcutaneous nodules confirmed a diagnosis of cysticercosis. Stool microscopy was negative. HIV screening was non-reactive.

A diagnosis of neurocysticercosis with bony involvement was made.

He received treatment with 400mg of albendazole twice a day after meals for four weeks and single dose 2mg dexamethasone, and an anticonvulsant phenytoin at 300mg daily. He was discharged home after completion the first round of albendazole and remarkable improvement of the presenting symptoms. He returned 2 weeks after for follow-up with satisfactory condition. He was placed on a second course of albendazole but never returned for follow-up.

*Position for figures 1-4

DISCUSSION

Neurocysticercosis is the most frequent parasitic disease of the central nervous system and is a major health problem in endemic regions. A retrospective study done on 35 patients with NCC showed no significant sex predominance in adults.¹⁴ Numerous studies carried out in South Africa and other parts of Africa (mean age 21-50 years) showed the disease is prevalent in age group similar to that of our patient, however a study carried out on 239 patients attending the associated teaching hospitals of University of Cape Town showed that 123 (51.46%) were children 12 years of age or younger.¹⁵

Our patient having presented with a 2 year history of headaches and convulsions, was managed as a case of epilepsy which is a common presentation. Other features in our patient included passage of

melaena stools, sometimes fatty stools and presence of subcutaneous nodules. Subcutaneous nodules are more commonly seen among Africans and Asians.¹⁶

The stool microscopy was normal despite the gastrointestinal symptoms. A negative stool microscopy does not exclude cysticercosis. In a study conducted in Peru, the serosurvey revealed a prevalence of cysticercosis-specific antibodies of 14.6% (95% CI: 12.6-16.6%), and stool microscopy detected 12 *T. solium* tapeworm carriers, for a prevalence of taeniasis of 1.2% (95% CI: 0.6-1.8%).¹⁷ Unusual forms of cysticercosis¹⁸ (giant cysts and racemose forms) have been reported in patients with HIV; however, our patient was HIV negative and showed no such findings.

Neurocysticercosis incites a mild or extensive host response, almost always triggered by death of the larva. Extra-parenchymal lesions (ventricular, subarachnoid, intraspinal and mixed), have a poorer prognosis than parenchymal lesions. Both parenchymal and extraparenchymal lesions (subarachnoid) were seen in this patient.

Cysticercosis may show calcifications on skull, muscles or elsewhere in the soft tissues; however failure to demonstrate calcified soft tissue *Cysticercus* on cranial CT scanning does not exclude cerebral cysticercosis, because it is possible to have the parasite in only one organ. Plain radiographs of the skull, right shoulder, right arm and chest showed multiple moderate typical calcifications in our patient. Of interest were two isolated lesions in the right temporal muscle and another on the left. Such temporal muscle lesions may present as a pseudotumour without intracranial extension or bone invasion.¹⁹ A similar observation was made in this case, however, the lesions were small and bilateral.

Computed Tomography demonstrates both calcified and uncalcified cysts as well as free floating cysts and hydrocephalus in many patients.⁶ Axial slices from a CT brain done with both bone and soft tissue windows in this case showed multiple hyperdense calcific opacities with surrounding hypodensities representing calcified scolex and surrounding edema. The distribution of the lesions were in the cerebral and cerebellar hemispheres, almost uniformly, and simulating a 'milliary pattern' of the disease. Solitary lesions may be an

alternate form of presentation^{20,21} simulating cystic diseases or tumors of the brain.

Of greater interest and peculiarity were the bony lesions seen in this patient. Prior to the advent of CT, Lenczner and Wollin in 1958 described multiple bone infarcts and necrosis in cysticercosis.⁸ Ruiz and Haughton in 1991 described a new plain film finding in cysticercosis.¹⁰ They reported lytic lesions of the skull caused by cysticercosis due to encysted larvae in the subarachnoid space which eroded the inner table of the skull in a 10 year Guatemalan male. The plain skull radiograph in our patient did not demonstrate any lytic changes; however, similar erosions were seen involving the inner tables of the parietal bones bilaterally on CT. These changes may be too early for detection on plain radiographs; moreover our patient is older with more thickened skull bones. According to their report, erosions of the inner table seen on the CT were caused by chronic enlarging cysticercosis cyst in the subarachnoid space in proximity to the skull which was seen in this case. Rarely, cysts may produce smooth and well defined bony erosion in the cranial vault that maybe demonstrated as increased translucency of the skull rather than a cystic defect.⁶

