学 位 論 文 の 要 旨

氏名　岡本　栄祐

学　位　論　文　名　Pilot Study Demonstrating Benefits of Virtual CT Sonography for Enhanced Detection of Small Hepatic Nodules: Prospective Study

発　表　雑　誌　名（巻，初頁～終頁，年）　*American Journal of Roentgenology*（**194**: 1272~1278, 2010）

著　者　名　Eisuke Okamoto, Shuichi Sato, Alvaro A Sanchez-Siles, Junichi Ishine, Tatsuya Miyake, Yuji Amano and Yoshikazu Kinoshita

論 文 内 容 の 要 旨

INTRODUCTION

Recently, a new imaging technique termed virtual CT sonography (Real-time Virtual Sonography, Hitachi Medico) has been developed. With this method, computed tomography (CT) scan images can be digitally reconstructed into multiplanar reconstructed (MPR) images, after which the MPR images can be synchronized to the corresponding conventional ultrasonography (US) section in real time by the system. This novel system facilitates and speeds objective nodule detection and localization in a non-invasive manner, and provides more precise monitoring of interventional procedures. The purpose of the present study was to evaluate the feasibility of virtual CT sonography for detection of liver nodules that are difficult to detect by conventional US alone.

MATERIALS AND METHODS

Between January 2005 and December 2006, a total of 59 patients with 140 nodules were enrolled in this study. All patients first underwent CT angiography (CT during hepatic arteriography (CTHA) and/or CT during arterial portography (CTAP)) to search for suspected liver malignancy, which was defined as a nodular lesion with a perfusion defect shown by CTAP or early enhancement with CTHA. Four experienced gastroenterologists, specifically trained in using virtual CT sonography scanners (Hitachi EUB 8500: Hitachi Medical Corporation, Tokyo),

performed both conventional US and virtual CT sonography examinations, with both procedures performed within 2 weeks of the diagnostic CT angiography examination. Two of the 4 gastroenterologists were present during both conventional US and virtual CT sonography procedures to assess the findings, and diagnosis was determined by consensus agreement.

Nodules detected by CT angiography and included in this study were divided into 3 groups: nodules detected by conventional US, nodules detected only by virtual CT sonography, and nodules not detected by either conventional US or virtual CT sonography. Variables evaluated to compare the ability of conventional US and virtual CT sonography to detect nodules were: (1) nodule diameter, (2) nodule echo pattern; hyper-, iso- or hypo-echoic, (3) nodule location; peripheral or intrahepatic, and (4) echo pattern of the parenchyma surrounding the nodules. US-guided liver biopsy examinations were also conducted for histological evaluations.

RESULTS AND DISCUSSION

Of the 140 nodules detected by CT angiography, 71 were detected by both conventional US and virtual CT sonography, while an additional 46 were detected by the latter method alone, for a total of 117 nodules detected. The sensitivity of conventional US was 50.7%, which increased to 83.6% with the help of virtual CT sonography.

The average maximum diameter of nodules detected by conventional US was 16.6±6.2 mm (range, 5-30 mm), while that of those detected only by virtual CT sonography was 9.7±3.3 mm (5-20 mm). The average maximum diameter of nodules detected only by virtual CT sonography was significantly smaller than that of those detected by conventional US (p<0.001). Only 19.7% (14 of 71) of the nodules detected by conventional US had a diameter of ≤10 mm, while 67.4% (31 of 46) of those with a diameter of ≤10 mm were detected by virtual CT sonography alone.

Based on the echo pattern, nodules were classified as hyper-, iso-, or hypo-echoic. Forty-one nodules (57%) detected by conventional US were hyper-echoic, while only 6 (13%) of those detected by virtual CT sonography were hyperechoic. In contrast, iso- and hypo-echoic nodules were more easily detected by virtual CT sonography (p<0.001). Only 15 of 71 nodules (21%) detected by conventional US had a peripheral location, while 20 of 46 nodules (43%) detected

only by virtual CT sonography were peripheral. Nodules located in the liver periphery were significantly more easy to detect by virtual CT sonography (p=0.018), as were those located in a patchy liver (p=0.026).

We performed percutaneous US-guided biopsies of 78 of the 117 nodules, 46 detected by conventional US and 32 detected by virtual CT sonography. Of the 78 nodules biopsied, 64 had malignant potential. In addition, 26 of 30 nodules (86.7%) with a diameter ≤10 mm were histologically diagnosed as malignant or pre-malignant. Multivariate analysis suggested that the factors affecting the difference in detection ability were size ($p<0.001$), echo pattern ($p=0.004$), and location ($p=0.028$).

In addition to the 71 nodules detected by conventional US, an additional 46 were detected by virtual CT sonography, which increased the sensitivity of conventional US from 50.7% to 83.6%. Generally, nodule size is an important prognostic factor for hepatocellular carcinoma (HCC) as well as for recurrence after radio frequency ablation when the HCC nodule is ≥20 mm in diameter. Therefore, we consider that the higher sensitivity and greater ability of virtual CT sonography to detect small nodules are important advantages. In 2000, a panel of experts from the European Association of the Study of the Liver (EASL) proposed an algorithm for diagnosis and surveillance of nodules detected by conventional US based on the size of the nodule. They concluded that nodules less than 1 cm in size cannot be diagnosed with confidence, and should not considered to be malignant or premalignant. In the present study, it was possible to evaluate and manage 59.6% of the nodules with a diameter ≤10 mm at the patient bedside using virtual CT sonography, of which 86.7% were shown to be malignant or premalignant. Therefore, we consider virtual CT sonography to be a good option for examination of patients at high risk of HCC to evaluate and control small nodules that may be emerging HCCs.

CONCLUSION

Virtual CT sonography was found to be superior to conventional US for detection of small hepatic nodules that have malignant potential.