Advanced imagery examinations on the diagnosis of obstructive jaundice

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Abstract

Obstructive jaundice is one of the most frequent and grave forms of hepatobiliary disease and it is defined as the impossibility of inflow of a normal quantity of bile into the duodenum due to lesions or obstacles at the level of choledochus or the common hepatic duct. Nowadays, there is a continuous development on the examinations for diagnosis of obstructive jaundice, including transabdominal ultrasound (TUS), computed tomography (CT), endoscopic retrograde cholangiopancreatography (ERCP), percutaneous transhepatic cholangiography (PTC), magnetic resonance cholangiopancreatography (MRCP) and cholangio computed tomography (CCT).

The use of accurate methods in patients with obstructive jaundice is important to surgeons, radiologists and endoscopists. In this context, the aim of this paper is to review the latest literature in order to shed light on the advances of imagery about the obstructive jaundice diagnosis.

TUS still continues to be the preliminary examination method for identifying the possible presence of obstructive jaundice. Its incapability to answer the true extent and cause of obstructive jaundice requires the use of another imaging examination such as MRCP or ERCP with a higher diagnostic accuracy. Actually, MRCP can be considered as the new gold standard for the investigation of biliary obstruction, allowing the appropriate use of ERCP in patients with a high probability of therapeutic intervention.

Keywords: advances, examination, imagery, obstructive jaundice.

Introduction

Obstructive jaundice is one of the most frequent and grave forms of hepatobiliary disease and is defined as the impossibility of inflow of a normal quantity of bile into the duodenum due to lesions or obstacles at the level of the choledochus or the common hepatic duct. Obstructive jaundice is not a definitive diagnosis and the early investigation of the cholestasis cause is of great importance, because if obstruction is not relieved, pathological changes (e.g. secondary biliary cirrhosis) can occur (1,2).

The main causes of extra hepatic jaundice are: common bile duct (CBD) stones, CBD strictures and congenital malformations (cysts, Caroli disease), cholangiocarcinoma, ampullary carcinoma, pancreatic diseases (pancreatic head carcinoma or pseudocysts, pseudotumoral chronic pancreatitis), duodenal diverticulas, ascaridiasis, and hemobilia. In some particular conditions (postcholecystectomy or in elderly people), can appear the CBD dilatation. The importance of differentiating the obstructive jaundice from non-obstructive jaundice is related to the fact that there is a great difference in the respective treatment regimens (1-5).

In recent years there has been a continuous development in the diagnosis of biliary obstructive disease. The examination modalities includes the transabdominal ultrasound (TUS) computed tomography (CT), endoscopic retrograde cholangiopancreatography (ERCP), percutaneous transhepatic cholangiography (PTC), magnetic resonance cholangiopancreatography (MRCP) and cholangio computed tomography (CCT).

The use of accurate methods in patients with obstructive jaundice is important to surgeons, imageries and endoscopists (6). Thus, the aim of this paper is to shed light on the advances of imagery on the diagnosis of obstructive jaundice.

The review of the literature indicates that use of the imaging modalities depends on patient's clinical signs, complication rate of the imaging modalities, and the experience of health professionals in diagnosis of the obstructive jaundice.

Transabdominal ultrasound

Due to its cost-effectiveness and easy availability, abdominal ultrasound examination has been considered as the first choice in the diagnosing of biliary tract disease for several years. Transabdominal ultrasound examination is considered crucial in defining the presence and etiology of obstructive jaundice. It is usually a preferred initial imagery examination method as it is considered relatively cheap, readily available and non-invasive.

Routine transabdominal ultrasound indicates the size of the bile ducts, and thus it may define the level of bile duct obstruction, identify the cause and provide other information related to the disease (e.g., presence of gallstones or hepatic metastases, benign and malignant causes of obstruction, or any associated conditions and complications). TUS is particularly useful because it offers the ability to assess non-invasively in real-time the pancreaticobiliary tracts, and it does not expose the patient to radiation.

However, TUS is highly dependent on the operator and requires technical skills and experience to produce consistently valid results (4,7).

Nowadays, with the development of high resolution ultrasound machine, better collaboration with patients and improved techniques, transabdomial ultrasound is still considered to be accurate in defining the etiology of obstructive jaundice (4,7-8).

