Ultrasonography and magnetic resonance cholangiopancreatography correlation in patients with obstructive jaundice

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Abstract

Background: Obstructive jaundice is a condition caused by blockage of the flow of bile out of the liver. This results in an overflow of bile and its by-products into the blood and bile excretion from the body is incomplete. Ultrasound (USG) is used to evaluate patients for biliary stones and cholecystitis. It can detect cystic duct and neck of the gallbladder obstruction as well as distension and inflammation of the gallbladder. It can identify carcinoma of the gallbladder, which is highly malignant and metastasize quickly. Magnetic resonance cholangiopancreatography (MRCP) is a relatively new noninvasive diagnostic technique for direct visualization of the biliary ducts through images similar to those produced in endoscopic retrograde cholangiopancreatography and percutaneous transhepatic cholangiography.

Objective: To highlight the role of ultrasonography and MRCP as preliminary investigation in patients with obstructive jaundice.

Materials and Methods: Thirty patients with complaints of jaundice and clinico-pathological appearance of obstructive jaundice were included in the study. The patients had undergone sonography of abdomen in radiology department and then MRCP study was conducted. Data of patients matching inclusion criteria were recorded after getting informed consent.

Result: Of 30 patients, 17 (56.66%) were females and 13 (43.33%) were males. Most common age group of patients was 51–60 years (23.3%) followed by 61–70 years (16.6%). Jaundice was the most frequent symptom (96%) followed by abdominal pain (86.66%). Common bile duct (CBD) was most commonly involved in 50% of cases followed by confluence of right and left hepatic duct and pancreas in 13.33%. Most common obstructive lesions in this study were congenital anomalies of CBD (choledochal cyst) in 30% cases followed by stone in CBD +/- CHD with or without stricture in 19.99% cases. In this study, of 30 cases, 16 (53.33%) were benign lesions and 14 (46.66%) were malignant. Among benign lesions, choledochal cyst was the most common (9/16; 56.25%), especially more among females. However, among malignant lesions, hilar cholangiocarcinoma was most common (5/14), especially among females. USG (30/30) was found to be equally good as MRCP (30/30) in detecting the presence and level of obstruction. In detecting the extent of obstruction, USG could not localize the distal extent of the lesion involving distal CBD (6/30) due to poor patient factors (obesity) and bowel gases. In assessing the cause of obstruction, MRCP (30/30) scored over USG.

Conclusion: USG is a cost-effective, noninvasive, and nonionizing easily available preliminary investigation in the evaluation of obstructive jaundice but MRCP scores over USG for evaluation of small hepatic metastasis in the presence of pancreaticobiliary malignancies that may be missed with USG.

KEY WORDS: Obstructive jaundice, ultrasonography, MRCP

Introduction

Jaundice is a common problem in both medical and surgical practice. Its cause can often be correctly anticipated clinically, but usually biochemical and radiological imaging investigations are required for confirmation. The signs and symptoms of obstructive jaundice differ depending on the completeness of the blockage and the disease course varies

among individuals. Some people with obstructive jaundice may have no symptoms initially, but if the condition persists they may have severe abdominal pain, fever, nausea, and vomiting. Complete blockage may also occur posing a risk of infection leading to liver and gallbladder damage. Fortunately, in most cases obstructive jaundice can be treated with intravenous fluids, antibiotics, and surgical removal of the obstruction.

Untreated obstructive jaundice can lead to serious infection that spreads to other parts of the body. Immediate medical care should be sought for serious symptoms such as high fever, severe abdominal pain, abdominal swelling, and nausea with or without vomiting. Prompt medical care is required if being treated for obstructive jaundice but mild symptoms recur or are persistent. Hence, prompt and accurate diagnosis is needed for management of obstructive jaundice.[1]

In recent years, the incidence of tumor causing obstructive jaundice (irrespective of age, sex, caste, etc.) has increased due to increased longevity and better diagnostic methods. The high morbidity and mortality associated with it necessitates its early diagnosis so as to plan the intervention that is required.

Patients with jaundice are referred for initial ultrasound (USG) examination followed by appropriate imaging modality such as computed tomography of the abdomen with contrast, magnetic resonance cholangiopancreatography (MRCP), endosonography, and endoscopic retrograde cholangiopancreatography (ERCP).

USG is used to evaluate patients for biliary stones and cholecystitis. It can detect cystic duct and neck of the gallbladder obstruction as well as distension and inflammation of the gallbladder. It can identify carcinoma of the gallbladder, which is highly malignant and metastasizes quickly.[2] It is important because gallbladder cancer has a very low prognosis; therefore, any early diagnosis of this condition is potentially lifesaving.

