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Multimodality Imaging in Obstructive Jaundice: A Review with Our Experience

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Abstract: ***A brief review of the different imaging modalities in obstructive jaundice are discussed here. Ultrasound serves as a preliminary investigation in comparison to other non-invasive imaging modalities like MRCP and CECT (contrast-enhanced computed tomography). Ultrasound remains one of the easily available preliminary imaging modalities in obstructive jaundice. However limitations due to inability to tell the exact extent of the lesion and the inability to detect small stones in the distal CBD exist, which are overcome in MRCP (Magnetic Resonance Cholangiopancreatography). MRCP with its higher diagnostic accuracy, is another upcoming non-invasive modality which will answer most of our questions in the clinical setting of obstructive jaundice. In a study conducted in our hospital with 140 cases of clinical obstructive jaundice, it was found that the sensitivity of detecting the presence and level of obstruction was almost same 100% vs 98% and 98% vs 99% respectively. But it was found that with respect to the extent and cause of obstruction ultrasound was not as sensitive (67% vs 94%) and specific (68% vs 89%) as compared with CECT and MRCP. Additionally, MRCP with MRI helped detect the presence of small metastases missed by ultrasound and CECT. Ultrasonography though easily available preliminary imaging modality in obstructive jaundice is often not able to diagnose the exact cause and extent of lesion whereby more advanced imaging modality like CECT and MRCP plays an important role to accurately diagnose the exact cause and extent of the underlying lesion expediting accurate diagnosis and further aiding in patient management.***

Keywords: ultrasound, obstructive jaundice, MRCP, CECT, diagnostic accuracy

1. Introduction

The first step in the evaluation of obstructive jaundice is distinguishing intrahepatic and extra-hepatic biliary obstruction. Clinical history and laboratory tests have been shown to accurately identify up to 85% of patients whose jaundice is caused by extra-hepatic obstruction[1].

The role of any radiologic procedure in obstructive jaundice is to confirm the presence of biliary obstruction by detecting biliary dilatation, its exact location, extent and probable cause. imaging modalities available for the evaluation of obstructive jaundice are ultrasound (US), magnetic resonance cholangiopancreatography (MRCP), CECT, cholangiopancreatography (ERCP) & percutaneous transhepatic cholangiopancreatography (PTC).

These techniques enhance diagnostic accuracy to enable surgeons to choose an optimum therapeutic option.

2. Materials and Methods

Study method

All patients with clinical or laboratory features of obstructive jaundice underwent ultrasonography followed by contrast enhanced CT abdomen. Magnetic Resonance Cholangiopancreatography (MRCP) and the diagnostic accuracy compared.

Ultrasonography

All US studies were performed with 3.5-5.5MHz convex transducer probe (HDI 5000 PHILIPS MEDICAL SYSTEM after an overnight fast.

Contrast Enhanced CT Abdomen

CECT was performed after overnight fasting after giving intravenous contrast with phasic acquisition using a four slice CT Scanner.

Magnetic Resonance Cholangio Pancreatography (MRCP)

MRCP was performed after a period of overnight fast by MR scanner 0.3 T. 2D and 3D breathhold MRCP acquisition using sequences fast reversal fast spin echo (FRFSE) and steady state fast spin echo (SSFSE). Additionally, T2 weighted fast spin echo (T2 FSE) or fat-saturated (FATSAT) sequences were performed to locate the dilated biliary and pancreatic ducts.

3. Results

In our study, on 140 patients of obstructive jaundice, the most common presenting complaint was jaundice (82%) followed by vomiting (72%). There was a male preponderance in this study with a male: female ratio of 1.3: 1.

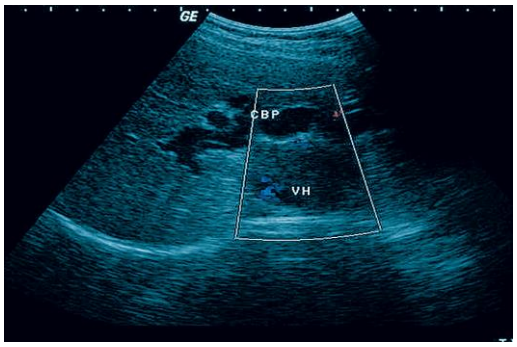
Ultrasound was found to be the preliminary investigation of choice for the diagnosis of the presence of obstruction and to some extent the level of obstruction. USG could pick up the presence of biliary obstruction in almost all

cases, as compared to previous studies (24, 25). Accurate detection of the level was possible in 130 cases (92%) as compared to reported studies 27-95% and to a much lesser extent the cause of obstruction 84 cases (60%) as compared to 23-88% (26). This was primarily because of some factors like obese patients who were poor ultrasound candidates, as well as to bowel gases which caused obscuration of distal CBD. Besides, smaller lesions beyond the resolving power of ultrasound were missed (10 cases).

