Identification of hydatid cysts and concomitant liver enzyme dysfunction in patients from Al-Najaf and Al-Diwaniyah City by conventional and phylogenetic methods

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ABSTRACT

Hydatid cyst infection is a serious disease that affects humans who come into touch with the infective stage of the tapeworm Echinococcus granulosus, which is found all over the world. The current study used patient physical and laboratory examinations, X-ray imaging, ultrasonic inspection, and polymerase chain reaction (PCR) to identify hydatid cyst presence in patients from the Iraqi cities of Al-Najaf and Al-Diwaniyah and to identify hydatid cysts and concomitant liver enzyme dysfunction in patients from the Iraqi cities of Al-Najaf and Al-Diwaniyah using conventional and phylogeny. Both strategies used partial gene sequencing (PGS) to target the E. granulosus antigen subunit B2 (EgB2) gene. The findings revealed an abdominal lump (6-7cm, left costal border), leukocytosis (12103/mm3), eosinophilia (84101/mm3), and an increased erythrocyte sedimentation rate (ESR) (35mm/hr), ultrasonic-detected splenic and liver cysts, and increased levels of alkaline phosphatase (ALP)= Mean standard error (MSE) (170.12.3 IU/l). Patients with such changes were then given surgical interventions to diagnose and remove cysts, which were identified as hydatid cysts (wheel-like, "rosette-like," or "honeycomb-like" cysts with cystic cavity-based "snowflakes" like protoscoleces, wavy or serpentine-like cystic membranes of punctured or solid-pseudotumor ball-like calcified degenerated cysts, respectively). The existence of hydatid cysts from the E. granulosus tapeworm was discovered by PCR. The PGS validated the results of the previous tests, yielding three nucleotide-sequence-based isolates that were identical to those from Brazil (bovine), Argentina (camelid), and Bengal (buffalo). The study found hydatid cyst infection in human patients in the Iraqi cities of Al-Najaf and Al-Diwaniyah, implying the presence of the adult form of the worm, Echinococcus granulosus tapeworms, in dogs in these areas.

Keywords: Echinococcus granulosus, EgB2 gene, hydatid cysts.
INTRODUCTION

Echinococcosis is a zoonotic infection caused by the larvae of the cestode genus Echinococcus. Previously, it was considered that only E. granulosus caused cystic echinococcosis (CE). However, it was shown that additional taxa had different mature morphological traits, host specialization, and pathogenicity. Various E. granulosus strains have been discovered, each with a specific affinity for intermediate hosts (such as buffalo, sheep, horses, cattle, and camels). Phylogenetic investigations demonstrated that E. granulosus sensu stricto (G1 to G3), E. equinus (G4), E. ortleppi (G5), E. canadensis (G6 to G10), E. multilocularis, E. oligarthrus, E. vogeli, E. felidis, and E. shiquicus are all different species. The taxonomy is currently under discussion and still needs to be finished. For example, the E. granulosus genotypes G6, G7, G8, and G10 have not been characterized. Depending on the species, Echinococcus can cause a range of ailments in humans. E. granulosus sensu stricto is the most prevalent cause of CE, but E. equinus, E. ortleppi, and E. canadensis are also to blame. E. multilocularis cause alveolar echinococcosis, whereas polycystic echinococcosis is caused by E. vogeli and E. oligarchus. Carnivores (such as dogs, cats, and hyenas) serve as the parasites' final hosts, whereas intermediate hosts (such as cattle, sheep, goats, and camels) contain metacestode, the larval stage.

The cestode's egg-producing mature stage is discovered in the final host's small intestine. Hundreds of worms may infect a single final host, each of which can produce thousands of eggs per day. The eggs become infectious once they are discharged into the feces of the final host. Depending on the environment, the eggs could remain infectious for months or even a year. Eggs can withstand cold temperatures despite their fragility due to desiccation and heat. The oncospheres hatch from the eggs when the intermediate host eats them, passing past the intestinal mucosa and into the bloodstream, reaching the liver and other key internal organs. A fluid-filled cyst (metacestode or hydatid cyst) occurs when an organ becomes diseased. When eaten by a definitive host, protoscolices arise from the germinal layer and grow into sexually mature adults by evaginating and adhering to the intestinal mucosa throughout 4 to 7 weeks. If a final host consumes a protoscolex or the cystic fluid leaks into a cavity such as the peritoneal membrane, the protoscolex can mature into an adult parasite (secondary CE). Although metacestodes can arise in mammals, not all intermediate hosts can continue the cycle. Humans are considered accidental or aberrant hosts for disease transmission because they are rarely involved. Human-to-human contact does not occur. The current study identified hydatid cysts in patients from Al-Najaf and Al-Diwaniyah cities, Iraq.

