OBSTRUCTIVE JAUNDICE

Muhammad Shuja Tahir

Key Contents

- Pathology of obstructive jaundice
- Causes of obstructive jaundice
- Investigation of obstructive jaundice
- Management of obstructive jaundice

Learning Objectives

- To explain pathology of obstructive jaundice
- To explain investigation for obstructive jaundice
- To describe management of obstructive jaundice

Key words: Obstructive Jaundice, ERCP, MRCP, Bismuth classification


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Jaundice is the yellow discoloration of the skin and mucous membranes due to increased serum bilirubin level caused by the obstruction to the normal out flow of the bile. (normal serum bilirubin level is 17 µmol / litre or 0.2 - 0.8 mg / 100 mls). It is also called as surgical jaundice.

Obstruction of any type caused by any reason such as stone, stricture, tumor, secondary deposits, pressure from outside, ligation or injury anywhere in the biliary passages leads to obstruction to the flow of the bile.

PHYSIOLOGICAL BASIS OF JAUNDICE
Bilirubin is a breakdown product of haemoglobin. Free bilirubin combines with plasma albumin which is carried to the liver through its circulation. This is also called unconjugated bilirubin. It is water insoluble. (indirect reacting bilirubin).

The albumin separates from bilirubin in the liver and circulates in the plasma while bilirubin enters the cells (hepatocytes).

Bilirubin combines with the cytoplasmic proteins in the liver cells. This combination is acted upon by the glucuronyl transferase (enzyme present in the hepatocytes) and bilirubin glucuronide is formed which is excreted into the biliary passages. This is called conjugated bilirubin (direct reacting bilirubin). It is water soluble.

The bile is produced in the liver and is transported via intrahepatic biliary canaliculi to the right and left hepatic ducts. These ducts join together to form the common hepatic duct which carries bile to the gall bladder through the cystic duct and to the duodenum through the common bile duct.

The bile is stored in the gall bladder where it is concentrated and evacuated mainly under the effect of the fatty meals. Jaundice or hyperbilirubinemia occurs due to following reasons:
- Pre-hepatic (Haemolytic)
- Hepatic (Hepato-cellular)
- Post Hepatic (Obstructive or surgical)

PRE-HEPATIC JAUNDICE
It occurs due to excessive breakdown of red blood cells and excessive production of bilirubin. The production of bilirubin is much rapid than its excretion leading to increased serum levels and clinical appearance of jaundice. It is also called prehepatic jaundice. Mainly indirect bilirubin is raised in this type of jaundice.

HEPATIC JAUNDICE (Hepato-cellular)
It occurs due to:
- Defective uptake of bilirubin by the liver cells.
- Defective conjugation by hepatocytes (absent enzyme).
- Defective secretion of conjugated bilirubin to the biliary passages.

OBSTRUCTIVE OR SURGICAL JAUNDICE
It occurs due to the obstruction to the outflow of bile. It may present due to obstruction in the lumen of the biliary duct or in the wall of the duct or by pressure from outside the duct.
WITHIN LUMEN
- Gall Stones
- Parasites

INTRINSIC CAUSES
- Congenital atresia
- Strictures
- Cholangitis
- Cholangiocarcinoma

EXTRINSIC CAUSES
- Pancreatitis
- Tumour of head of Pancreas
- Tumour of ampulla of vater

Obstruction in the hepatic ducts and common bile duct leads to progressive rise of serum bilirubin level and appearance of the jaundice while obstruction of the few intrahepatic biliary canaliculi doesn’t cause clinically obvious jaundice.

Generalized multiple obstructions of the intrahepatic canaliculi such as sclerosing cholangitis also lead to obstructive jaundice.

BILIARY CALCULI (CHOLEDOCHOLITHIASIS)
It is the most common cause of obstructive jaundice. Usually one or few of the smaller and multiple gall stones slip into the common bile duct through the cystic duct and cause obstruction to the flow of bile. It leads to obstructive or surgical jaundice.

