Ultrasound in Med. & Biol., Vol. 38, No. 2, pp. 183–189, 2012

0301-5629/$ - see front matter

ELSEVIER

doi:10.1016/j.ultrasmedbio.2011.11.010

● *Original Contribution*

EVALUATION OF COLOR DOPPLER ULTRASONOGRAPHY IN DIAGNOSING HEPATIC ALVEOLAR ECHINOCOCCOSIS

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(*Received* 18 *September* 2011; *revised* 02 *November* 2011; *in final form* 17 *November* 2011)

Abstract—To assess the accuracy of color Doppler ultrasonography in diagnosing hepatic alveolar echinococcosis, 129 patients were examined at the First Affiliated Hospital of Xinjiang Medical University between July 2004 and June 2010. Those patients suspected of having hepatic alveolar echinococcosis were examined and diagnosed by color Doppler ultrasound. All the cases were compared with the gold standard. The findings of their sensitivity, specificity, positive predictive value, negative predictive value, positive likelihood ratio, negative likelihood ratio and 95% confidence interval were recorded. Sensitivity: 95% (95% confidence interval: 90.7%–99.3%); specificity: 20.7% (95% confidence interval: 6.0%–35.4%); positive predictive value: 80.5%; negative predictive value: 54.5%; positive likelihood ratio: 1.2: negative likelihood ratio: 0.2. Our study indicates that color Doppler ultrasonography, when used in diagnosing hepatic alveolar echinococcosis, has high sensitivity although specificity is low. Color Doppler ultrasound is, thus, considered to be an efficient means for diagnosing hepatic alveolar echinococcosis. (E-mail: drwenhao@163.com) **Crown Copyright © 2012 Published by Elsevier Inc. on behalf of World Federation for Ultrasound in Medicine & Biology.**

Key Words: **Color Doppler, Ultrasonography, Hepatic alveolar echinococcosis.**

INTRODUCTION

Alveolar echinococcosis (AE) is a rare zoonotic helminthic disease in humans. It represents a serious public threat in the north and west of China, with 90% of those affected primarily suffering from hepatic disorders. Hepatic alveolar echinococcosis (HAE) lesions are characterized by tumor-like, infiltrative growths (Sahin et al. 1997). In advanced cases, they may present as invasive masses causing biliary obstruction or portal hypertension, due to invasion of the biliary and vascular structures of the liver. If the infection metastases, it may spread to other organs such as the lungs or brain. The annual incidence of AE is generally low in most of the endemic areas but the disease can be lethal within 5–10 years of diagnosis if not treated or inadequately treated (Xu 1994). Therefore, early diagnosis and treatment of HAE is a key to improving survival rates.

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The diagnosis of HAE is currently made on the basis of clinical findings, epidemiologic data, immunologic and other laboratory tests and lesion morphology reviewed by imaging techniques. Imaging tests include: ultrasound (US), computed tomography (CT), magnetic resonance imaging (MRI) and positron emission tomography (PET). US has been used as a primary diagnostic tool because it is a simple, noninvasive and cost-effective form of examination. In areas of China where HAE is endemic, US has been used for mass screening in conjunction with epidemiologic questionnaires and rapid diagnostic kit. This kit (dot immune-gold filtration assay kit, or DIGFA) represents a valuable diagnostic tool to confirm the nature and species of the etiologic agent. It provides a rapid, simple and reliable serological test for Echinococcosis, using samples of either serum or whole blood (Wen and Xu 2007).

Past studies have showed that the diagnostic accuracy rate of ultrasound was very low at only 53.7% (Xin et al. 2000). This study is a retrospective analysis designed to investigate the cause of inaccuracies in diagnosis of HAE, using color Doppler ultrasonography (CDUS) examination.