MRCP is a relatively new noninvasive diagnostic technique for direct visualization of the biliary ducts through images similar to those produced in ERCP and percutaneous transhepatic cholangiography.[3] Also, MRCP does not require contrast media. The use of specific biliary agents has been drastically reduced because of insufficient opacification in many cases and the incidence of allergic reactions. Thus, MRCP is nowadays a preferred procedure over others.

Thus, our objective was to evaluate USG and MRCP correlation among patients with obstructive jaundice with respect to

- Highlight the role of USG and MRCP as preliminary investigation in patients with obstructive jaundice.
- Find out correlation between USG and MRCP finding in case of obstructive jaundice.
- Assess limitation of USG and MRCP.

Materials and Methods

It was a prospective observational study conducted from May 2009 to September 2011 at Government Medical College, Surat, Gujarat, India. Permission from Human Research Ethics Committee was sought before starting the study. Participants were included according to inclusion and exclusion criteria as stated later. Informed written consent was taken before the inclusion of participants in the study. Total 30 patients presenting with complaints of jaundice and clinicopathological appearance of obstructive jaundice were included in the study. After inclusion in the study, all participants underwent USG and MRCP of the abdomen in the radiology department. For sonography, MyLab 60 USG machine was used (Esaote, India), and for MRCP MAGNETOM Essenza 1.5 Tesla MRI scanner was used (Siemens). All the data were recorded into the case record form and analyzed. Identity of the patient was kept confidential.

Inclusion Criteria

Patients with clinical features of obstructed jaundice, those with biochemical features of obstructed jaundice such as elevated serum bilirubin, those in whom USG investigation showed dilatation of biliary system, those with a clinically documented cause of jaundice, and those with surgical and/or obstructive lesion were included in the study.

Exclusion Criteria

Patients who refused to give consent, those with contraindication for MRCP such as patients with ferromagnetic implant, aneurysm clips, pacemaker, and those with claustrophobia were excluded from the study.

Data Collection

Various data of patients such as name, age, and sex were noted. Symptoms and various morphological characters of obstructive lesion were studied. A clinico-radiological correlation and confirmation of radiological diagnosis was done by biopsy, surgery, or MRI whenever possible to minimize patient follow-up.

Results

After performing USG of the abdomen and dedicated MRCP study of the abdomen in 30 patients the findings were evaluated and then organized in tabular manner. Different parameters of patients such as age, sex, clinical complaints, types of lesion, abnormal MRI findings, consistency of lesion, pattern of contrast enhancement, and pattern of calcification were also tabulated and evaluated.

Of 30 patients, 17 (56.66%) were females and 13 (43.33%) were males. In our study, most of the patients belonged to the age group of 51–60 years being 7 (23.3%) followed by 61–70 years with 6 (20%), 41–50 years with 5 (16.6%), 0–10 years with 4 (13.3%), 11–20 years and 31–40 years with 3 (10%), and 21–30 years with 2 (6.66%).

In this study, jaundice was the most frequent symptom seen in 28 of 30 (96%) patients followed by abdominal pain among 26 (86.66%). However, vomiting and abdominal lump were seen in 63.33% and 43.33% patients, respectively.

Table 1: Cause of obstruction

Type	Number of patients	Percentages
Choledochal cyst	9	30
CBD calculus with/without stricture	5	16.66
CHD calculus with CBD calculus	1	3.33
Hilar cholangiocarcinoma	5	16.66
Pancreatic head mass	3	10
Distal CBD mass	3	10
Metastatic mass lesion near confluence of CHD	1	3.33
Cholangiocarcinoma of CHD	1	3.33
Carcinoma of gallbladder	1	3.33
Focal pancreatitis of head of pancreas	1	3.33

CBD, common bile duct; CHD, common hepatic duct.

Table 2: Incidence of obstruction

Etiology	Total cases	Male	Female
Benign	16 (53.33%)	7 (43.75%)	9 (56.25%)
Choledochal cyst	9 (30%)	2	7
Distal CBD calculus	4 (16.66%)	2	2
CHD calculus	1 (3.33%)	1	0
Pancreatitis	1 (3.33%)	1	0
Benign stricture with CBD calculus	1 (3.33%)	1	0
Malignant	14 (46.66%)	6 (42.85%)	8 (57.14%)
Hilar cholangiocarcinoma	5 (16.66%)	1	4
Ca head of pancreas	3 (10.00%)	3	0
Distal CBD mass	3 (10%)	1	2
Cholangiocarcinoma of CHD	1 (3.33%)	0	1
Carcinoma of gallbladder	1 (3.33%)	0	1
Metastasis	1 (3.33%)	1	0
Total	30	13 (43.33%)	17 (56.66%)

CBD, common bile duct; CHD, common hepatic duct.

