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Original article

Magnetic Resonance Cholangiography in the evaluation of early stage primary sclerosing cholangitis

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SUMMARY

Background:The purpose of our study was to evaluate the MR Cholangiographic findings of early stage primary sclerosing cholangitis (PSC). Method:The patients were examined with half fourier – single – shot turbo spin – echo (HASTE), breath hold MR Cholangiography (MRC) using a 1T Siemens Expert Plus Scanner. Axial T2 – Weighted images were also obtained from all patients. We examined 32 patients with a cholestatic biochemical profile positive for primary sclerosing cholangitis. The patients were divided into two groups according the degree of the abnormality of the values of the biochemical data. A third group of 20 men and 5 women with normal biochemical profile also were examined. Results: The first group comprised 11 patients with mild disturbance of biochemical profile showing a mild increase in signal intensity on T2WI in liver parenchyma and haziness of the margins of the intrahepatic bile ducts, due to inflammation, at MRC cholangiography. The second group comprised 21 patients with more stable increase of the biochemical profile. MRC findings were haziness of the bile duct margins due to inflammation and areas with dilatation of bile duct branches due to stenosis from fibrosis. From the third group, we found a mild increase in signal intensity on T2WI in the liver parenchyma and haziness of the margins of the intirhepatic bile duct in 2 men with normal laboratory data. Conclusion: This study suggests that MRC can be used for the detection of early stage primary sclerosing cholangitis, but it has low specificity in the characterization of this disease. Although the method has low specificity, it is the method of choice to evaluate this disease, if findings are combined with positive laboratory data.

Key words: Bile ducts diseases, MR Cholangiography, Cholangitis

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INTRODUCTION

Primary sclerosing cholangitis is a chronic cholestatic liver disease. The term "primary" is applied to a clinical syndrome when it does not occur in association with choledocholithiasis or post–operative stricture[1]. It frequently occurs in patients with inflammatory bowel diseases.[1,2]

A cholestatic biochemical profile is the main finding in all patients with primary sclerosing cholangitis, because the physical examination may be normal in a large number of patients.

There are four histologic stages of primary sclerosing cholangitis. The first stage includes cholangitis or portal hepatitis, the second stage includes periportal fibrosis or periportal hepatitis, the third stage, septal fibrosis, bridging necrosis or both and the end–stage the biliary cirrhosis.[2,3]

Diagnosis of primary sclerosing cholangitis at an early stage (1 – 2) is based mainly on biochemical and histologic criteria. We will present the MRI and MRC findings in correlation with the pathologic findings in 32 patients in the early stage of primary sclerosing cholangitis.

MATERIAL AND METHODS

This study involved 32 patients, 24 male and 8 female between 29 and 46 years (mean age of 37 years).

The examination was usually performed early in the morning and with an empty stomach.

All the patients underwent MR Cholangiography with 1T Siemens Expert Plus Scanner, using a body phased array receive coil. MRC was performed using a HASTE, breath hold sequence. The following parameters were used: TR 6200msec, TE 90msec, flip angle 150°, slice thickness 8 and 5mm, FOV 400m, pixel size 1,67 X 1,56mm, number of acquisitions made were three and we obtained 11 coronal or oblique coronal source images for each scan. Scan time was 23 sec. The source images were reconstructed using MIP technique.

Axial T2 – weighted images (TR 3800ms, TE 90ms) were also obtained for all patients without any instructions for the patients to hold their breath.

Two radiologists read the MRC findings with information about the history and/or other jointly findings from other imaging modalities.

Immediately after the MRI examination, the patients underwent biopsy with a 14 or 16 gauge core–needle. The biopsy was under CT guidance from the abnormal segment of the perfermed liver parenchyma.

RESULTS

All the patients had a cholestatic biochemical profile with increased serum level of alkaline phosphatase and 5 of them had a mild increase in the level of serum aspartate transaminase. Bilirubin values were increased only in 12 patients and the tests for antimitochondrial antibodies were negative.

Tests related to copper metabolism were not obtained in the majority of patients. In a few cases (4 patients) serum ceruloplasmin values and urinary copper levels were abnormal.

