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ORIGINAL ARTICLE

Usefulness of Magnetic Resonance Cholangiopancreatography in Pancreatobiliary Abnormalities in Pediatric Patients

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Background: Magnetic resonance cholangiopancreatography (MRCP) is an innovative and noninvasive technique for evaluating the biliary tree and pancreatic duct in children. The aim of this study was to assess the usefulness of MRCP as a noninvasive method to evaluate the biliary system in children.
Methods: We retrospectively reviewed the records of patients undergoing MRCP between October 2002 and May 2007 for suspected biliary system abnormalities. MRCP findings were compared with other imaging modalities, operative findings, and clinical endpoints.
Results: Complete data were available for 60 patients (35 girls, 25 boys; mean age 2 years, 33 children less than 1 year old). Ultrasound was performed in all 60 patients. Twenty-two patients had choledochal cyst, and 19 had a thin or invisible gall bladder. Endoscopic retrograde cholangiopancreatography was done in two patients. The sensitivities and specificities of MRCP for diagnosing choledochal cyst and biliary atresia were 100.0% and 100.0% and 86.7% and 100.0%, respectively. Surgery was performed in 37 patients, including 21 with a choledochal cyst, 14 with biliary atresia, and 1 with a pancreatic duct stone.

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Conclusion: MRCP is useful method for evaluation of the pancreaticobiliary system in pediatric patients. It yields a high degree of accuracy in the diagnosis of biliary atresia and choledochal cyst.

1. Introduction

Ultrasonography (US) and computed tomography are the initial imaging methods for evaluating the pediatric pancreaticobiliary ductal system. If they fail to provide an accurate diagnosis, endoscopic retrograde cholangiopancreatography (ERCP) is often performed.[1] However, ERCP is difficult to perform in young children and infants because it requires special equipment and expertise that are not available in many institutions.[2] In addition, ERCP is an invasive procedure with potential complications[3]; it is both more difficult and more hazardous in the pediatric population than when performed in adults.[4] Magnetic resonance cholangiopancreatography (MRCP) is an innovative technique for evaluating the biliary tree and pancreatic duct, initially used in adults in the early 1990s.[5,6] It is considered to be a reliable diagnostic tool to evaluate primary sclerosing cholangitis, Caroli disease, choledochal cyst, and other forms of biliary pathology.[7,8] The advantages of MRCP are that it is noninvasive, requires no contrast material, is without ionizing radiation, and can be performed on an outpatient basis. The safety is deemed comparable with that of US.[9] MRCP is therefore increasingly replacing ERCP or percutaneous cholangiogram in assessing many pancreaticobiliary diseases.[10,11]

Given its success in adults, MRCP has begun to be used in children during the past decade,[12,13] with reports on its application for suspected biliary atresia, choledochal cyst, cholelithiasis, choledocholithiasis, bile plug syndrome, pancreatitis, and in liver transplantation.[4,14,15] However, the pediatric literature to date consists mostly of case reports and a few serial studies focusing on particular clinical conditions,[13,16–21] especially in Taiwan.[22,23] We therefore designed this retrospective review of our experience using MRCP in a larger series of pediatric patients.

2. Materials and Methods

Mackay Memorial Hospital, Taipei, Taiwan is a tertiary referral center for pediatric gastrointestinal and hepatobiliary disease. The records of all pediatric patients younger than 18 years undergoing MRCP for suspected pancreaticobiliary system abnormalities between October 2002 and May 2007 were retrieved in this hospital, yielding 62 cases. We excluded records of two patients who underwent MRCP only for follow-up after operation, leaving a total of 60 cases. Data extracted from the records included gender and age; medical history (including prenatal history, abdominal US findings on newborn screening, and any surgery before MRCP); and clinical manifestations, including jaundice, clay-colored stool, abdominal mass, and abdominal pain. All imaging study findings were recorded, including those from abdominal US, MRCP, ERCP, Tc-99m diisopropyl iminodiacetic acid scan, and operative cholangiography. The results of surgery and pathology examination were also reviewed.

MRCP examinations were all performed with a 1.5-T scanner (Signa EXCITE; GE Medical Systems, Waukesha, Wisconsin, USA) by using head or phased-array surface coil, depending on the body size of patients. The T2-weighted fast spin-echo and fat-suppressed sequence images were acquired with the following parameters: single-shot fast spin-echo sequence, repetition time/echo time range, 2015–16,000/33.8–541; slice thickness, 6 mm; slice gap, 0; field of view, 35 cm; and matrix, 288×256. The images were acquired by use of breath-hold technique in the older children if possible. In children who could not hold their breath, the MRCP examination was performed with respiratory triggering. The acquisition time for each sequence varied according to the patient's body volume and breathing rate. The whole MRCP examination time was about 45 minutes in general. Patients fasted at least 6 hours before the examination. Sedation with oral chloral hydrate at a dose of 40 mg/kg of body weight (maximum, 1 g) was used if the child was younger than 6 years or not able to cooperate during the examination. Vital signs were monitored during the sedation, and all the patients completed the examination smoothly, without any complications. MRCP images were analyzed by an experienced pediatric radiologist. The MRCP diagnosis of choledochal cyst was based on the disproportional dilatation of extrahepatic bile ducts and excluding other cause of dilatation, such as stone, tumor, or inflammation. The MRCP diagnosis of biliary atresia was made on the basis of the nonvisualization of either the common bile duct or the common hepatic duct and demonstration of a small or atresic gall bladder. For patients suspected with choledochal cyst in whom the results of MRCP were also consistent, a pediatric surgeon was consulted for complete surgical excision of the cyst. In the patients suspected with biliary atresia and consistent with MRCP findings, Kasai portoenterostomy was performed after direct cholangiography confirmed the diagnosis. For those patients suspected to have biliary atresia after normal MRCP examination, we observed the clinical manifestations, reviewed all follow-up images (abdominal US), and arranged Tc-99m scanning. Direct cholangiography was performed if the diagnostic work-up was still inconclusive. The final diagnosis of choledochal cyst was based on the findings of cystic dilatation occurring at varying segments of the extrahepatic or intrahepatic bile duct by direct cholangiography, ERCP, and operative findings. The final diagnosis of biliary atresia was confirmed by direct cholangiography of obstruction or absence of the biliary tree, operative findings of small and fibrotic gallbladder along with diffuse fibrosis of the extrahepatic system, pathology