Intraductal ultrasonography and endoscopic retrograde cholangiography in diagnosis of extrahepatic bile duct stones: a comparative study

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BACKGROUND: **Intraductal ultrasonography (IDUS) is highly accurate in detection of extrahepatic bile duct stones. This study was to compare the accuracy of IDUS and endoscopic retrograde cholangiography (ERC) in the diagnosis of extrahepatic bile duct stones.**

METHODS: **Thirty patients suspected of extrahepatic bile duct stones on B ultrasonography, CT, or MRI were enrolled for study. ERC was performed using a Fujinon duodenoscope (ED-410XT, ED-410Xu), then IDUS was done by inserting a Fujinon microprobe (PL2220-15) through the endoscopic biopsy channel to detect the extrahepatic bile duct. Finally stones in the extrahepatic bile duct were detected and extracted by endoscopic sphincterotomy (EST).**

RESULTS: **Among the 30 patients, 26 were diagnosed as having cholelithiasis accurately through ERC. In one patient the stone detected by ERC was really floccule. Misdiagnosis happened in 2 patients with extrahepatic bile duct stones. So the overall accuracy and sensitivity of ERC in the diagnosis of extrahepatic bile duct stones were 86.7% (26/30) and 92.9% (26/28) respectively. In contrast, IDUS showed the results of diagnosis were in consistent with those of EST stone extraction. Its accuracy and sensitivity in the diagnosis of extrahepatic bile duct stones were 100% (30/30) and 100% (28/28) respectively.**

CONCLUSION: **IDUS which is superior to ERC in diagnosing extrahepatic bile duct stones can avoid the visual error of ERC.**

(*Hepatobiliary Pancreat Dis Int 2004; 3: 129-132*)

KEY WORDS: **endoscopic retrograde cholangiography; intraductal ultrasonography; extrahepatic bile duct stones**

Introduction

Intraductal ultrasonography (IDUS) with a thin-caliber high-frequency US probe is applicable to pancreatobiliary diseases,[1-17] and it is rarely reported as an adjunct to endoscopic retrograde cholangiography (ERC) or as an adjunct to laparoscopic cholecystectomy for detection of extrahepatic bile duct stones.[18-21] The diagnostic accuracy rate of ERC is as high as 90% or above, which is higher than that of CT, MRI or abdominal ultrasonography in the diagnosis of extrahepatic gallstones.[22-27] However, it is an indirect imaging technology that is subject to considerable influences of factors including operator, concentration of contrast media, quality of Xay-machine, etc.[20] But the influences of the factors could be eliminated by IDUS. Unfortunately, there are rare reports on the technology of diagnosing extrahepatic gallstones through IDUS in China. We performed IDUS in 30 patients suspected of extrahepatic gallstones and compared the results of IDUS and ERC.

Methods

Patients

According to the inclusion criteria for subjects, 30 patients with symptoms of colic, icterus and fever, and with abdominal ultrasonography, CT or MRI-confirmed or suspected extrahepatic bile duct stones were enrolled for comparison of ERC and IDUS. Of these patients 22 were men aged from 37 to 70 years, and 8 were women aged from 38 to 74 years. The study was started in No-

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vember 2000, and ended in August 2001.

Equipments

Side-viewing duodenoscope (Fujinon ED-410XT, ED-410Xu, Japan), ultrasound microprobe (Fujinon microprobe PL2220-15 and SP-701 ultrasonography system, Japan) were used.

Procedures

Bile duct examination was performed through an endoscopic intubation of the duodenal papilla in all of the patients. The patients took the position of the left lateral decubitus or prone position. Diazepam (10 mg) and 654-2 (10 mg) were injected intramuscularly as a routine medication. Intramuscular injection of pethidine (50 mg) was given when necessary. An electronic duodenoscope was introduced into the descending segment of the duodenum. ERC was done after exposing the duodenal papilla and the imaging results were recorded. Subsequently, the ultrasonic microprobe was introduced through the biopsy channel into the duodenal papilla to detect the bile duct. The positioning of the probe was determined by a fluoroscope, and the results of ultrasonography were recorded.

Identification of intraductal objects by ERC

Gallstones

Gallstones showed round, oval or polygonal filling defects in the bile ducts with invariable shapes in imaging. The filling defects exhibited no change in size and descended automatically when the patient's position changed.

Biliary pneumatoses

Biliary pneumatoses appeared as filling defects in the bile duct with variable shapes in imaging. The filling defects ascended when the position of the patient changed.

Floccules

Floccules appeared as irregular filling defects with variable shapes. The defects exhibited changes in size but did not descend automatically when the position of the patient was changed.

Identification of intraductal objects by IDUS

Gallstones

Strong echo with echo shadow demarcated clearly from the wall of the bile duct could be seen in the bile duct.

Biliary pneumatoses

Strong circular echo could be seen around the probe, behind which the ultrasound wave attenuated completely.

Floccules

Strong laminar echo could be seen without echo shadow.

Detection of the bile duct after sphincterotomy

Sphincterotomy was performed in patients suspected of intraductal solid substance on ERC and IDUS. The substance was trapped and extracted with a net basket and the bile duct was cleaned up with a balloon. The characteristics of the substance were observed under an endoscope.

Results

Sphincterotomy stone extraction

Of the 30 patients, 28 had bile duct gallstones floccules, and one had biliary pneumatosis as well as a history of stone extraction by sphincterotomy.

