Dilated bile duct is commonly seen in clinical practice and usually represents an obstructive lesion limiting the flow of bile. The evaluation of dilated bile duct is aimed to diagnose and treat the obstructive lesion. The clinical approach therefore requires (i) definition of normal limits of bile duct size (ii) predictive markers for obstruction & (iii) imaging modality for defining the level and etiology of obstruction. The following questions need to be answered:

- Is the bile duct pathologically dilated?
- Are there associated clinical or biochemical features to suggest obstruction?
- Which imaging modality to use for further evaluation?
- How to treat?

The bile duct diameter varies according to the site of measurement. Dilatation may be present in the intra or extrahepatic ducts or both. Distal ductal obstruction causes diffuse dilatation whereas proximal lesions may lead to focal intrahepatic biliary duct (IHBD) dilatation only. IHBD as small as 1-2 mm in diameter are seen as scattered and non-confluent on Computerised Tomography (CT) and ultrasound (US) but become confluent and more easily imaged as they move centrally with diameters exceeding 2mm in size. Abnormal IHBD are present when duct diameter exceeds 40% of diameter of adjacent intrahepatic portal veins and when they appear as parallel tubes coursing together. The upper limit of normal common bile duct (CBD) on ultra sound (US) is 6-8 mm (lumen) and that of common hepatic duct (CHD) is 6mm. However, on CT scan it is more common to accept a value of 8-10 mm for CBD. This is because CT visualizes mid to distal CBD and the measurement includes the duct wall. On the other hand, ERCP and cholangiogram may reveal a duct diameter up to 10.6 mm because of magnification of the cholangiogram and may also reflect ductal distension from contrast injection. Measurements may also vary according to the age of the individual. A trend of increasing CBD diameter has been noticed in older individuals. In general, one may add 1mm to the upper limit of normal CBD for each decade of life after 60 years. Dilatation of CBD after Cholecystectomy has also remained a controversial issue. There is a trend of duct dilatation post - cholecystectomy. In a study of 234 patients undergoing cholecystectomy, the CBD increased after surgery from a diameter of 5.9 mm to 6.1 mm at an average 393 days post - cholecystectomy. CBD diameter may increase 1-2 mm post surgery but some patients may have a more profound asymptomatic dilatation of the ducts. There are also changes in duct size due to other extrinsic factors such as the time of day, respiration or patient positioning.

Thus, it is difficult to define an absolute measurement for the duct size which should be interpreted in the clinical context of a potential biliary obstruction and the clinical presentation or biochemical tests may be considered in the decision to pursue further diagnostic evaluation.

**ETIOLOGY**: Identification of the level of biliary obstruction is important in developing a differential diagnosis. Common causes of biliary obstruction include both benign causes e.g. choledocholithiasis or neoplastic causes (Table1). The etiology in decreasing order of prevalence is choledocholithiasis, pancreatic cancer, ampullary carcinoma and cholangiocarcinoma. In India, biliary ascariasis is also encountered.

**EVALUATION**: Once a dilated biliary duct is encountered, the decision to proceed with further evaluation should include both a clinical and biochemical assessment for obstruction (Fig 1).

**CLINICAL EVALUATION**:

The history should elicit symptoms such as jaundice, fever, weight loss, abdominal pain, pale stools, dark urine or pruritus. The physical examination may be limited in utility apart from jaundice. Special attention, however, should be paid to the presence of abdominal tenderness, mass, hepatomegaly or lymphadenopathy. A positive history or physical examination is a clear indication for further diagnostic tests in patient with equivocal duct size on initial imaging. The presence of jaundice, pain or fever has a high probability for ductal stones.

**BIOCHEMICAL EVALUATION**:

Liver Function Test (LFT) is essential in patients with dilated bile ducts. The principal marker of biliary obstruction is serum bilirubin and alkaline phosphates (AP). A conjugated hyperbilirubinemia
**Table 1: Etiology of biliary obstruction according to the site**

<table>
<thead>
<tr>
<th>SITES OF BILIARY OBSTRUCTION</th>
<th>Intrahepatic</th>
<th>Porta hepatis</th>
<th>Suprapancreatic</th>
<th>Intrapancreatic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary sclerosing cholangitis</td>
<td>Cholangiocarcinoma</td>
<td>Pancreatic carcinoma</td>
<td>Pancreatic carcinoma</td>
<td></td>
</tr>
<tr>
<td>Space occupying hepatic lesion</td>
<td>Primary sclerosing cholangitis</td>
<td>Choledocholithiasis</td>
<td>Pancreatitis</td>
<td>Choledocholithiasis</td>
</tr>
<tr>
<td>Gallbladder carcinoma</td>
<td>Cholangiocarcinoma</td>
<td>Metastatic disease / carcinoma</td>
<td></td>
<td>Ampullary stenosis</td>
</tr>
<tr>
<td>Hepatocellular carcinoma</td>
<td>Direct extension of gastric / colon / noma</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malignant lymph nodes</td>
<td>Gallbladder carcinoma</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liver metastases</td>
<td></td>
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</tbody>
</table>

Along with an elevated AP level is suggestive of biliary obstruction. An AP levels more than three times the upper limit of normal is more specific for biliary obstruction and infiltrative diseases of liver. Transient rise in SGOT / SGPT levels occurs with choledocholithiasis and cholangitis but usually remains less than 500 IU/dl. Mild elevation of transaminases may be present with other causes of obstruction. It is unusual for biliary obstruction and CBD dilatation to occur without clinical or biochemical abnormality. There are instances, however, that choledocholithiasis is present despite normal LFT.