The jaundice caused by calculi is usually intermittent as the stones allow passage of accumulated bile inter-mittently by changing their position.

MIRIZZI’S SYNDROME
Mirizzi’s syndrome is the condition presenting with obstructive jaundice due to pressure of an impacted gall stone in the cystic duct (hartman’s pouch) and inflammation, resulting edema and extrinsic compression of the common bile duct or common hepatic duct. It is an uncommon complication of cholelithiasis.

NEOPLASTIC LESIONS
Primary or secondary tumors of biliary passages and of viscera lying nearby may cause obstructive jaundice. The fungating growth may obstruct the lumen from inside or pressure of the tumor outside the biliary tree may obstruct lumen from outside leading to obstructive jaundice. Tumors of the gall bladder may lead to obstructive jaundice due to extrinsic common bile duct compression. It is very uncommon entity.

STRUCTURES
Strictures of the biliary passages may be;
- Multiple.
- Single.
Obstructive Jaundice

- Ultrasonography
  - Dilated bile ducts
    - Gall Stones
      - Present
      - Not Present
        - MRCP
          - Stone in CBD
            - ERCP
              - Endoscopic sphincteropapillotomy
              - Percutaneous transhepatic cholangiography
              - Surgery
            - Staging of Tumour
              - Endoscopic sonography
              - Laparoscopy
  - Non-dilated bile ducts
    - Parenchymal liver disease or Ductal disease
      - (MRCP/Liver Biopsy)
        - CT Scan
          - Mass Lesion
            - Stone Disease
These could also be:
- Inflammatory.
- Neoplastic.
- Iatrogenic.

<table>
<thead>
<tr>
<th>BISMUTH CLASSIFICATION FOR STRICTURES</th>
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**BILIARY ATRESIA**

It is a progressive sclerosis of the extra hepatic biliary tree that occurs within the first three months of life. It is one of the most common causes of neonatal cholestasis. It accounts for 50%-60% of the children who undergo liver transplantation. It is seen in 1 in 8000 to 1 in 15000 live births.

**MULTIPLE STRICTURES**

It could be the manifestation of sclerosing cholangitis which is a non malignant condition of the biliary passages leading to multiple stricture formation in the intrahepatic and extrahepatic biliary passages. Sometime cholangiocarcinoma also presents as multiple strictures of the intrahepatic passages leading to jaundice.

**SINGLE STRICTURE**

It is usually present either in the common hepatic duct or common bile duct. The single stricture, when present in intrahepatic biliary canaliculi or in one of the hepatic ducts does not cause jaundice.

**INFLAMMATORY STRICTURE**

It is very rare and occurs secondary to collection of the bile or pus around the biliary passages. These strictures also present secondary to infestations with Ascaris Lumbricoids and Liver fluke. Both these worms lead to fibrous stricture and multiple stone formation in the biliary tree.

**NEOPLASTIC STRICTURES**

These are the strictures due to primary or secondary malignancies. Carcinoma of the head of pancreas and peri-ampulary carcinoma also obstruct the lumen of the lower end of the common bile duct leading to the obstructive jaundice.

Bile duct neuromas also cause surgical jaundice. Biliary obstruction due to bile duct neuroma typically occurs after previous cholecystectomy.

**IATROGENIC STRICTURES**

These are the strictures which occur accidentally during surgery of the biliary tree. If the ligature is applied after pulling the cystic duct during cholecystectomy, the lumen of the common bile duct is also partially ligated and stricture develops.

Injury to common bile duct and its improper repair may result in stricture due to cicatization and fibrosis. Stricture formation is more common after exploration of the common bile duct and after emergency operation on the biliary tree. Stricture of common bile duct may also follow use of electrocautery in close vicinity of common bile duct during laparoscopic cholecystectomy.