The patients had had no treatment of any jubd prior to the examination.

The patients were divided into two groups according to the serum level of alkaline phosphatase and the findings of MRI and MRC.

The first group of patients comprised 11 patients with a mild increase in serum level of alkaline phosphatase, and in this group we found an increase in signal intensity in T2–weighted images involved in the liver parenchyma and an haziness of the margins of the intrahepatic bile ducts, due to periductal inflammation at the MR Cholangiography (Figure 1). We biopsied these abnormal areas which revealed an increase in signal intensity in T2WI, with a core–needle of 14 or 16 gauge under CT guidance. The results of the biopsy showed that there was inflammation around the bile ducts and portal triads in 6 patients (Figure 1).

Some results from the biopsies were probalbly not characteristic for PSC. In these cases, follow up is necessary until the diagnosis of PSC is established.

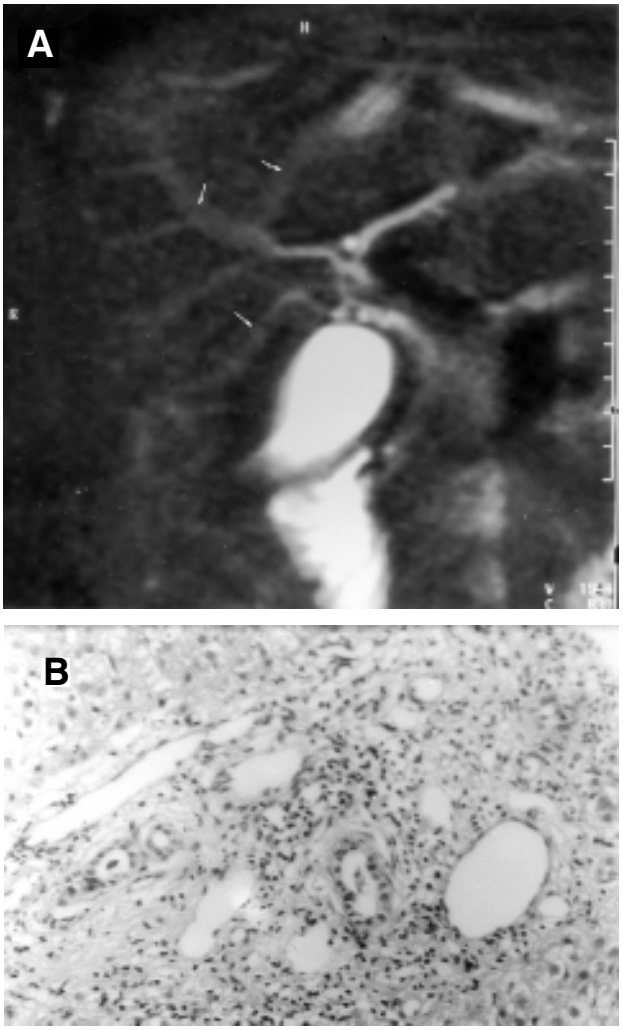

Figure 1. (A) MRC which reveals haziness around the peripheral bile duct branches (arrows). (B) Histopathological findings of biopsy specimen. Portal tract is expanded with little fibrosis and chronic inflammatory infiltration (H – E stain X 200), (stage I to II of PSC).

The second group of patients comprised 21 patients with a more stable increase of serum level of alkaline phosphatase. In this group we found an increase in signal intensity of hepatic parenchyma and a mild focal dilatation of the bile ducts in T2–weighted images. In MR Cholangiography there were only areas of haziness of the bile ducts margins due to inflammation and areas with dilatation of bile duct branches due to stenosis from the fibrosis (Figures 2, 3). Histology, on the other hand demonstrate the fibrosis and stenosis of the small peripheral bile ducts and inflammation in all patients (Figures 2, 3).

Extrahepatic bile ducts were normal in all patients in these two groups.

A third group of 20 men and 5 women with normal laboratory data were also examined. In this group, in two men, MRC revealed haziness around the bile ducts branches and an increase in signal intensity on T2WI of the liver parenchyma like the PSC group.