Computed tomography

The computed tomography (CT) is another non-invasive procedure used in initial patient evaluation. It has variable sensitivity in detecting of different etiology of obstructive jaundice. The accuracy of conventional CT in determining the presence and level of obstruction has been reported at 81%-94% and 88%-92%, respectively. CT has a limited availability due to the high costs and exposure to radiation, both of which reduce the routine use. It is contra-indicated in pregnant patients, as well as in those who are allergic to contrast agents (3,9).

Use of intravenous contrast helps to differentiate

and define the vascular structures and the biliary tract more accurately than TUS. Thus, traditional computed tomography (CT) is usually considered more accurate than TUS on determining the specific obstruction's cause and level. The insufficiency of TUS and/or CT on defining the accurate diagnosis of the obstructive jaundice leads to repetitive examinations, delay in treatment and development of complications (10). If the clinical and laboratory findings are not confirmed by TUS or CT finding, the diagnosis must be defined by use of imaging examination of a higher accuracy like ERCP, PTC, or MRCP (4,10). PTC and ERCP are direct cholangiographic techniques.

Percutaneous transhepatic cholangiography

If the intra-hepatic ducts are dilated, the success diagnostic rate of PTC is very high. It is reported that the accuracy in defining the level of obstruction is more than 90%.The technique of performing of PTC is not easy and it requires a considerable experience in order to achieve the desired sensitivity and specificity. As it is reported in the respective literature, there is the opportunity of complication development during PTC. The complication rates are estimated to be high, probably up to 10% of the cases. They include skin infection and sepsis, intra-peritoneal hemorrhage, hemobilia and bile outflow, hepatic and perihepatic abscess, pneumothorax and granuloma at the catheter entry site (9,11,12).

Endoscopic retrograde cholangiopancreatography

Over the past years, ERCP has been the principal diagnostic examination of the biliary tract and it is considered to be the gold standard for the evaluation of pancreaticobiliary disease. (9,13-16). ERCP differentiates between the intra hepatic and extra-hepatic biliary duct dilatation, presence of stones and the site of bile duct stricture with the highest accuracy (approximately 90%-100%). Nevertheless, diagnostic ERCP is an uncomfortable and painful procedure associated with a complication rate of up to 9% (9). ERCP is associated with significant complications such as pancreatitis, perforation, hemorrhage, sepsis, and bile leak. ERCP procedure has been reported to be accompanied by a mortality of up to 1% (5,13-16).

PTC and ERCP have high accuracy rates on detecting the presence and level of obstruction, but they are invasive and have high complication rates. Thus, the need for an accurate and patient friendly technique has been consistently evident over the past years.

Magnetic resonance cholangiopancreatography

Magnetic resonance cholangiopancreatography is a new application of MR, considered as a non-invasive, simple, and accurate method. MRCP defines the biliary tract in patients suspected of obstructive jaundice, and it can provide both a high quality cross-sectional image of duct structures, as well as projectional images of the biliary tract and pancreatic duct. Unlike ERCP, MRCP is noninvasive and the images are obtained without any use of oral or intravenous contrast agents (17). MRCP has a sensitivity of 95% and specificity of 95% on defining the level and presence of biliary obstruction (9,13).

MRCP, for its high diagnostic value, is necessary to be performed prior to invasive procedures of ERCP and/or PTC in patients showing a suspicious clinical and laboratory findings and negative finding on TUS/CT (17).

There are no known risks associated with MRCP. The limitations of MR are related to claustrophobia, cardiac pacemakers, massive ascite or hemodynamic instability. Claustrophobia and emotional distress prevent completion of MRI procedure in up to 5% of the patients (13,18,19). The impracticality of its therapeutic application after detecting the cause of the obstruction is another limitation. Patient obesity may limit the quality of MRCP images and prevent patients from being able to enter the MRI scanner. In addition, the MRCP cannot detect lesions or

calculi smaller than 3 mm (20).

Different from ERCP, MRCP – through administration of intravenous paramagnetic contrast medium if required – allows the accurate imaging of the extraductal structures, and thus MRCP is a fundamental procedure for the characterization and stage of spreading tumors with a sensitivity and specificity comparable to those of CT (3,17,19,20).

Cholangio computed tomography

Diagnostic capability of CCT is comparable to that of MRCP, and it is appropriate and recommended if MRCP is not applicable, in particular in presence of a persisting suspicion of a biliary tract disease supported by clinical and laboratory and TUS findings. The main advantages of CCT are quick performance with few motion artifacts, good patient compliance and further identification of confusing lesions of the liver, pancreas and hepatoduodenal ligament. Due to adverse reactions and contraindications of ionizing radiation, CCT is used to correct MRCP false negatives rather than as a proper alternative of MRCP (20,21).