**FEATURES OF OBSTRUCTIVE JAUNDICE**

The symptoms and signs are very important and useful in the diagnosis of jaundice and its nature.
- Yellowish discoloration.
- Dark colored urine (due to presence of water soluble bilirubin).
- Clay colored stools (due to lack of
ABDOMINAL EXAMINATION
- Liver may get enlarged due to biliary congestion/metastatic spread.
- Palpable gall bladder (indicates malignant obstruction)

PALPABLE MASS
- Mass may be palpable in epigastrium in case of carcinoma head of pancreas causing biliary obstruction.
- Ascites (Signifying peritoneal metastasis or cirrhosis)

Both of these features are very reliable and have sensitivity of 92% and specificity of 86%.

INVESTIGATIONS
These are performed to confirm the diagnosis and plan the management.

URINE EXAMINATION
Urine contains bilirubin but no urobilinogen in obstructive jaundice.

BLOOD EXAMINATION
- Haemoglobin estimation.
- Total leucocyte count.
- Differential leucocyte count.
- Sedimentation rate.

LIVER FUNCTION TESTS
- Bilirubin level is raised (direct more than indirect)
- Enzyme assays help to assess damage to liver parenchyma
- Alkaline phosphatase level is raised.
- Prothrombin time needs correction if disturbed.
- Serum proteins help to assess overall liver’s synthetic capacity.

INVESTIGATION

<table>
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<tr>
<th>Test</th>
<th>Pre-hepatic</th>
<th>Hepatic</th>
<th>Obstructive</th>
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<td>Urine</td>
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<td>Serum bilirubin</td>
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<td>ALT (SGPT)</td>
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<td>AST (SGOT)</td>
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<td>ALP</td>
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<td>Blood glucose</td>
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<td>Reticulocyte</td>
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<td>Haptoglobins</td>
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<td>Prothrombin time</td>
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<tr>
<td>Ultrasound</td>
<td>Normal</td>
<td>May be abnormal liver</td>
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<td>texture, e.g. Cirrhosis</td>
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TUMOR MARKERS
- Serum Carcino Embryonic Antigen (CEA)
- Mild CA 19-9 elevation during jaundice or cholangitis is not necessarily indicative of cholangio carcinoma.

IMAGING
Intrahepatic problems leading to obstructive jaundice are best picked up by ultrasound, CT and MRI scan. All three types of scanning are
complementary to each other.

ULTRASONOGRAPHY
It is used as first line investigation for obstructive jaundice. The ultrasonographic examination shows:
- Size of bile ducts
- Defines the level of obstruction
- Identifies the cause (in some cases)
- Gives other information related to the disease (e.g. hepatic metastases, gall stones and hepatic parenchymal changes)

Ultrasound scan is very helpful as one can see the site of obstruction and cause of obstruction. It is non-invasive investigation. It has almost replaced other invasive investigations. It can be performed in severely jaundiced and ill patients at bed side.

CT SCAN (SPIRAL)
When jaundice is due to malignancy, CT scan is best investigation to diagnose. It is an excellent investigation to pickup the site of obstruction and cause of obstruction to the biliary passages. It may not be available at every hospital and is expensive. Thin-cut spiral CT scan predicts resectability in about 70%-80% of patients with carcinoma of the head of pancreas. The ability of dual phase CT scan to identify vascular involvement has eliminated the need for angiography.

MRCP (MAGNETIC RESONANCE CHOLECYSTO PANCREATICOGRAPHY)
It is an expensive investigation. It may not be available at every center. It offers excellent soft tissue definition. It can image in all planes without moving the patient. It avoids radiation exposure. It is non-invasive and does not carry any biological hazard. Proximal bile duct stricture can be imaged well with MRCP.

MRS (magnetic resource spectrometry) probably will be best of liver function tests in future.

ENDOSCOPIC ULTRASONOGRAPHY (EUS)
It is the use of ultrasonography through endoscope. It is useful in the diagnosis of bile duct and proximal pancreatic pathology. Recent advancement is use of intraductal ultrasonography (IDUS) in which the ultrasound probe is introduced into bile duct or pancreatic duct while performing ERCP.