**IMAGING:**

This includes US, CT, CT Cholangiography, Magnetic Resonance Imaging (MRI), Magnetic Resonance Cholangio-Pancreatography (MRCP), Endoscopic ultrasound (EUS) & Endoscopic Retrograde Cholangio-Pancreatography (ERCP). Each has advantages and disadvantages as well as limitations in evaluation of the biliary system. The aim of imaging is to define the location, extent and cause of obstruction.

- **Ultrasound**—is the first line imaging in evaluation of bile

![Algorithm for evaluation of Common Bile Duct Obstruction](image-url)
Clinical Approach to Dilated Bile Duct

Fig. 2: Algorithm for evaluation of obstructed bile ducts

- **Symptoms of Cholangitis**
  - Cholangitis (+)
  - ERCP for Biliary drainage
  - Cause still unknown, Consider for imaging
  - EUS / FNA
  - MRI / MRCP or CT
  - ERCP / brushing or biopsy

The sensitivity and specificity of CT for diagnosing dilated duct is 96% and 91% respectively. It defines the level of obstruction in 88.9% cases and the cause of obstruction in 70-95% cases. However, it requires IV contrast with potential adverse effects including nephrotoxicity. It also lacks sensitivity for choledocholithiasis (sensitivity 70-94%) since 20-25% of biliary stones are isodensity with bile making them difficult to detect.

- **MRCP** – has a high accuracy in detecting the level and cause of biliary obstruction (sensitivity 91-97% and specificity 99%) for choledocholithiasis and 88% and 95% for malignant disease. Addition of conventional T1 & T2 images to MRCP allows for evaluation of extraductal soft tissue which increases the diagnostic accuracy. The major advantages of MRCP over other imaging techniques includes avoidance of IV contrast, ionizing radiation and ability to visualize the biliary system above and below an obstruction. There are certain drawbacks such as cost, extended time of examination and contraindications such as magnetic objects. Occasionally static images showing contraction in distal CBD can simulate stenosis.

- **Endoscopic U/S** – has emerged as a significant advancement in GI endoscopy. It allows both diagnostic evaluation of pancreatic-biliary system as well as therapeutic procedures. It is highly sensitive for choledocholithiasis (sensitivity >90% and specificity 100%). It is especially useful for microcalculi (stone < 3mm) and also pancreatic lesions e.g neoplasm and cysts. It has shown greater sensitivity for pancreatic carcinoma (sensitivity 90%) especially for smaller lesions. It provides accurate evaluation of biliary dilatation in > 90% patients. The limitations are poor visualization of proximal CBD lesions and sometimes distal CBD in acute pancreatitis or in patients with extensive pancreatic calcifications.

- **ERCP** – With the advent of non invasive MRCP, the role of ERCP has mainly become therapeutic. As a diagnostic modality, it is comparable to MRCP for diagnosis of cause/ location of obstruction but MRCP is superior for peri-hilar obstruction because it also displays biliary tree proximal to obstruction and also the character of intra-ductal biliary defect. However, ERCP remains the best modality for diagnosis of ampullary cancers because of direct visualization and ability to biopsy the lesion. Therefore, ERCP is less commonly used for diagnostic purpose and is primarily reserved for patients with moderate/ high probably of therapeutic intervention. Stone retrieval and duct clearance is achieved in over 90% cases of choledocholithiasis. In cases of suppurrative cholangitis, ERCP also improves the clinical outcome and can be life saving. ERCP is also used for palliation of non-surgical obstructive biliary lesions through stenting or for obtaining tissue for diagnosis. The complications of ERCP e.g. pancreatitis may occur in 1-7% patients.

- **Percutaneous Transhepatic Cholangiography (PTC)** – This is not used as a diagnostic modality. It should be used in patients who needs therapeutic biliary intervention but who are not candidates for ERCP or who have failed endoscopic biliary access.

- **Biliary Scintigraphy** – This employs IV radioisotope to evaluate the biliary system. This has limited utility and although it may elucidate obstruction in the setting of dilated bile duct but provides little information regarding the etiology of obstruction.

**CLINICAL APPROACH**

When dealing with a patient with dilated bile duct demonstrated on initial US, the first step is to determine the clinical probability that an underlying obstructive lesion is present which requires further evaluation. This decision is based on the anatomical information from the initial imaging study along with clinical and biochemical assessment. Extrahepatic duct with diameter > 7mm on US may be considered abnormal because 99% of non-obstructed population has duct size equal to or less than 7mm. Values of up to 10mm may be considered normal for CT. The duct size must be correlated with clinical and biochemical features suggesting obstruction. In the absence of any such abnormality it is unlikely that obstruction is present even with a duct diameter > 7mm. No further evaluation is required for such patients.

When the dilated duct is associated with clinical and / or biochemical features of obstruction the next decision is how to proceed with further evaluation. Patients with features of obstruction with cholangitis require not only diagnostic, but therapeutic intervention acutely. ERCP is the choice of procedure in these patients.
Patients without emergency indication for biliary drainage require cross sectional imaging with MRI / MRCP or CT. The availability of the imaging modality, cost, patient characteristic and probability of underlying cause must be considered when choosing between the imaging techniques. CT has a high accuracy for defining many common causes of biliary obstruction but has a low sensitivity for choledocholithiasis. MRCP has the advantage of cross-sectional imaging and has the highest sensitivity for defining the obstructive lesion and should be the test of choice. Based on the findings, further invasive procedures such as EUS or ERCP may be needed. Treatment can then be planned depending on the etiology. The algorithm for evaluation of obstructed bile duct is shown in Fig 2.