ERC and sphincterotomy stone extraction

Twenty-seven patients were diagnosed by ERC as having extrahepatic bile duct stones, except suspected stones in 1 patient and no stones in 2 patients. The diagnoses were confirmed by sphincterotomy stone extraction in 26 of the 27 patients, and one demonstrated actually a floccule. The one who had been suspected of cholelithiasis was confirmed to have biliary pneumatosis by stone extraction. The 2 patients who had been misdiagnosed by ERC were found to have stones by sphincterotomy stone extraction. The accuracy and sensitivity of ERC in the diagnosis of extrahepatic bile duct stones were 86.7% (26/30) and 92.9% (26/28), respectively.

IDUS and sphincterotomy stone extraction

IDUS showed cholelithiasis in 28 patients, floccule in 1, and biliary pneumatosis in 1. The diagnoses were consistent with those of EST stone extraction. The accuracy and sensitivity of IDUS in the diagnosis of extrahepatic bile duct stones were 100% (30/30) and 100% (28/28), respectively.

Stone extraction in patients with inconsistent results of ERC and IDUS

In 4 patients, the results of ERC and IDUS were not consistent. Gallstones were not detected by ERC in contrast to IDUS in 2 patients, who were confirmed by stone extraction. One patient was found to have stone by ERC but floccule by IDUS which was confirmed by net basket stone extraction. The other patient suspected of stone by ERC was found to have biliary pneumatosis after IDUS, which was later confirmed by net basket and balloon stone extraction.

Discussion

ERC has been the gold criterion for the diagnosis of extrahepatic bile stones ever since it was applied clinically in the 1970s. Its diagnostic accuracy seems to be as high as 90% or more. Instantaneous diagnosis could be made for patients with stones in sharp contrast to contrast media. For those patients with stones in poor contrast to the media or patients with pneumatosis or gas bubbles, it is difficult to make an instant diagnosis. However, the purpose of duodenoscopy nowadays is to give an endoscopic treatment rather than merely to make a diagnosis of cholelithiasis. If the existence of stones can not be ascertained instantly, the endoscopic treatment could not be carried out promptly and accurately. Sphincterotomy might be performed in patients without gallstones at all, whereas patients with bile duct stones might miss the chance for prompt treatment. It is a fact beyond dispute that such incidents occur during ERC, but not high.

IDUS is an accurate method for the diagnosis of bile duct stones. Ascher et al[18] inserted a microprobe with a diameter of 6.2 Fr and a frequency of 12.5 MHz into the lumen of the bile duct to detect stones successfully in 1992. Subsequently, Thomason et al[19] put an ultrasonographic microprobe into the lumen of the common bile duct during cholecystectomy via a laparoscope and detected gallstones, which were confirmed by subsequent operation. In 2001, Tamada et al[20] used IDUS to detect the residual stones after percutaneous transhepatic cholangiography and compared the result with that of cholangioscopy. They found that the two methods were identical in detecting extrahepatic bile duct stones (100%, 11/11). After IDUS under a duodenoscope and comparison of the results with those of EST, we concluded that the two procedures had a diagnostic accuracy and a sensitivity of 100%, respectively

The images obtained from ERC are indirect. The quality of intraductal substance is determined according to its shape and contrast to media. Initially we performed ERC in 30 patients, of whom 27 had filling defects; the diagnosis of cholelithiases by ERC was identical with that by EST in 26 of the 27 patients. Floccules were determined by ERC according to the variable irregular shapes of intraductal substance during the course of detection. In this group, one patient had a floccule in the common bile duct. Because imaging exhibited no change in the process of detection, the foccule was determined as stone by ERC. But IDUS showed the texture of the substance as laminar echo without shadow, indicating the existence of floccule. The result of IDUS was confirmed by the substance extracted by EST.

In our series, one male patient with biliary pneumatosis had a history of sphincterotomy. His bile duct was dystonic and dilated. Gas was accumulated in the middle segment of the extrahepatic bile duct, causing an illusion during ERC. IDUS demonstrated the sign of complete attenuation of ultrasound wave when the microprobe was placed in the middle segment of the common bile duct. Hence, biliary pneumatosis was considered. At the time the fully-released net basket was passed through this segment, no resistance was found. A big balloon was used to clean up the lumen and placed at the opening for photography, and the contrast medium was well filled into the lumen of the bile duct, thus confirming the diagnosis of pneumatosis.

Of the 2 patients who were misdiagnosed by ERC, one had small stones in the wide bile duct, which were concealed by the contrast material.[20] The other patient in this series had the stone at the end of the bile duct and the papilla was close to a diverticulum. Therefore the end of the bile duct was inside the diverticulum, which resulted in a visual error during ERC. The stone, however, was detected by IDUS. These circumstances are common in routine ERC. i. e. clinical symptoms suggest bile duct stones, whereas ERC shows negative result. Thus an instant determination of sphincterotomy is not possible. At this time, IDUS can ensure the accuracy of the diagnosis.

The methods for detecting bile duct stones include intraductal ultrasonography during operation, PTC, and cholecystectomy through laparoscopy. But there have been no reports on intraductal ultrasonography under a duodenoscope. Although identical results could be obtained through the methods cited above, the manipulation of IDUS is more suitable to the physiological conditions of patients.

We conclude that IDUS could make up for the visual errors of ERC and has a higher accuracy rate in diagnosing extrahepatic bile duct stones. If IDUS is used in combination with ERC, the diagnostic accuracy of extrahepatic bile duct stones would be improved.

Competing interest

The author or authors do not choose to response to the statements listed in Instructions for Authors.

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Received June 9, 2003
Accepted after revision November 29, 2003