In this study, the most common site of obstruction was common bile duct (CBD) seen in 15 of 30 (50%) patients followed by confluence of right and left hepatic duct and pancreas in 6 (13.33%). However, other sites of obstruction were gallbladder, common hepatic duct (CHD), and pancreas.

The most common obstructive lesion in this study was congenital anomalies of CBD (choledochal cyst) in 30% cases followed by stone in CBD +/- CHD with or without stricture in 19.99% cases. Next in the order of the frequency were hilar cholangiocarcinoma (16.66%) and distal CBD mass and pancreatic head mass (10%) [Table 1].

In this study, of 30 cases, 16 (53.33%) had benign lesions and 14 (46.66%) had malignant. Among benign lesions, choledochal cyst was the most common (9/16) in 56.25% patients, especially in females. However, among malignant lesions hilar cholangiocarcinoma was common (5/14), especially in females [Table 2].

Discussion

Of 30 patients who were evaluated in this study, 17 (53%) were males and 13 (47%) were females aged 45.49 years (range 3–85 years). The maximum number of patients were in their 60s (23.3%) followed by those in 50s (20%), which is similar to a study conducted by Huis et al.[4] in which maximum number of patient were in their 70s (21%) followed by those in 60s (18%). These results were also comparable to the results of the studies conducted by Huis et al.,[4] Siddique et al.,[5] and Huang et al.[6]

In this study, the male-to-female ratio (M/F) was 0.76:1, which is comparable to that reported by Huis et al.[4] being 0.69:1 and that by Huang et al.[6] with 0.63:1. However, in the study by Siddique et al.[5] the M/F was 1.3:1 and that in Sharma et al.[7] was 1.29:1.

In this study, jaundice was the most common presenting feature seen in 96% patients followed by abdominal pain. Most of the patients in this study presented with multiple symptoms, which is comparable to the results of the study by Sharma et al.[7] Nonspecific symptoms such as anorexia, weight loss, and fever were found to be more commonly associated with malignancy than with benign lesion. Also, a significant number (63%) of patients presented with vomiting. Pain in the abdomen (the right hypochondria) was noted more commonly in malignant causes (85%). Clay-colored stools were reported more commonly by patients with the malignant jaundice (64%). Pruritus was seen equally in both the benign and the malignant cases. Anorexia and weight loss were more frequently seen among the patients of malignant jaundice. Hepatomegaly was seen in the patients with malignancy whereas palpable gallbladder was noted in cases of malignant obstruction, thus supporting the Courvoisier's law. The scratch marks were seen in equal percentage of patients among the benign and the malignant conditions.

In this study, hilar cholangiocarcinoma was the most common malignant lesion found in 16.66% patients. Although carcinoma of gallbladder was the most common malignant lesion found in the study by Sharma et al.,[7] carcinoma of head of pancreas was the most common lesion found in the studies of Huis et al.,[4] Siddique et al.,[5] and Huang et al.[6]

Incidence of CBD calculus was very frequent in our study (16.66%), which is comparable to that in the studies by Huis et al.,[4] Siddique et al.,[5] and Huang et al.[6]

Majority of benign causes were seen in the age group of 1–40 years, whereas the malignant cases were more common between 41 and 70 years. The difference in age distribution of the benign and malignant disease was statistically significant ($p < 0.05$).

Benign obstructive jaundice was seen in 16 (53%) patients whereas 14 (47%) had malignant etiology. Choledochal cyst was the most common etiology seen in 9 (30%) patients followed by hilar cholangiocarcinoma and choledocholithiasis seen in 5 (16.66%) cases.

In female patients, malignant causes of obstructive jaundice predominated (57.14%) whereas in males benign causes

Table 3: Comparison of USG and MRCP

N = 30	USG	MRCP
Presence of obstruction	30/30 (100%)	30/30 (100%)
Level of obstruction	30/30 (100%)	30/30 (100%)
Extent of obstruction	25/30 (83.33%)	30/30 (100%)
Cause of obstruction	24/30 (80.00%)	30/30 (100%)

USG, ultrasonography; MRCP, magnetic resonance cholangiopancreatography.

were predominant (43.75%). Choledochal cyst was the most common cause of obstructive jaundice as a whole as well as the most common benign etiology of obstruction in female patients. Although in general CBD stones were more common in general population including females as compared to choledochal cyst, and this difference may be due to easy feasibility to investigations. In males, choledocholithiasis was the most common benign cause of obstruction. Hilar cholangiocarcinoma was the most common cause for malignant obstruction in females. In males, carcinoma of head of pancreas was the most common malignant cause of obstructive jaundice.