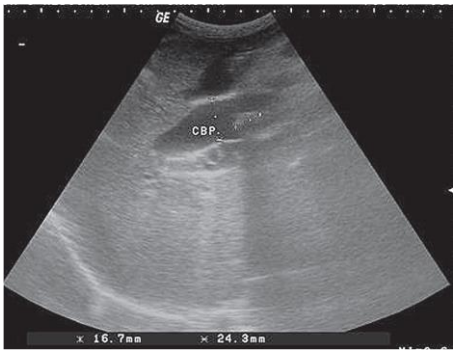
Poor test performance at detecting CBD stones with sensitivities 25-58% and specificities 68-91%25. Accuracy ranging from 47-90% for distinguishing benign from malignant causes. In a study conducted in our hospital with 140 cases of clinical obstructive it was found that, for detecting the presence and level of obstruction MRCP is much better than ultrasound.

Additionally, MRCP with MRI helped detect the presence of small metastases missed by ultrasound and CECT. Though Ultrasonography is preliminary imaging modality in obstructive jaundice it is often not able to diagnose the exact cause and extent of lesion whereby more advanced imaging technique like CECT and MRCP plays an important role to accurately diagnose the exact cause.

With the use of colour Doppler in addition to gray scale sonography, the detectability rate of lesions and actual extent increased. it is useful in patients for evaluation of distal CBD calculi as well as for lesions of the pancreas leading to biliary obstruction. Use of Colour Doppler was made to appreciate underlying portal vein thrombosis causing portal biliopathy leading to obstruction.