The level of values of alkaline phosphatase was stable for a period of six months. The patients were examined via laboratory data every 3 months.

DISCUSSION

PSC is a chronic cholestatic syndrome which is characterized by chronic cholestasis and a diffuse inflammation and fibrosis that involves the entire biliary tree to varying degree.

The disease is a progressive disease which obliterates the intra – and extrahepatic bile ducts and ultimately leads to cirrhosis.[4]

The cause of PSC remains unknown, although many factors have been suggsted on to contributing to the pathogenesis of this cholestatic syndrome.

Diagnosis is based mainly upon the cholestatic biochemical profile (alkaline phospatase level of more than 1,5 times the upper limits of normal for 6 months or more) and histology which reveals inflammation and fibrosis in the biliary tree.

In the early stages of PSC (portal stage I and periportal stage II), there is a proliferation of small peripheral bile ducts, edema in some portal tracts and later there is a periductal fibrosis in some portal tracts, inflammation with or without ductular proliferation, and piecemeal necrosis.[2,3]

These histological features are not specific for PSC,

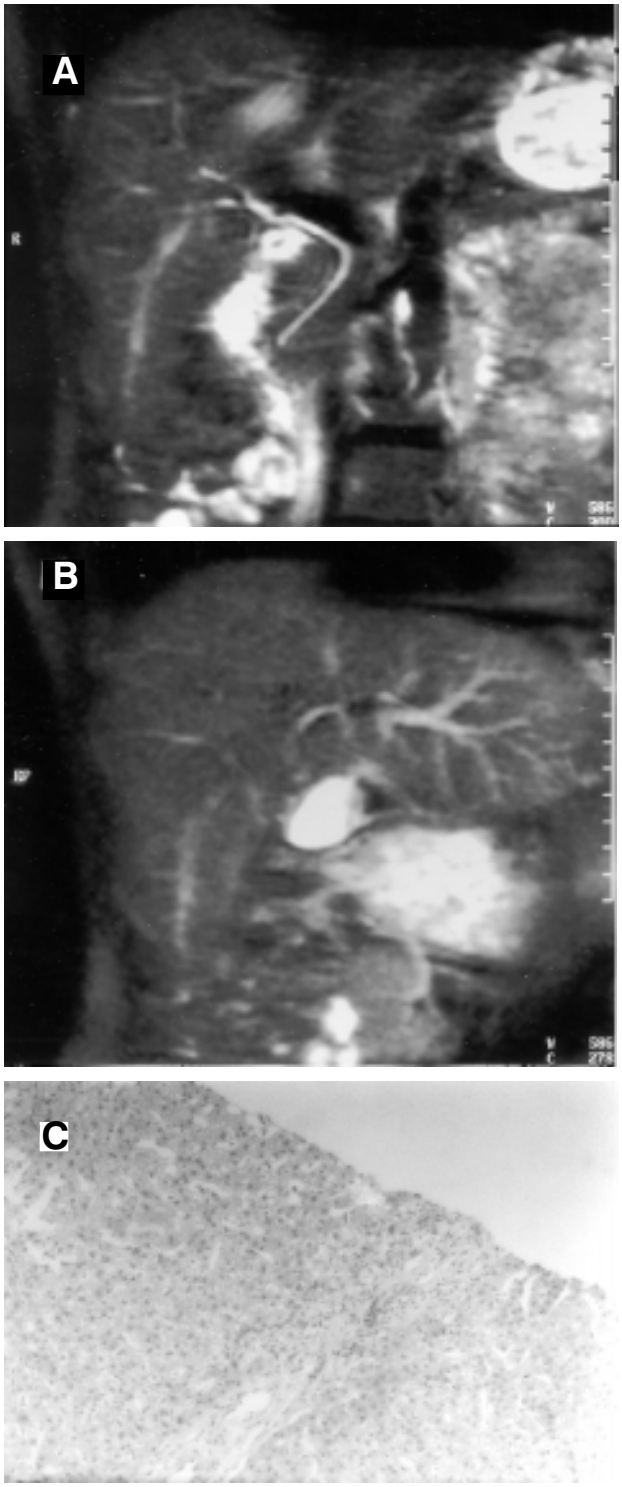

Figure 2. (A) and (B) MRC which reveals subtle biliary dilatation and haziness around some bile duct branches.The common bile duct is normal. (C) Histopathological findings of biopsy specimen. Portal tract is expanded with fibrosis, bile ductular proliferation and mild chronic inflammatory infiltration. The lobular architecture of the liver is preserved (H – E stain X 100).