The abdominal USG was able to diagnose dilatation of biliary system (intra- or extrahepatic) in 30/30 (100%) cases and correctly identify level of obstruction in 16/16 (100%) benign cases, whereas the cause of obstruction was delineated in 13/16 (81.25%) cases. Level and cause of obstruction were correctly identified in 14/14 (100%) and 11/14 (78.25%) malignant cases, respectively [Table 3].

MRCP was performed in all cases and correctly identified level and cause of obstruction in all cases (100%), including choledocholithiasis, choledochal cysts, periampullary and hilar mass, and CBD stricture.

The majority of patients in this study had benign obstructive jaundice being 53.33% (16/30) whereas the malignant jaundice was seen in 46.66% (14/30), which is comparable to the findings of Huis et al.[4] in which benign lesion was seen in 74.17% and malignant lesion in 25.83% cases. However, in other studies such as by Siddique et al.,[5] Sharma et al.,[7] Moghimi et al.,[8] and Cheema et al.[9] malignant lesions were more common than benigns.

In this study, both benign and obstructive obstructive jaundice were more common among females than among males, which was statistically significant ($p < 0.05$). For benign jaundice, M/F was 1:1.2 whereas it was 1:1.3 for malignant obstructive jaundice. The incidence of hilar cholangiocarcinoma was statistically significantly ($p < 0.05$) higher in females than in males. The incidence of pancreatic head mass was statistically significantly ($p < 0.05$) higher in males than in females, possibly related to alcohol abuse and higher incidence of smoking in males. Carcinoma of gallbladder was more common malignancy in females, most likely related to higher incidence of chronic cholelithiasis and dietary factors.

Among the radiological investigations, the diagnostic accuracy of USG in defining the level of obstruction was 91.8% as compared to 100% for MRCP. To measure the etiology of the obstruction, the accuracy of USG and MRCP was 80% and 100%, respectively. The sensitivity of USG and MRCP in the diagnosis of benign disease was 81.25% and 100%, respectively, whereas the specificity was 88.4% and 100%, respectively. The sensitivity for a diagnosis of malignant disease was 78.25% and 100% for USG and MRCP, respectively, whereas the specificity was 85.3% and 100%, respectively, which is comparable to the findings of Admassie et al.[10] and Vilgrain and Palazzo.[11]

USG (30/30) was found to be equally good as MRCP (30/30) in detecting the presence and level of obstruction. In detecting the extent of obstruction, USG could not localize the distal extent of the lesion involving distal CBD (6/30) due to poor patient factors (obesity) and bowel gases. In assessing the cause of obstruction, MRCP (30/30) scored over USG. In this study, the sensitivity of USG for presence of obstruction, level of obstruction, and extent of obstruction was 100% but the sensitivity for cause of obstruction was 80%. In this study, 30 of 30 obstructive lesions were accurately diagnosed through MRCP accounting for a diagnostic accuracy of 100%.

Conclusion

From this study, it is concluded that USG is a cost-effective, noninvasive, and nonionizing easily available preliminary investigation in the evaluation of obstructive jaundice. Though operator dependent, a well-performed USG under good technical parameters can give vital information, which not only detects the presence and level of obstruction but also the extent and cause of obstruction in a large number of cases of obstructive jaundice, thereby serving as a cost-effective preliminary investigation to help in treatment planning and avoid invasive and other costly and time-consuming investigations. The diagnostic accuracy of MRCP in evaluation of obstructive lesion was 100%. That is, MRCP (1) gives high-resolution images of the biliary tree; (2) gives diagnostic images both above and below the level of obstruction; (3) gives three-dimensional (3D) image of the biliary tree, which can help in treatment planning; (4) can be used in obese patients and those patients who are poor USG candidates due to technical factors or limited field of view as in postoperative patients; and (5) MRCP with MRI abdomen scores over USG for evaluation of small hepatic metastasis in the presence of pancreaticobiliary malignancies, which may be missed with USG.

However, a few limitations of MRCP are as follows:

➢ The requirement of sedation to obviate patient movement in pediatrics patients. Elderly patient with abdominal distension and distress may not be able to hold breath, which is prerequisite for MRCP.

➢ The cost of the MRI was limiting factor in many patients.

➢ In cases of prosthesis of in the body such as prosthesis pacemakers and aneurysm clip insertion, MRI is not possible. Also, among patients having claustrophobia, MRI is not possible.

Yet, with the above limitations, MRCP remains the definitive investigation for diagnosing and evaluation in obstructive biliopathy with a reasonable degree of diagnostic accuracy and with the advent of newer modifications of MRCP, a new era has heralded for the 3D spatial localization and detailed evaluation of lesion causing obstructive jaundice.

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