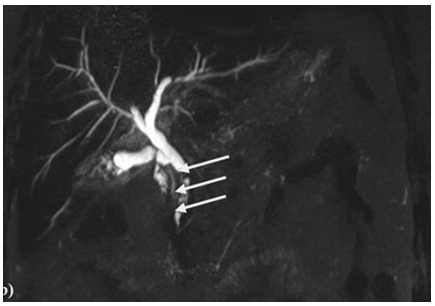


Transabdominal ultrasonography: ampullary carcinoma

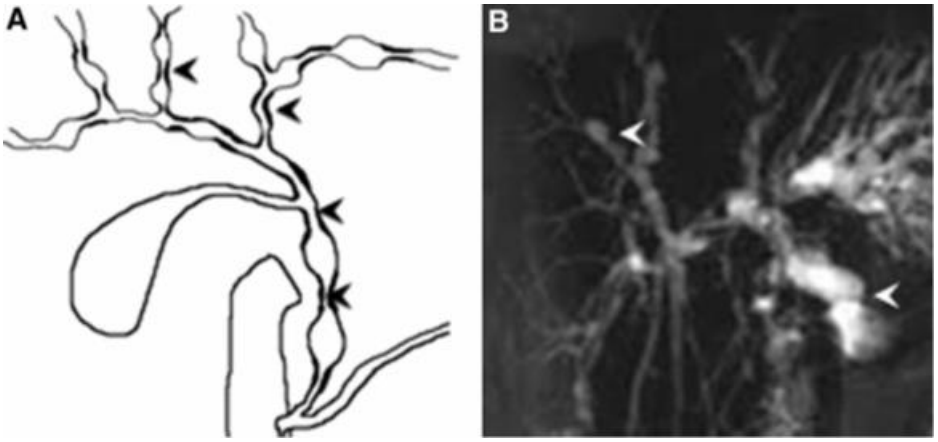


Transabdominal ultrasonography: common bile duct stone

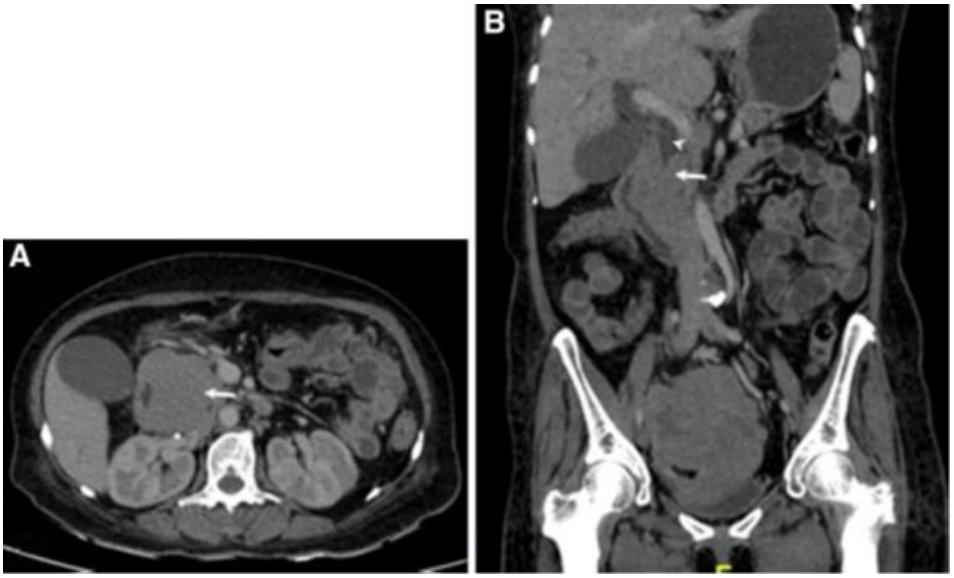
Transabdominal ultrasonography: cholangiocarcinoma (billiary tract dilatation)



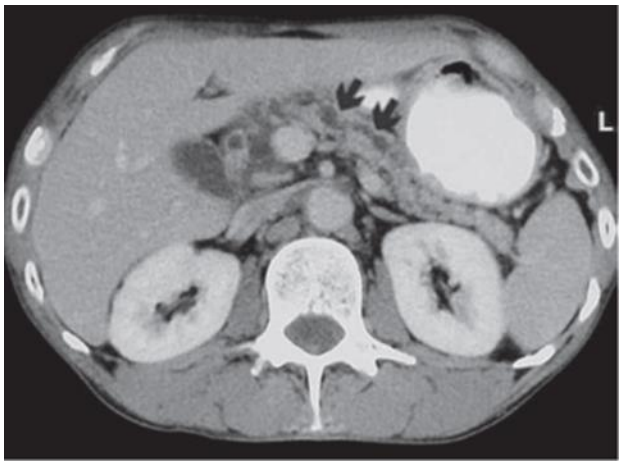
Multiple calculi (arrows) in the suprapancreatic and intrapancreatic common bile duct resulting in obstructive biliopathy



Schematic diagram and b single shot MRCP showing multiple strictures involving intra-and extrahepatic biliary tract (arrowheads) in case of primary sclerosing cholangitis



A contrast-enhanced multidetector CT scan showing lobulated minimally enhancing mass in the head of the pancreas, encasing a long segment of the common bile duct (arrow) with the resultant proximal biliary dilatation (arrowhead).



Computed tomography: pancreatic pseudocyst

CECT could detect the presence and level of obstruction in all cases (100%). It provided additional information with respect to the extent of lesion.

Additional information regarding the presence of other intrabdominal lesions were also given. But very small metastatic foci were missed in ten cases which were picked on MRI with MRCP. CECT could not give information regarding the excat extent of involvement of the hepatobiliary tree.

In our study, MRCP was able to detect the level and presence of obstruction in 100%. A meta-analysis summarizing 67 studies has shown that sensitivity of MRCP for detecting the presence (99%) and level (99%) of biliary obstruction was more as compared to that for diagnosing stones (92%) and for differentiating benign from malignant obstruction (85%) (29). Reports have shown that MRCP can diagnose bile duct obstruction in 91-100% of cases and level of obstruction in 85-100% cases [17, 26].

MRCP has shown less sensitivity for the detection of stones (90%). In the diagnosis of choledocholithiasis sensitivity has been shown to vary from 81% to 100% and

specificity from 85% to 98% [17, 30]. Poor detection of small stones has also been reported by Guibaud et al, [17] who considered MRCP was not sensitive for stones less than 4mm: in their series of 32 confirmed cases of choledocholithiasis, six false-negatives were observed on MRC for which stone diameter ranged from 2mm to 7mm, with a mean of 5m. Moreover, sensitivity decreases as the size of the stone decreases 67-100% for stones > 10mm, 89-94% for stones 6-10mm and 33-71% for stones <6mm. Studies conducted using 3D MRCP, for the detection of CBD stones have reported sensitivity, specificity and accuracy of 90%, 88% and 89% respectively, which after the exclusion of stones <6 mm, have improved to 100%, 99% and 99% respectively. The detection accuracy of stones <6 mm is likely to improve with the newer 3D sequences [31].