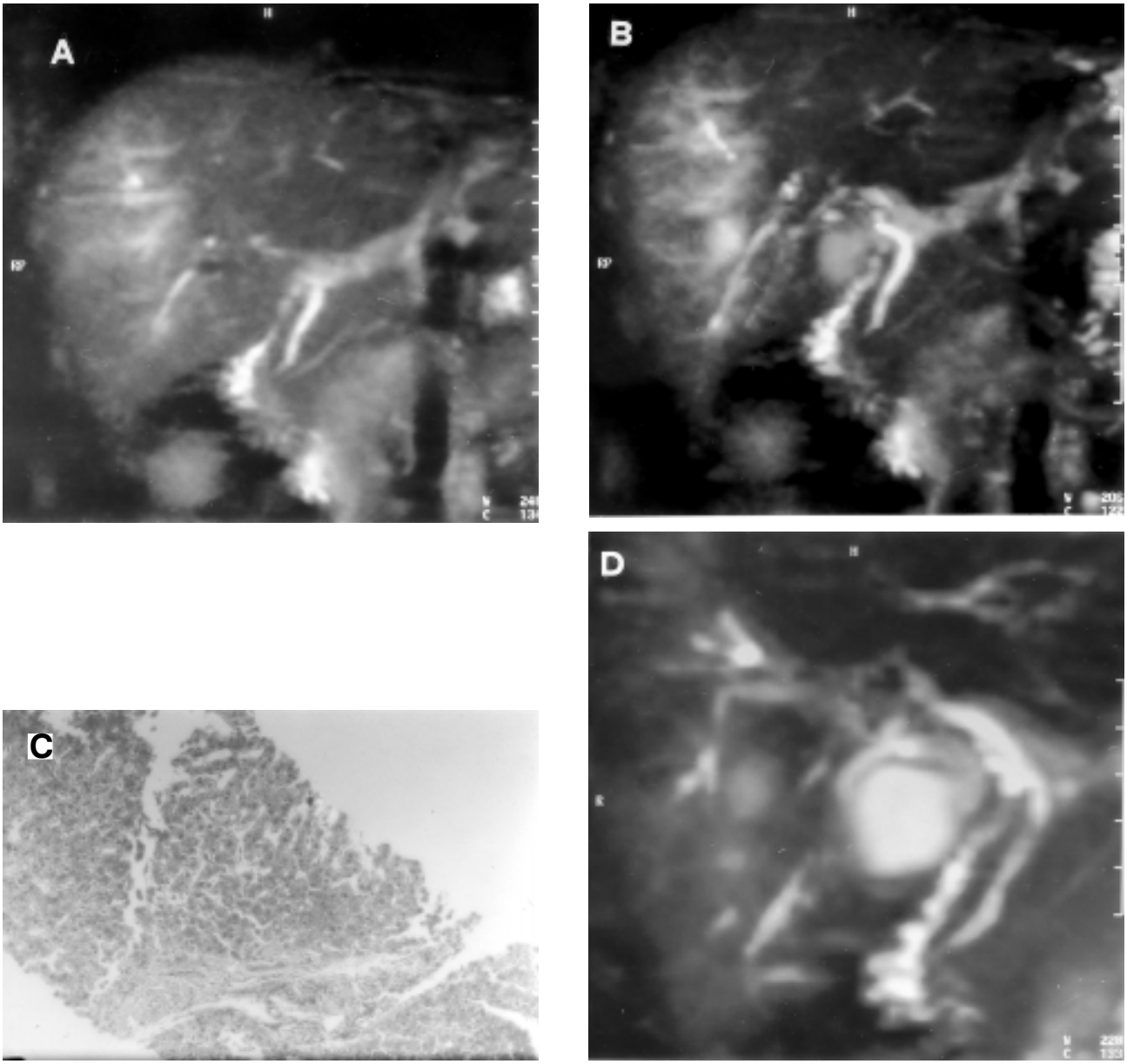

Figure 3. (A) and (B) Magnetic Resonance Cholangiography which reveals increased signal intensity in the right liver lobe and haziness around the biliary radicles. The common bile duct is normal. (C) Histopathological findings of biopsy specimen. Portal tract is expanded with fibrosis, mild chronic inflammatory infiltration and circumeferential fibrosis around bile ducts. The lobular architecture of the liver is preserved (trichrome stain X 100). (D) MRC -in the same patient after four years, which reveals the absence of haziness, the absence of increased signal in the liver parenchyma, strictures and dilatation of the intrahepatic biliary radicles and also of the common bile duct (advanced stage of PSC).

but very important for staging the disease and in determining the prognosis.[5]

The changes of the liver paranchyma, may be different in the various segments of the liver.[6]

The role of MR cholangiography in the evaluation of intrahepatic ductal abnormalities is currently being investigated in large studies.

The cholangiographic findings, early in the course of the disease are the randomly distributed, short (1-2mm), annular intrahepatic strictures, alternating with normal or slightly dilated segments.[7]

Strictures usually occur at the bifurcation of ducts and

are out of proportion to upstream ductal dilatation.[7]

Although these findings were described as early manifestations of the disease they represent the advanced disease of stage III or IV.

Our observations of the MRI and MRC findings early in the course of the disease clearly represent stage I and II of the disease.

The two main findings in our study are the hazzy margins of the small bile ducts due to inflammation and the stenosis and dilatation of the small bile ducts due to fibrosis.

These findings are not specific for PSC, but if we combine these with a positive biochemical profile for PSC then the diagnosis of PSC can be established.

Biliary abnormalities in PSC were classified into three types of intrahepatic and four types of extrahepatic abnormalities depending on the extent of bile duct narrowing.[8,9]

Intrahepatic type I consisted of multiple strictures with normal caliber bile ducts or minimal dilatation. Type II lesions consisted of multiple strictures, saccular dilatation and decreased arborization. Type III involvement corresponded to severe pruning of peripheral bile ducts.[8-10]

