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Jay Luther and Lawrence S. Friedman

Management of coagulopathy in patients with advanced liver disease undergoing therapeutic endoscopic procedures is complex. Improvements in the understanding of hemostasis at a physiologic level have highlighted the inaccuracy of currently available clinical tests, like platelet count and prothrombin time, in estimating hemostasis in patients with cirrhosis. With identification of novel factors that contribute to bleeding risk in patients with cirrhosis, there is a dearth of clinical trial data that account for all potentially relevant factors and that examine interventions to reduce bleeding risk. Precise recommendations regarding transfusion strategies based on hemostatic test results in patients with cirrhosis are impractical.

Polypectomy, Endoscopic Mucosal Resection, and Endoscopic Submucosal Dissection in the Cirrhotic Population  13
Ahmad Nakshabandi, Manasi Rungta, and Mohamed O. Othman

Endoscopic mucosal resection and dissection are advanced endoscopic procedures that have proven essential for resecting premalignant and early malignant lesions throughout the gastrointestinal tract. Over time, these procedures have proven to play a key role in avoiding more invasive surgical approaches and thus decrease overall mortality. However, the success of these procedures does come with a slightly increased risk of adverse events such as bleeding and perforation. In this article, we review the literature for reported adverse events, specifically in the cirrhotic population. This article also discusses experts’ opinions on approaches taken to perform these procedures with acceptable risks.

Endoscopic Treatment of Esophageal Varices  21
Marc J. Zuckerman, Sherif Elhanafi, and Antonio Mendoza Ladd

Acute variceal bleeding is a complication of portal hypertension, usually due to cirrhosis, with high morbidity and mortality. There are 3 scenarios for endoscopic treatment of esophageal varices: prevention of first variceal bleed, treatment of active variceal bleed, and prevention of rebleeding. Patients with cirrhosis should be screened for esophageal varices. Recommended endoscopic therapy for acute variceal bleeding is endoscopic variceal banding. Although banding is the first-choice treatment, sclerotherapy may have a role. Treatment with Sengstaken-Blakemore tube or self-expanding covered metallic esophageal stent can be used
for acute variceal bleeding refractory to standard pharmacologic and endoscopic therapy.

**Endoscopic Treatment of Gastric and Ectopic Varices**

Roberto Oleas and Carlos Robles-Medranda

Gastric variceal bleeding has a high mortality. Endoscopic cyanoacrylate injection is the standard therapy; however, rebleeding and unexpected adverse events, such as injection sites ulcers and distal glue embolisms, are pitfalls of this therapy. Endoscopic ultrasound (EUS)-guided endovascular therapies offer a safer and more practical alternative for the treatment of gastric varices. EUS-guided combined therapy with coiling and cyanoacrylate injection is the most promising alternative with high obliteration rates and fewer adverse events reported. The authors reviewed the latest available data for all endoscopic therapies proposed for the management of gastric varices in patients with chronic liver disease.

**Role of Endoscopic Retrograde Cholangiopancreatography in the Diagnosis and Management of Cholestatic Liver Diseases**

Tara Keihanian, Monique T. Barakat, Sooraj Tejaswi, Rajnish Mishra, Christopher J. Carlson, John J. Brandabur, and Mohit Girotra

Cholestatic liver diseases (CLDs) occur as a result of bile duct injury, emanating into duct obstruction and bile stasis. Advances in radiological imaging in the last decade has replaced endoscopic retrograde cholangiopancreatography (ERCP) as the first diagnostic tool, except in certain groups of patients, such as those with ischemic cholangiopathy (IsC) or early stages of primary sclerosing cholangitis (PSC). ERCP provides an opportunity for targeted tissue acquisition for histopathological evaluation and carries a diverse therapeutic profile to restore bile flow. The aim of this review article is to appraise the diagnostic and therapeutic roles of ERCP in CLDs.

**Improving Diagnostic Yield in Indeterminate Biliary Strictures**

David J. Restrepo, Chris Moreau, Cyrus V. Edelson, Ameesh Dev, Shreyas Saligram, Hari Sayana, and Sandeep N. Patel

Indeterminate biliary strictures are defined as a narrowing of the bile duct that cannot be differentiated as malignant or benign after performing cross-sectional imaging and an ERCP. Identifying the etiology of a bile duct stricture is the single most important step in determining whether a complex and potentially morbid surgical resection is warranted. Due to this diagnostic and therapeutic dilemma, new technologies, laboratory tests, and procedures are emerging to solve this problem.

