Solitary Neurocysticercosis Case Caused by Asian Genotype of *Taenia solium* Confirmed by Mitochondrial DNA Analysis

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A Japanese woman presenting with neurologic symptoms was presumptively diagnosed with neurocysticercosis based on imaging findings. Hooklets in the scolex of the resected lesion were not confirmed through histopathological observation. However, the illness was confirmed by mitochondrial DNA analysis to be a solitary neurocysticercosis case caused by the Asian genotype of *Taenia solium*.

CASE REPORT

A 53-year-old Japanese woman developed aphasia and numbness of the right arm beginning 29 November 2002. The patient was admitted to the Department of Neurosurgery, Yokohama Minami Kyosai Hospital, Yokohama, Japan, on 16 December 2002 with complaints of aphasia and numbness of the right arm. On admission, cerebral computed tomography (CT) showed a low-density area in the left frontal lobe (Fig. 1A), and the lesion appeared as a ringlike small mass (hole-with-dot imaging) with a diameter of 2 cm surrounded with edema at the same site in the CT scan with contrast enhancement (Fig. 1B). Magnetic resonance imaging (MRI) showed the lesion with a low-intensity signal in a T1-weighted image (Fig. 1C) and a high-intensity signal in a T2-weighted image (Fig. 1D). Perifocal edema is evident in the T2-weighted image. The lesion was enhanced after administration of gadolinium-diethylenetriaminepentaacetic acid (Fig. 1E and F). Neurocysticercosis (NCC) caused by *Taenia solium* cysticercus was strongly suspected based on the imaging findings, and total removal of the mass was performed for differentiation from a tumor (Fig. 2A). The mass was located near the surface of the brain and had prominent surrounding gliosis. Histopathological examination of the resected lesion revealed suckers and a spiral canal unique to the taeniid cysticercus, but no hooklet was observed in any section (Fig. 2B). Postoperative examinations for screening of other visceral organs including X rays of the extremities and the whole body showed no other abnormality. After surgery, the patient recovered well with no residual deficit, resuming her preillness activity. She repeated extensive travels to France, Spain, Portugal, India, and Southeast Asian countries (Thailand, Myanmar, Vietnam, and Malaysia) that she had taken during the period from 1993 to 2001.

Serological examination and mitochondrial DNA analysis. A blood sample was obtained from the patient with informed consent according to guidelines from institutional review boards at Yokohama Minami Kyosai Hospital. Serological confirmation of immunoblots using both purified glycoproteins (5) and a recombinant chimeric antigen (9) was carried out at Asahikawa Medical College before surgical operation; however, there was no detectable specific antibody response against either antigen (data not shown). For definitive diagnosis of the causative agent, mitochondrial DNA analysis was performed using a small piece of a formalin-fixed, paraffin-embedded specimen. The paraffin was melted in a heat block at 70°C, and a tiny amount of parasite material was separated. The parasite was lysed in 60 μl of 0.02 N sodium hydroxide containing proteinase K at 90°C for 15 min. After removal of the proteinase K by use of phenol-chloroform, the resulting solution was used directly as template DNA for the amplification of the cytochrome c oxidase subunit 1 gene (*cox1*). Two products, one of approximately 1.6 kb and one of 984 bp, were successfully amplified by using 5′-TTGTATATTTTTGATTACTAAC-3′ (16) as the forward primer and 5′-TCCACTAAGCATAATGCAAAAGGC-3′ (7) and 5′-GACATAACATATGAAATG-3′, respectively, as the reverse primers (reference 16 and data not shown). The PCR protocol consisted of 35 cycles of 94°C for 1 min, 60°C for 1 min, and 72°C for 2 min plus 1 cycle of 72°C for 5 min using the Ex Taq DNA polymerase Hot Start version (Takara Bio Inc., Shiga, Japan). The samples for DNA sequencing were prepared using the ABI PRISM BigDye Terminator Cycle Sequencing Ready Reaction kit, and DNA sequencing was performed on an ABI PRISM 310 Genetic Analyzer.

In Fig. 3, the partial nucleotide sequence of the taeniid specimen is aligned with nucleotide sequences of *cox1* from...
human taeniid cestodes. Although some differential nucleotides are dispersed over the cox1 sequences, the representative three nucleotides at positions 672, 690, and 723 are shown as diagnostic markers for taeniid species or *T. solium* genotypes. A nucleotide at position 672 is for differentiation of taeniid species, and the other two, at positions 690 and 723, are pertinent for differentiation of two genotypes of *T. solium* (7, 15). In this case, the nucleotides at positions 690 and 723 are guanine and cytosine, respectively, indicating that the resected cysticercus has the Asian genotype of *T. solium*. Consideration of the patient’s travel history revealed possibilities of exposure to *T. solium* eggs during her stays in India or other Southeast Asian countries where *T. solium* NCC is still endemic.

NCC is one of the most serious parasitic diseases of public health importance and is currently recognized as a reemerg-
cestodes and particularly for correlation between pathogenicity and genotypes of *T. solium* (4) when parasite materials are available.

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**REFERENCES**


**FIG. 3.** Alignment of the partial nucleotide sequences of *cox1* from human taeniid cestodes. *T. solium*-specific and *T. solium* genotype-specific nucleotides are boxed and marked with arrows. The numbers indicate the nucleotide positions in the 1,620-bp *cox1* gene. The nucleotide sequence of the causative agent in the case described in the present paper is shown on the top. The nucleotide sequences from the Asian genotype of *T. solium* (from China), the American-African genotypes of *T. solium* (from Brazil and Tanzania), *Taenia saginata* (from China), and *Taenia asiatica* (from Taiwan) are from the DDBJ database with accession numbers of AB066485, AB066492, AB066493, AB066495, and AB066494, respectively.

- *T. solium* . . . GGAAGTGTTATGCTTGGTCTTCACAATGATGGTTTGGCTACTGGAG .
- *T. solium* (China) . . . GGAAGTGTTATGCTTGGTCTTCACAATGATGGTTTGGCTACTGGAG .
- *T. solium* (Brazil) . . . GGAAGTGTTATGCTTGGTCTTCACAATGATGGTTTGGCTACTGGAG .
- *T. solium* (Tanzania) . . . GGAAGTGTTATGCTTGGTCTTCACAATGATGGTTTGGCTACTGGAG .
- *T. saginata* (China) . . . GTGAGGTGTTATGCTTGGTCTTCACAATGATGGTTTGGCTACTGGAG .
- *T. asiatica* (Taiwan) . . . GGAAGTGTTATGCTTGGTCTTCACAATGATGGTTTGGCTACTGGAG .