E.R.C.P
Endoscopic retrograde cholangiopancreatography helps in finding out the obstruction specially in the lower parts of biliary passages. It is an excellent investigation for lower bile duct obstruction.

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PERCUTANEOUS TRANSHEPATIC CHOLANGIOGRAPHY (PTC)
Chiba needle is used under x-ray control and dye is injected into the biliary canaliculi and x-ray pictures are taken. This shows the site of obstruction and dilatation of the biliary passages. This is an excellent investigation as it shows proximal biliary passages very clearly.

It is extremely helpful as it drains the cholestasis and offers not only diagnostic but therapeutic help as well. It is not used as a first line investigation because of its invasive nature.

It can lead to intra peritoneal bleeding and leakage of bile into the peritoneal cavity. It may cause cholangitis as well. The patient must be admitted and kept under observation for at least 24 hours after the procedure.

LAPAROSCOPY
It is performed when biliary or pancreatic cancer is suspected. It provides most sensitive and reliable means of assessing, staging and judging the operability of biliary and pancreatic cancers, especially when combined with endoscopic ultrasonography. It also helps to palliate the patients.

DIFFERENTIAL DIAGNOSIS
Different causes of obstructive jaundice are to be differentiated from each other. History, examination and above mentioned investigations help to differentiate between all types of obstructive jaundice.

MANAGEMENT

OBJECTIVES OF MANAGEMENT
- To understand pathophysiology of jaundice.
- To establish the cause of jaundice.
- To identify the patients with obstructive / surgical jaundice requiring relief of cholestasis.
- To plan appropriate surgical procedure (treatment of cause of obstruction)
- To understand the principles of management during peri operative period (before, during and after surgery).

TREATMENT
The aim of treatment is to restore flow of bile into gastrointestinal tract and correct any metabolic or other complications due to biliary obstruction. Treatment of obstructive jaundice has two main components as given below;
- Conservative
- Definitive
CONSERVATIVE
It is used to prepare the patient for surgery as the definitive treatment for obstructive jaundice is surgical.

FLUID AND ELECTROLYTES
Fluids and electrolytes are given intravenously in calculated amount.

URINE OUTPUT MONITORING
Urethral catheter is passed to collect urine from the bladder and to monitor hourly urinary output. It has to be kept > 30ml/ Hour to prevent hepatorenal syndrome.

CORRECTION OF COAGULATION DEFECTS
Vitamin K has to be given intravenously as there is deficiency of this vitamin due to lack of absorption of fat soluble vitamins leading to bleeding disorders. (Prolonged PT).

Fresh frozen plasma is infused if Vitamin K injection fails to bring down the prothrombin time to normal limits.

PREVENTION OF INFECTION
The obstruction in the biliary tract leads to cholangitis and severe infections and septicaemia. If the patient is pyrexial, appropriate antibiotic is started prophylactically which will cover gram negative bacteria. 2nd/ 3rd generation Cephalosporin and quinolones are commonly used.

PREVENTION OF HEPATO-RENAAL SYNDROME
Jaundiced patients are likely to suffer from renal failure (hepato-renal syndrome). Loop diuretics or Mannitol 500 ml is given intravenously within 15-30 minutes just before the operation or during operation to clear the nephrons by causing diuresis to prevent renal failure.

NUTRITION
Basic caloric requirement of patient should be met. Enteral route is the preferred route. Large amount of glucose (carbohydrate) are required to replenish the glycogen content of the liver. (Rule out diabetes mellitus before giving glucose).

SURGICAL TREATMENT
This is the definite treatment of obstructive jaundice and it varies with the cause of obstruction and condition of the patient. Surgery is performed in physically fit patients to minimize morbidity. Surgical resection is performed in patients with operable disease in fit patients.

Various surgical options are available depending upon the cause and site of obstruction.

GALL STONES AND BILE DUCT STONES
The principle of treatment is;
- Removal of stones from CBD
- Removal of gall bladder
- Following combination of procedures is performed for treatment of obstructive jaundice due to stone disease.
- ERCP and Laparoscopic cholecystectomy is performed. Stones from the bile duct are removed.
- Open cholecystectomy and exploration of the common bile duct is performed and stones are removed.
- Laparoscopic cholecystectomy and exploration of the common bile duct and removal of stones is done.