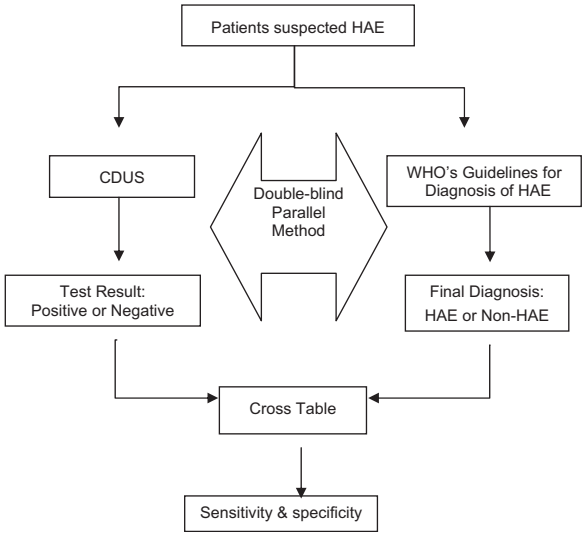

Fig. 1. Diagnostic pathway of the hepatic alveolar echinococcosis (HAE) study.

MATERIALS AND METHODS

Study design and setting

The design of this study was as a retrospective study of diagnosis accuracy. The study complied with good clinical practice guidelines and with the principles of the Helsinki Declaration and was approved by the Ethics Committee of our hospital.

This was a double-blind parallel study involving patients from the First Affiliated Hospital of Xinjiang Medical University. This is the officially appointed central facility for surgical instruction and treatment of human Echinococcosis within China. Patients suspected of having HAE were asked to participate in the study. All the patients were examined and diagnosed using CDUS and according to World Health Organization-Informal Working Group on Echinococcosis (WHO-IWGE) guidelines. The CDUS results were compared with the gold standard. Figure 1 shows the diagnostic pathway in this study. The findings of their sensitivity, specificity, positive predictive value, negative predictive value, positive likelihood ratio, negative likelihood ratio and 95% confidence interval were recorded.

Subject

Patients. The study group comprised of 129 consecutive patients from July 2004 to June 2010 with suspected HAE (57 females and 72 males; 13–79-years-old; median age 45 ± 15 years). The diagnosis of 115 patients was confirmed by postoperative histopathology, while the diagnosis of eight patients was confirmed on the basis of historical, serologic and imaging tests including US, CT and MRI. The remaining six patients' immunologic responses were positive but their imaging tests indicated no liver lesions.

Inclusion and exclusion criteria. Patients were included in this study if they were suspected of suffering from HAE by the clinical doctors. Patients were excluded if:

- they were accurately diagnosed as having intrahepatic masses (*e.g.* hepatocellular carcinoma or hepatic hemangioma) by CDUS in this study before the next stage of research;
- they had been operated upon and had a confirmed diagnosis of HAE;
- their clinical data was not complete;
- they had not been diagnosed by the gold standard.

Diagnostic gold standard of HAE and color Doppler ultrasonography

Gold standard of HAE. Postoperative histopathologic results are regarded as the preferred gold standard for confirmation of HAE diagnosis. In advanced cases, where lesions could not be operated upon, the diagnoses were instead confirmed by clinical and epidemiologic history, imaging findings (*e.g.*, abdominal US, CT, MRI) and serologic tests, as defined by the WHO Informal Working Group on Echinococcosis (WHO-IWGE 1996).

Color Doppler ultrasonography. CDUS examinations were performed with the following systems: Acuson Sequoia 512 Ultrasound System (Siemens Medical Solutions, Mountain View, CA, USA), LOGIQ 7 and 9 Ultrasound System (GE Medical Systems, Milwaukee, WI, USA) , using a 2–5 MHz wideband convex transducer head. The average mechanical index was 1.0. Focus position and penetration depth were set individually. Patients were given nothing to eat for at least 8 to 12 h before the ultrasound examination. The patients were examined in the supine, steep decubitus and upright positions. Transverse, sagittal and oblique scans were made over the upper abdomen to identify the liver, gallbladder, biliary system and inferior vena cava. The number, localization, size, shape, boundary and inner echogenicity of the lesions, their calcification, the bile duct and the vascular structure of the liver were observed and reported upon. The blood flow signal of each lesion was then examined in color Doppler flow imaging mode (CDFI-mode). Examinations were saved in the ultrasound imaging system.

Referencing the research of Lu (1988), US images of HAE were categorized into three patterns as follows:

- Mixed echogenicity masses (Fig. 2)
- Solid hyperechoic masses (Fig. 3)
- Multiple space-occupying masses (Fig. 4)