This classification is based mainly on the comparison of MR cholangiographic findings with those of direct cholangiography and there is no MR cholangiographic – pathologic correlation.

Our observations focused on early manifestations of PSC which corresponded only to type I and in some degree to type II of cholangiographic classification of intrahepatic PSC.

Inflammation around the small bile ducts produces an increase in signal intensity. This high signal is usually undistinguished from the high signal intensity of the small bile ducts although it is slightly lower, producing the hazziness around the small bile ducts.

On the other hand, fibrosis produces stenosis of the small peripheral bile ducts, which reduces the amount of bile within this segment. Visualization with MR Cholangiography requires some amount of fluid such as bile within the ducts because this method is based on the acquisition of a heavily T2–weighted sequence and moving fluid reveals a low signal intensity, whereas fluid with slow flow, including the bile, shows high signal intensity.

Therefore when fibrosis is not a dominant feature but is at an early stage, the stenosis is small (stage II) and easily depicted by MR Cholangiography, corresponding in subtle stenosis with slightly dilatation of the peripheral part of stenotic bile ducts. When fibrosis is in an advanced stage, then there is no bile within the billiary vessels and so there is no imaging of this stenotic segment of bile duct by MR cholangiography. The dilated peripheral (proximal) part at the stenotic segment of the bile duct was clearly depicted by MR Cholangiography, because there was a large amount of bile within it. In contrast to direct cholangiography which cannot depict this post–stenotic dilated segment of bile duct because of non-filling.

This is clearly an advantage of MR Cholangiography over direct cholangiography or ERCP.[9,11,12]

Although the MR cholangiographic characteristics of early stage of PSC are not specific, if we combined these findings with a positive biochemical profile, for PSC this method proved to be very helpful and should be routinely included in the examination of a patient with suspected primary sclerosing cholangitis.

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