Sensitivity and specificity rates for detection of malignant strictures were has been found to be intermediary to those of benign strictures [32]. MRCP helps in the diagnosis of cholangiocarcinoma by identifying the exact location, extent and severity of obstruction [33].

Detection of pancreatic cancer without ductal dilatation is difficult [35].

Ampullary lesions may be missed because of the poor performance of MRCP at or near the duodenal wall as a result of interference from bowel gas [36].

Studies have shown that loss of spatial resolution and motion artifacting play an important role in lowered MRCP performance in distal main bile duct obstruction [17, 31]. Although diagnostic efficacy remains high, diagnostic pitfalls of MRCP have been small choledocholithiasis and small distal benign and malignant strictures, for which technical advances in spatial resolution and reduction of motion artifact will most likely improve performance [32].

4. Discussion

In spite of different diagnostic modalities available for detecting biliary obstruction, currently no single method is both risk free and with high sensitivity and specificity.

Transabdominal Sonography

Transabdominal ultrasonography has remained the initial imaging modality of choice in the evaluation of suspected biliary obstruction as it is noninvasive, inexpensive and readily available [4]. Sonographic scanning of the biliary ducts has been used successfully as a screening test to distinguish between surgical and medical jaundice with an accuracy of 90% [5]. However, although it is well suited to visualize the common hepatic duct and proximal CBD, one of its major limitations is assessment of the distal CBD and pancreas, which are often obscured by overlying bowel gas in about 30-50% of the patients [6, 7]. Its limited ability to define biliary pathologies restricts its use to a preliminary imaging investigation to guide choice of further imaging work up.

Computed Tomography

Computed tomography (CT) scan is usually considered more accurate than US for helping determine the specific cause and level of obstruction. In addition, it helps visualize liver structures more consistently than US. The addition of intravenous contrast helps differentiate and define vascular structures and the biliary tract. The accuracy of conventional CT in determining the presence and level of obstruction has been 81 to 94% and 88 to 92% respectively [13].

CT scan has limited value in helping diagnose CBD stones because many of them are radiolucent and CT scan can only image calcified stones. It is also less useful in the diagnosis of cholangitis because the findings that specifically suggest bile duct infection (increased attenuation due to pus, bile duct wall thickening, and gas) are seen infrequently. Lastly, CT scan is expensive and involves exposure to radiation, both of which lessen the routine use. Spiral (helical) CT scan improves biliary tract imaging by providing several overlapping images in a shorter time than traditional CT scan and by improving resolution by reducing the presence of respiratory artifacts.

CT cholangiography by the helical CT technique is used most often used to image the biliary system and makes possible visualization of radiolucent stones and other biliary pathology [14].

Magnetic Resonance Cholangiopan Creatography (MRCP)

MRCP is a non-radiating, non-invasive and yet a highly sensitive method of investigating obstructive lesions of the biliary tract [17]. It is accurate and thus increasingly accepted means of imaging pancreatobiliary diseases. MRCP permits evaluation of the pancreaticobiliary tract, and gall bladder without the use of contrast material and is thus preferred in patients where use of contrast is restricted or contraindicated. It has a sensitivity of 95% and specificity of 95% for demonstrating the level and presence of biliary obstruction [15]. MRCP techniques have greatly evolved, providing high resolution images of the biliary tree with short exam duration, while remaining noninvasive without contrast medium injection [18].

Many studies have shown that diagnostic images below and above the level of obstruction can be obtained that will provide a 3-D image of the biliary tree which will help in treatment planning [19].

5. Conclusion

Although ultrasound continues to remain the preliminary investigation modality for detecting the presence or absence of surgical obstructive jaundice, its inability to answer the true extent and cause of obstructive jaundice necessitates the use of another imaging modality like CECT and MRCP which scores over ultrasound in the diagnostic accuracy. MRCP can be considered as the new gold standard for the investigation of biliary obstruction.

MRCP allows accurate diagnosis in biliary obstruction thereby saving time and resources thereby facilitating prompt patient management.

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