STONES, SLUDGE, & STRICTURES: MANAGEMENT OF BENIGN & MALIGNANT BILIARY DISEASE

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Ten "Pearls"

1. Adequate pre-procedure imaging is essential: CT/MRI abdomen should be performed on the large majority of cases: percutaneous planning and complication prevention
2. Pre-procedural work-up will decrease procedural complications: antibiotics, IV hydration, correction of coagulation parameters
3. Adequate pain control will make the procedure more comfortable for patient/provider: do not get behind on conscious sedation, routine use of bupivicaine/intercostal blocks, and selective use of MAC/general anesthesia. Pre-op evaluation is very helpful in predicting which patients would benefit from an anesthesia consults
4. Left approach: left is typically less painful, easier for patient to take care of, and less likely to get dislodged
5. Right approach: lower bleeding complications, larger volume of liver is drained, less radiation exposure to operator
6. Keep manipulations to a minimum in septic patients: staged procedures are preferred with initial intra-hepatic drain placement then extended manipulation at one setting
7. Direct US access of segment 3 ducts in liver can be accomplished in thin patients with high quality ultrasound
8. Diagnosis of cholangiocarcinoma can be very difficult and may require repeat brush biopsies, intraductal forcep biopsies, and/or cholangioscopic biopsies through 12 Fr sheaths
9. Avoid metal stents in benign biliary disease
10. Post-procedure tube teaching with family and patient will increase treatment success, decrease follow-up calls/ER visits

Percutaneous transhepatic biliary drainage (PTBD) was described more than 45 years ago but has become clinically applicable mostly in the past 25 years after a number of technical advancements. It was first utilized as a means of providing palliative decompression for patients with malignant biliary obstructions. PTBD remains a viable treatment option for patients with advanced malignancies where few therapeutic alternatives exist. PTBD has increasingly been employed in the management of benign biliary diseases. Through the transhepatic tract created by PTBD, various therapeutic manipulations can be performed, including biliary lithotripsy, stricture dilatation, biliary biopsies, and sphincterotomy.

Pre-procedural assessment of the patient with obstructive jaundice

Consultation in a patient with obstructive jaundice should include a complete review of the patient's medical history, current imaging, and laboratory values. The level of biliary obstruction often determines the best initial approach for drainage. Ampullary and common bile duct obstructions can usually be treated from an endoscopic approach with lower complications then percutaneous drainage. PTBD is reserved for endoscopic failures. Hilar and intra-hepatic obstructions may be approach endoscopically but have lower success and higher complication rates. The decision on how to initially treat these lesions often depends on the pre-procedureal

imaging, degree of obstruction, clinical staus of the patient, local expertise, and local referral patterns. Patients with previous Roux-en-Y procedures, gastrojejunostomies, gastric/duodenal cancers, and duodenal diverticuli may be more successfully treated with percutaneous approaches.

Contraindications to percutaneous drainage include coagulopathy, ascites, no safe percutaneous approach, cirrhosis, or a liver mass preventing access to intra-hepatic ducts.

Antibiotic coverage:
It is the standard of care to administer pre-procedure antibiotics prior to biliary interventions. The biliary system is most commonly colonized by gram negative species (E. Coli, Klebsiella, enterobacter, Pseudomonas), enterococcus, and anaerobes. Third generation cephalosporins have good biliary excretion and ceftriaxone has a long half life with good biliary penetration-making it an appropriate choice. In bacteremic patients, additional enterobacter coverage is desirable and Unasyn (ampicillin/sulfbactam) or ampicillin/gentamycin are acceptable.

Unilateral versus bilateral approach:
Common bile duct lesions usually can be drained from an ipsilateral approach. Hilar based lesions or intrahepatic occlusions may require bilateral drainage unless one lobe is atrophied. The septic or bacteremic patient may require bilateral drainage to clear the infection.