**Management of Biliary Complications in Liver Transplant Recipients**

Justin J. Forde and Kalyan Ram Bhamidimarri

Biliary complications are often referred to as the Achilles' heel of liver transplantation (LT). The most common of these complications include strictures, and leaks. Prompt diagnosis and management is key for preservation of the transplanted organ. Unfortunately, a number of factors
can lead to delays in diagnosis and make adequate treatment a challenge. Innovations in advanced endoscopic techniques have increased non-surgical options for these complications and in many cases is the preferred approach.

Endoscopic Ultrasound-Guided Biliary Interventions in Liver Disease 101
Shyam Vedantam and Sunil Amin

If endoscopic retrograde cholangiopancreatography (ERCP) fails in cases of biliary obstruction and jaundice, percutaneous drains have been traditionally the current second-line option. Endoscopic ultrasonography-guided biliary drainage (EUS-BD) with choledocoduodenostomy or hepaticogastrostomy is alternative modality that have shown equivalent or better technical and clinical success compared with percutaneous drainage. Similarly, EUS-guided gallbladder drainage has emerged as a therapeutic option in acute cholecystitis as well. Furthermore, EUS-BD avoids some of the pitfalls of percutaneous drainage. Current research in EUS-BD involves optimizing devices to improve technical and clinical success. In centers with advanced endoscopists trained in these procedures, EUS-BD is an excellent second-line modality.

Endoscopic Ultrasound for the Diagnosis and Staging of Biliary Malignancy 115
Martin Coronel, Jeffrey H. Lee, and Emmanuel Coronel

Cholangiocarcinoma (CCA) is the most common neoplasm of the biliary tract. The biological behavior and prognosis of CCA vary depending on the tumor’s location in the biliary tree, dictating a different diagnostic, and treatment approach. Establishing a diagnosis of CCA remains a challenge and up to 20% of biliary strictures can yield indeterminate results, despite extensive evaluation. Endoscopic ultrasound (EUS) has become an effective diagnostic tool, as it provides high-quality images of the bile duct and allows for the sampling of strictures in the same plane of view. In this chapter, we explore the utility of EUS as a diagnostic and staging tool for biliary cancers.

Endoscopic Ultrasound-Guided Liver Biopsy 127
Ishaan K. Madhok, Nasim Parsa, and Jose M. Nieto

Endoscopic ultrasound-guided liver biopsy (EUS-LB) has emerged as a safe and effective alternative to percutaneous and trans-jugular approaches for hepatic tissue acquisition. It has shown superior diagnostic yield for the targeted approach of focal lesions, less sampling variability, improved patient comfort, and safety profile. These advantages have contributed to the increased use of EUS-LB as a technique for obtaining liver tissue. In this review, we provide an update on the recent evidence of EUS-LB for the evaluation of liver disease.

Endoscopic Bariatric Interventions in Patients with Chronic Liver Disease 139
Marco A. Bustamante-Bernal, Luis O. Chavez, and Marc J. Zuckerman

Obesity and its associated comorbidities are rapidly increasing in the US population. Therefore, metabolic associated fatty liver disease (MAFLD),
previously known as nonalcoholic fatty liver disease (NAFLD), has become
a leading indication for liver transplantation. Lifestyle modifications as a
sole therapy have been insufficient to reduce the burden of chronic liver
disease secondary to MAFLD. Endoscopic bariatric interventions (EBI)
appear to be safe and effective therapies for obesity and chronic liver dis-
ease secondary to MAFLD. Gastric EBI include endoscopic sleeve gastro-
plasty (ESG) and intragastric balloons (IGB). Small bowel EBI are also
evolving in the field of bariatric endoscopy.

Endoscopic Ultrasound Evaluation of Portal Pressure

Enrico O. Souto

Portal hypertension is a complex syndrome with multiple clinical manifes-
tations that develop in a variety of conditions and diseases. Endoscopic
ultrasound (EUS) permits direct measurement of portal pressure and offers
an alternative to transjugular pressure measurement. The technique ap-
ppears to be safe and provides reproducible measurements.