MRCP versus ERCP

Actually, there is a strong debate on the use of MRCP or ERCP due to their high sensitivity and sensibility on detecting the presence and level of biliary obstruction in patients with obstructive jaundice.

The main advantage of MRCP is that diagnostic ERCP is associated with significant morbidity and mortality. The reported complication rates of diagnostic ERCP are up to 9% and mortality up to 1%, meanwhile any complication associated with MRCP is not yet reported (13,22).

As reported by Bravo at al., the diagnostic ERCP can be followed immediately by a therapeutic procedure. But if the use of ERCP is not based on a selective procedure, this can result in an increasing proportion of patients in whom such intervention is found to be unnecessary (23). If preliminary noninvasive examination, such as TUS or computed tomography, indicates the need for therapeutic ERCP, then the use of diagnostic MRCP is probably unwarranted. Patients with a high probability of choledocholethiasis on the TUS finding usually should proceed directly to ERCP (13,23).

MRCP is particularly useful where ERCP is difficult, hazardous or impossible, such as in patients who have had Billroth II gastrectomy, pancreatic pseudocysts, sclerosing cholangitis and prior serious ERCP complications (24).

Another important advantage of MRCP is that it can be coupled with MRI of adjacent viscera for identification, characterization and staging of malignant strictures (13,20-24).

In addition, MRCP is a non-invasive technique which – unlike ERCP – does not necessitate iodinated intravenous contrast agent or ionizing radiation, and enables a quick and reliable diagnosis in almost all cases. It permits a complete accurate imaging of the biliary tract above and below the obstruction site. MRCP provides a full image, as well as a detailed visualization of the whole biliary tract enables projection of the drainage catheters' location and pre-operatory evaluation especially in those patients with bilioenteric-anastomosis, along with the evaluation of stenoses and calculi resulting from cholecystectomy (20,21,25-27).

MRCP allows us to diagnose the site, nature and dimension of the obstruction also when ERCP fails to diagnose as a result of closed stenoses, which cannot be penetrated by the guide wire (20).

The estimated clinical and economic impacts of diagnostic MRCP versus diagnostic ERCP are very favorable. The baseline estimate is that MRCP would both be cost saving and result in improved quality of life outcomes compared with diagnostic ERCP (13).

ERCP has lost its traditional diagnostic role because it is an invasive method with risk of complications, and inability to provide a complete image of the biliary structures in the presence of closed stenoses, especially in view of the high diagnostic accuracy of

MRCP.

Currently, the diagnostic role of ERCP is limited to brushings, biopsies, and the analysis of bile in the search for tumor markers. However, ERCP still maintains its therapeutic role through the removal of calculi with stenosis, and placement of self-expanding stents (2,4,5,17,20-25).

Conclusion

Currently, the non-invasive diagnosis of obstruction jaundice relies mainly on abdominal ultrasound and computerized tomographic findings. However, if compared to the accuracy of endoscopic retrograde cholangiopancreatography, considered as the gold standard for the diagnosis of the biliary tract diseases, the accuracy of these techniques is limited. This limitation is due to low sensitivity for the diagnosis of stones in the common bile duct or detection of strictures, which are the common causes of obstructive jaundice. On the other hand, ERCP is an invasive and painful procedure with a significant failure rate, mortality and morbidity. MRCP appears to be very sensitive and specific for choledocholithiasis and biliary strictures which are the most common causes of obstructive jaundice. MRCP is a noninvasive diagnostic examination and easily performed in a short duration, and it is indicated in patients suspected for obstructive jaundice, especially in patients at risk for sedation or invasive ERCP techniques and in situations where main bile duct cannulation by ERCP is expected to be difficult (26-31).

Transabdomial ultrasound examination still continues to be the preliminary investigation modality to identify the presence of obstructive jaundice. Yet, its incapability to address the true cause of obstructive jaundice requires the use of another imaging modality such as MRCP, or ERCP. MRCP should be considered as the new gold standard for the diagnosis of obstruction jaundice, whereas ERCP should be employed only to patients with a high probability of therapeutic intervention.

Conflicts of interest: None declared.

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