Advantages of right approach:
Drain a greater volume of liver
Lower radiation exposure to the operator
Access is usually in a more peripheral duct with lower bleeding complications

Disadvantages of right approach
Intercostal access is usually more painful
Puncture above the 10 rib may lead to pneumothorax or empyema
More difficult for patient to take care of tube site
Higher incidence of tube dislodgement

Advantages of left approach
Easier for patient to care for catheter
Less pain associate with tube
Less likely to be dislodged
Ultrasound directed access into duct (segment III) is much easier
Avoids transpleural puncture and associated complications

Disadvantages of left approach:
Less liver volume drained
A more central duct usually accessed and high rates of bleeding reported
Higher radiation exposure to radiologist
Stomach/colon may be inadvertently punctured

NON-INVASIVE IMAGING OF OBSTRUCTIVE JAUNDICE

Non-invasive imaging advances in the past decade have greatly increased the diagnostic accuracy in patients with obstructive jaundice and improved the accuracy of pre-operative planning.
Hepatobiliary ultrasound is typically the initial imaging modality of choice because of low cost, ready availability, excellent spatial resolution and the ability to evaluate the hepatic vasculature. It is optimally performed in the fasting patient, in supine and RAO positions, and is less accurate in the obese patient. The CBD is normally 4-8mm in diameter but can be as large as 10mm in the post-cholecystectomy patient. Intra-hepatic ducts are usually 2mm or less in diameter in the porta-hepatis. The appearance in the periphery of the parenchyma is abnormal and termed the

“double duct” sign. Diagnostic accuracy for biliary obstruction is >90% in most series but identification of the cause is ~ 70%.
Multidetector CT imaging has revolutionized medical imaging and hepatobiliary imaging can be performed rapidly in multiple phases increasing lesion detection and characterization. Imaging of the entire liver volume can be accomplished in a single breath hold increasing accuracy. Hypervascular tumors (hepatoma, FNH, adenomas, vascular mets) are best detected in the arterial phase and hypovascular masses are best detected in the venous phase. Biliary tract imaging is optimized with thin section collimation and overlapping axial reconstructions. 3-D reconstructions are more accurate and allow CTA of the hepatic arterial/venous systems with CT cholangiography.

MRI imaging of the liver is usually complimentary to US and CT for obstructive jaundice but can be utilized primarily in the patient with an iodinated contrast allergy. MRCP has become an excellent non-invasive alternative to ERCP in the patient group. MRCP with 3-D reconstruction uses heavily T2 weighted images which reveals the biliary system as high signal intensities structures. It is useful in evaluating congenital anomalies, benign, and malignant causes of obstruction. It is becoming increasingly important as a pre-operative non-invasive means to evaluate the biliary tree prior to transplant, hepatic resection, or to rule out choledocholithiasis.

Non-invasive imaging is critical in confirming obstruction, documenting the level of obstruction, etiology of the obstruction, and planning the endoscopic or percutaneous intervention- thus, decreasing the chances of peri-procedural complications.

COMPLICATIONS OF PERCUTANEOUS BILIARY INTERVENTIONS

Complications decrease with adequate pre-operative planning, experience, and patient preparation but cannot be eliminated. In most institutions common hepatic and common bile duct level obstructions are usually attempted first from an ERCP approach because of a higher technical success and lower complication rate. PTBD is reserved for ERCP failures. Hilar and intra-hepatic obsctructions should usually be approached via a PTBD approach because of higher technical success rates.

MAJOR COMPLICATION RATES FOR PTBD:

COMPLICATION	REPORTED	THRESHOLD
Sepsis	2.5%	5%
Hemorrhage	2.5%	5%
Localized infection	1.2%	5%
Pneumothorax	0.5%	2%
Death	1.7%	3%

Sepsis occurs in 1-2.5% of patients and can be minimized by pre-procedural antibiotics, IV hydration, and avoiding excessive manipulation/distention of the biliary system during initial drainage. Complications from sepsis can be further limited by rapid recognition and treatment.

Major bleeding can occur from venous or arterial sources. The occurrence of bleeding increases with left sided and central punctures. Venous bleeding can usually be corrected by repositioning the sideholes of the drainage catheter more centrally. At times, the access may need to be relocated and the tract should be embolized during removal.