MATERIALS AND METHODS

Samples and conventional diagnosis

During the years 2018-2021, ten patients with fever, loss of appetite, dull abdomen ache, persisting pain, and left-side-abdominal dragging sensation, as well as weight loss, visited hospitals and private clinics in Al-Najaf and Al-Diwaniyah, Iraq. Physical and laboratory examinations, X-ray imaging, and ultrasonic inspection were used to assess the patients. Each patient's cystic lesion samples were taken surgically, along with a blood sample (for the level determination of ALP, ALT, and AST). The parasitology laboratory received the samples in an icebox.
Molecular detection

Polymerase chain reaction and DNA sequencing

The DNA was extracted according to the manufacturer's instructions using the G-spin genomic DNA extraction kit (iNtRON Biotechnology, South Korea). The F: 5'GGATCCTTCGTGGCCGTCGTTCAAGC3 and R5'TCGACAAATCATGTGTCCCGACGCA3 primers were used to target a 400bp segment of the E. granulosus EgB2 gene (Jena Bioscience, Germany). Initial denaturation was performed at 95°C for 3 minutes, followed by 35 cycles of (95°C-1min denaturation, 55°C-1min annealing, and 72°C-1.5min extension) and 72°C-10min final extension in a PCR thermocycler. The gel was viewed and photographed using a UV-dependent device after electrophoresis (80Volts and 100 Amp for 45 minutes) using a 0.7 percent ethidium bromide-stained agarose gel. The phylogenetic analysis regarding the after-PGS-processing was performed depending on criteria by Tamura and Nei by using MEGA6.

RESULTS

The findings revealed an abdominal lump (6-7cm, left costal border), leukocytosis (12103/mm3), eosinophilia (84101/mm3), and an increased erythrocyte sedimentation rate (ESR) (35mm/hr), ultrasonic-detected splenic and liver cysts, and increased levels of alkaline phosphatase (ALP)= Mean standard error (MSE) (170.12.3 IU/l). Patients with such changes were then given surgical interventions to diagnose and remove cysts, which were identified as hydatid cysts (wheel-like, "rosette-like," or "honeycomb-like" cysts with cystic cavity-based "snowflakes" like protoscoleces, wavy or serpentine-like cystic membranes of punctured or solid-pseudotumor ball-like calcified degenerated cysts, respectively). Figure 1.

The PCR revealed the presence of hydatid cysts that belong to the E. granulosus tapeworm Figure 2.
The PGS confirmed the findings of the tests mentioned above, resulting in three isolates, which were nucleotide-sequence-based, similar to isolates from Brazil (bovine), Argentina (Camelid), and Bengal (buffalo) Figure 3.

The phylogenetic tree of the partial sequencing of the EgB2 gene of hydatid cyst belongs to Echinococcus granulosus. The analysis was based on the Maximum Likelihood method, Neighbor-Joining, and Maximum Composite Likelihood (MCL) approach.
DISCUSSION

The current study's findings revealed that all of the patients had symptoms consistent with those reported in the literature, which state that CE usually has no symptoms unless there are complications. The main reasons for a cyst becoming clinically symptomatic include infection or allergy owing to cyst rupture, fistula creation with other bodily components (for example, the biliary system and gut), or mass influence on surrounding tissues. A single cystic lesion affects 40 percent to 80 percent of people, and they are frequently discovered in a single organ. The liver is affected in 70% of cases, with the right lobe being more typically injured than the left. The lung is the second most common organ to be affected in around 20% of individuals. Cysts can form in the abdominal or pleural cavities, the spleen, kidney, bones, brain, ovaries, testes, pancreas, and eyes, among other organs and body parts.

The study outcomes revealed elevated serum ALP, ALT, and AST levels in the study patients. These results agree with those by, who found that four patients from Egypt with a history of abdominal pain and gastrointestinal problems plus contact with dogs and lived in rural areas had increased levels of eosinophils and leukocytes and increased serum levels of liver enzymes. They also discovered that three subjects had positive serological laboratory test results. Ultrasonography revealed well-defined cystic tumors in the liver, according to the investigators. Using computed tomography, they confirmed that the hydatid cysts were present. Finally, they reported that all the patients underwent surgery and chemotherapy and recovered completely.

CONCLUSION

The study found hydatid cyst infection in human patients from the Iraqi cities of Al-Najaf and Al-Diwaniyah. This logically implies the presence of the adult form, Echinococcus granulosus tapeworms, in dogs in these cities.

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**References**

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