There is paucity of literature on temporal bone changes in cysticercosis. However, veterinary report in Canada has shown temporal bone involvement with a different presentation.²² The animal (Woodchuck-*Marmota monax*) presented with a large fluctuant, subcutaneous mass which extended under the zygomatic arch. Radiographs revealed lateral displacement of the zygomatic arch, marked thinning of the frontal process of the zygomatic bone and the zygomatic process of the temporal bone without any periosteal reaction. In our case it is the squamous temporal bone that was involved and it showed thickening rather than thinning. Similarly, Dinnik and Sachs reported cysticercosis caused changes in sacrum of antelopes.¹³

In conclusion, radiologists in endemic areas should add this feature to their gamut of localized thickened cranial vault. This rare and important finding will help us understand the devastating multisystem effects of parasites.

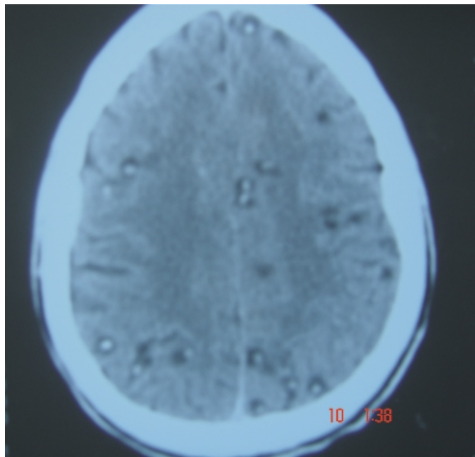


Fig. 1 Cranial CT scan with both soft tissue and bone windows revealed multiple hyperdense opacities with surrounding hypodensities involving the parietal lobes and note the lesions adjacent to the inner table.

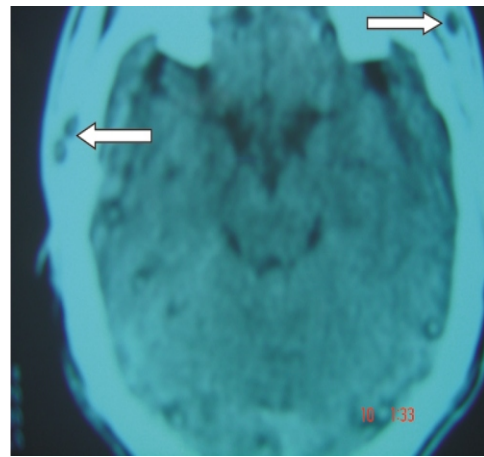


Fig. 2 Two soft tissue lesions were located in the right temporalis muscle and another one on the left side (*straight arrows*).

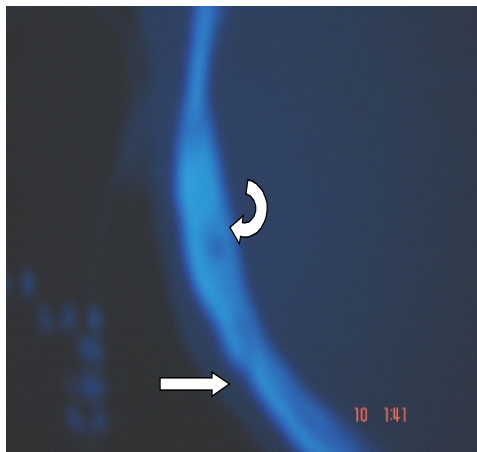


Fig. 3 A coned view of bone window of axial CT showing a rounded cystic lesion in the right squamous temporal bone (*curved arrow*) within the thickened inner and outer tables which are increased in density. Note the defect in the adjacent outer table (*straight arrow*).

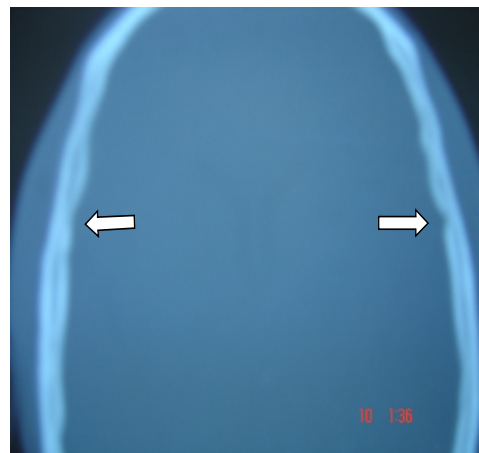


Fig. 4 Multiple areas of bone erosion involving the parietal bones bilaterally (*straight arrows*) seen on bone window of axial CT.