Arterial bleeding is classically episodic and associated with a drop in hematocrit levels. Bleeding may present as UGI bleeding and endoscopy may reveal bleeding from the ampulla. A high index of suspicion needs to be maintained because arterial bleeding can result in exanguination and death. Selective angiography of the hepatic artery needs to be performed with and without the drainage catheter in place. An intra-hepatic pseudo aneurysm is usually the source The artery needs to be super selectively catheterized and the bleeding point trapped with coils deployed distal and proximal to the injury to prevent back filling from intra-hepatic collaterals.

TREATMENT OF BENIGN BILIARY STRICTURES

Interventional radiologists and percutaneous management of benign biliary strictures play an important role in the management of benign biliary strictures. The role varies depending on the etiology and location of the lesion. Benign strictures are the result of surgical interventions related to inadvertent trauma during cholecystectomy or bile duct exploration and are usually ischemic in nature. They occur at the site of hepatico-jejunostomy anastamosis in transplant patients and occur more frequently in living related transplants. Benign strictures are also caused by inflammatory conditions including primary/secondary sclerosing cholangitis, pancreatitis, and stone disease.

These patients are best treated in a staged approach-initial PTBD with balloon dilation and upsizing being delayed several days. Balloon dilation is usually accomplished with a high-pressure balloon (20-30 atm) and diameters ranging from 6-10mm -depending on the level of obstruction. The biliary tube should be upsized to 14-16 French and drainage is usually for 3-6 months. In CBD lesions, it may be preferable to convert to ERCP drainage via a rendezvous procedure, this allows several tangential 8-10Fr stents to be placed for large caliber dilation.

In patients with stone disease, percutaneous or ERCP stone removal may be accomplished with standard occlusion balloon, basket, or cholangioscopy followed by sphincterotomy and ursidiol treatment to prevent recurrence.

Published data for long-term success of percutaneous management of benign strictures varies from 55-75% and depends on etiology, location, and technique. Placement of metallic stents in benign disease should be avoided because long term patency rates are poor and they may limit surgical options.

MALIGNANT BILIARY DISEASE

Unilateral versus bilateral drainage for treatment of malignant disease depends on the level of obstruction, presence of infection, degree of lobar atrophy, and overall prognosis. Right-sided drainage may be adequate in the non-infected patient with mild-moderate hyberbilirubinemia-particularly if the level of obstruction is at the common duct.

Tissue diagnosis can be made via bile cytology, endobiliary biopsy, percutaneous biopsy, or biopsy utilizing endoscopic ultrasound guidance. Endoscopic biopsy can be accomplished using brush biopsy, forcep biopsy, or direct cholangioscopic biopsy with increasing diagnostic yield, respectively. Diagnosis of cholangiocarcinoma can be notoriously difficult.

The decision to maintain adequate long-term drainage with internal external biliary versus internalization with metallic stents depends on the patient's prognosis, location of obstruction, patient's wishes as well as their ability to tolerate percutaneous drainage. If the patient's prognosis is for less then a year survival, the obstruction is in the CBD, or the patient is tolerating percutaneous drainage poorly- internalization is favored. If the tumor involves the duodenum or extends through the papilla into the duodenum- internalization is relatively contraindicated. Metallic stent choices are numerous and include balloon expandable versus self-expanding and bare metal versus covered. There is a paucity of level 1 data in the literature to guide the interventionalist. Patency data appear similar because stent failure is usually due to tissue growth extending above or below the stent. If a bare metal is utilized, a stent with tight cell pattern is preferable to prevent tumor in-growth. If the gallbladder has not been removed-covering the cystic duct with a covered stent graft may lead to cholecystitis and is to be avoided. Extension of the stent just through the ampulla is preferred to maximize biliary drainage and avoid distal tumor growth and ampullary dysfunction. Hilar-based occlusions frequently require bilateral drainage and this can be accomplished via bilateral stent placement from right and left approaches (Y-stent configuration) or via a unilateral access (T configuration).

Percutaneous drainage with internal brachytherapy with adjunctive external beam radiation appears to improve survival in patients with cholangiocarcinoma. The interventionalist must measure the distance from the external hub of the biliary catheter to both the proximal and distal extents of the tumor margin to help plan bracytherapy. The Mayo group has combined this treatment followed by liver transplantation.

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