Per-operative cholangiography is performed to ensure complete removal of the stones. T-tube drainage of the bile duct is performed.

MALIGNANT OBSTRUCTION OF BILE DUCT
Different options of resection depending upon
stage and site of tumor are available. Surgery is aimed at re-establishing reliable, long term conduit for bile flow from biliary to the gastrointestinal tract. Options for operative repair may include:

- Roux-en-Y hepaticojejunostomy
- Choledochojejunostomy
- Choledochoduodenostomy
- End-to-end repair (controversial)
- Mucosal grafting

Whipples resection is performed for operable carcinomas in case of carcinoma head of pancreas and tumors of ampulla. Previously its operative mortality used to be almost 22%. Now with the improvements in anesthesia and critical care, the mortality is reduced to about 10%.

**PALLIATIVE PROCEDURES**
These are performed when definitive and potentially curative resections are not possible. Palliation is provided by interventional endoscopy, radiology or open surgery\textsuperscript{11,12}. Following criteria is used to evaluate irresectable disease;

**CRITERIA FOR IRRSECTABILITY**
- Extra hepatic metastasis.
- Extra hepatic organ invasion.
- Peripheral hepatic metastasis remote from primary tumor.
- Major vascular involvement.

**OBJECTIVES OF PALLIATION**
- Relief of jaundice and pruritus.
- Prevention of recurrent cholangitis.
- Prevention of post cholestatic hepatic failure.

If the stricture is due to inoperable malignancy and by-pass is not possible, intubation of the bile duct with appropriate stent is performed to have adequate bile flow to the duodenum.

**ENDOSCOPIC STENTING**
It is use of stents to bypass the obstruction of bile flow. It reduces the hospital stay and is associated with lower procedure related morbidity and mortality. It is safe and effective in palliation of major symptoms associated with inoperable pancreatic carcinoma and cholangio carcinoma.

Plastic, polyethylene or self expanding metal stents (SEMS) are used in various sizes depending upon the size of lesion. The plastic stents occlude early and metal stents remain patent for longer period and are most cost effective in patients who survive for 3-6 months\textsuperscript{8}. Complications of stenting are;

- Pancreatitis
- Cholangitis
- Perforation
- Stent Migration
- Stent Occlusion
- Stent Fracture

These are recognized and treated on urgent basis\textsuperscript{10}. ERCP and stenting of proximal bile duct stricture adds little to diagnosis and management of the non infected operable patient.

**CHEMO-RADIATION**
Chemotherapy only offers marginal benefit. Radiotherapy helps in some tumors.

**INTRA LUMINAL BRACHYTHERAPY (ILBT)**
It is offered for the palliation of irresectable cholangio carcinoma. It gives mixed results. It can be performed endoscopically or percutaneously. Iridium-192 seeds implanted on a catheter are placed directly across the stricture. Higher doses of radiation can be
achieved at local level. It helps to relieve the obstruction by downsizing the tumor.

PHOTO DYNAMIC THERAPY (PDT)
It involves the intravenous administration of a photo sensitizer that preferentially accumulates in neoplastic tissue. Activation of the photo sensitizer is achieved by endoscopically applying laser light directly which results in the formation of free oxygen radicals in the tumor cells leading to ischemic necrosis\textsuperscript{10}.

HIGH INTENSITY INTRA-DUCTAL ULTRASOUND (HIUS)
Localized ablation of tumor cells by high intensity ultrasound has been found to be effective in experimental models as clinically in men with prostatic cancer. It is performed by passing an ultrasound probe over a guide wire into the bile duct during ERCP. Several treatments are applied throughout the length of stricture and stent is inserted after wards. It can be used as neo adjuvant therapy prior to performing potentially curative resection\textsuperscript{10}.

REFERENCES