REFERENCES

1. Von Sinner W. Advanced medical Imaging and treatment of human cystic echinococcosis. *Semin Roentgenol* 1997; 32: 276-290.
2. Zoli A, Shey-Njila O, Assana E, Nguekam JP, Dorny P, Brandt J, Geerts S. Regional status, epidemiology and impact of *Taenia solium* cysticercosis in Western and Central Africa. *Acta Trop*. 2003; 87: 35-42.
3. Onah DN, Chiejina SN. *Taenia solium* cysticercosis and human taeniasis in the Nsukka area of Enugu State, Nigeria. *Ann Trop Med Parasitol*. 1995; 89: 399-407.
4. [Reeder MM](#). Tropical diseases of the soft tissues. *Semin Roentgenol*. 1973; 8: 47-71.
5. Dahnert W. Brain disorders: Cysticercosis of the brain. In: *Radiology Review Manual* (Dahnert W. Ed). 4th edition, Baltimore, Williams and Wilkins. 1999; 227.
6. Enrique Palacios. NCC- *Taenia*, Cysticercosis, Sparganosis, other Tapeworm infections. In: *The imaging of Tropical diseases* (Palmer PES, Reeder MM .Eds). 2nd edition, Vol 1, Springer, Germany. 2002; 653-656.
7. Rahalkar MD, Shetty DD, Kelkar AB, Kelkar AA, Kinare AS, Ambardekar ST. Pictural Review-The Many Faces of Cysticercosis. *Clinical Radiology*. 2000; 55: 668-674.
8. Lenczner M, Wollin DG. Cysticercosis: multiple infarcts and necrosis in bone. *Can Med Assoc J*. 1958; 78: 344-345.
9. Rey L, Barbosa de Oliveira NR, Faure R. Bone cysticercosis caused by *Cysticercus racemosus*. *Rev Latinoam Parasitol (Mex)*. 1969; 11: 61-67.
10. Ruiz ME, Haughton VM. A new plain film finding in cysticercosis. *Neuroradiology*. 1991; 33: 79-80.
11. Timosca G, Gavrilita L. Cysticercosis of the maxillofacial region. A clinicopathologic study of five cases. *Oral Surg Orl Med Oral Pathol*. 1974; 37: 390-400.
12. Spenser RF, Ganpath V. Heterotopic bone formation following cerebral cysticercosis. A case report. *S Afr Med J*. 1988; 74: 35-6.
13. Dinnik JK, Sachs R. Cysticercosis of the sacrum bone of antelopes and *Taenia olngojinei* sp. nov. of the spotted hyena. *Z Parasitenkd*. 1969; 31: 326-39.
14. Morgado C, Gomes LB, de Compos JG. Neurocysticercosis, An imaging analysis of 35 cases. *Acta Med Port*. 1994; 7: 269-75.
15. Thompson AJ, Neurocysticercosis-experience at teaching hospitals in University of Cape Town. *S Afr Med J*. 1993; 83: 332-334.
16. Cruz I, Cruz ME, Teran W, Schantz PM, Tsang V, Barry M. Human subcutaneous *Taenia solium* cysticercosis in an Andian population with neurocysticercosis. *Am J Trop Med Hyg*. 1994; 51: 405-407.
17. Huisa BN, Menacho LA, Rodriguez S, Bustos JA, Gilman RH, Tsang VC, Gonzalez AE, Garcia HH. Taeniasis and cysticercosis in housemaids working in affluent neighborhoods in Lima, Peru. [Am J Trop Med Hyg](#). 2005 Sep; 73(3): 496-500.
18. Couppie P, Gueye M, Smadja D, Pradinaud R. Unusual forms cysticercosis associated with HIV infection. *Eur J Neurol*. 2004; 11: 55-58.
19. Kumar R, Singh V, Rastogi A. Cysticercosis of the temporalis muscle: a case report. *Journal of paediatric neurology*. 2005; 3: 269-272.
20. Carangelo B, Erra S, Del Basso De Caro, Bucciero A, Vizioli L, Panagiotoupoulos K, Cerillo A. Neurocysticercosis. Case report. *J Neurosurg Sci*. 2001; 45: 43-46.
21. Garcia HH, Del Brutto OH. Imaging findings in neurocysticercosis. *Acta Tropica*. 2003; 87: 71-78.
22. Brojer CM, Peregrine AS, Baker IK, Careno RA, Post C. Cerebral cysticercosis in a Woodchuck (*Marmota monax*). *Journal of wildlife diseases*. 2002; 38.