Endoscopic Ultrasound Guided Biliary Drainage (EUS-BD) in Patients with Benign Biliary Strictures (BBS)

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**Background of the Study**

Bile duct strictures are a significant cause of morbidity and mortality. It is caused by narrowing of the bile ducts thus preventing the proper flow of bile into the gastrointestinal tract. These strictures can be subdivided into benign and malignant strictures with the former being less common with a prevalence of 30%1. Differentiating between the two is very important since it can affect the prognosis, clinical course and treatment of a patient. This involves taking a good clinical history and physical examination, laboratory work up such as blood tests, abdominal imaging such as computed tomography scan or magnetic resonance cholangiopancreatography, and biopsy of the stricture which is the gold standard. Cyto/histological diagnosis can be done through brushings and/or biopsy by Endoscopic Retrograde Cholangiopancreatography (ERCP) or Endoscopic Ultrasound (EUS) guided fine needle aspiration.

Benign biliary strictures have different etiologies with iatrogenic bile duct injury from post operative complications being the most prevalent at 80%1. Of these, cholecystectomy is the most common iatrogenic cause of BBS from hepatobiliary surgery. This is followed by post liver transplantation with anastomotic biliary stricture being the most common adverse event2, usually occurring 3-6 months post surgery.

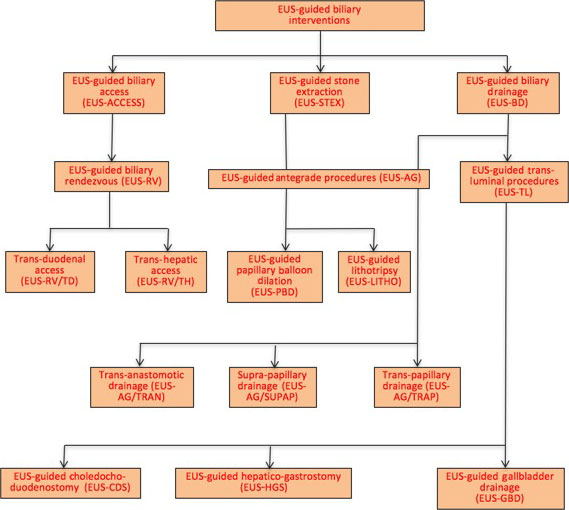
The second most common etiology of BBS (10%) is chronic pancreatitis which affects the common bile duct through periductal fibrosis and inflammation1. The other etiologies of benign biliary strictures include: inflammatory cholangiopathies such as primary sclerosing cholangitis, inflammation from bile duct stones, side effects of radiation or chemotherapy, infectious etiologies such as tuberculosis, trauma to the abdomen1.

Endoscopic retrograde cholangiopancreatography (ERCP) has been the standard of care for the management of biliary strictures2. However, this is not always feasible or successful due to altered anatomy from surgery, gastric or duodenal outlet obstruction which leads to inaccessibility of the ampulla, and altered anatomy of the ampulla. Double balloon enteroscopy (DBE) assisted ERCP may also be difficult due to difficulty in obtaining a direct view of the papilla, limited availability of ERCP accessories for DBE scope length and is time consuming. Percutaneous transhepatic biliary drainage (PTBD) has been used as an alternative to ERCP in these cases. However, PTBD is associated with a lot of complications such as bile leak, peritonitis, tube dislodgement, recurrent infection, bleeding. The placement of external catheters during PTBD causes pain and inconvenience to the patient as well as negative cosmetic effects. Furthermore, multiple procedures are often required for tube upsizing, dislodgement and clearing of obstruction.

Endoscopic ultrasound has emerged as an important modality in the diagnosis and treatment of gastrointestinal diseases. It provides real time images and access to organs which are inaccessible by other means. Recent technological advances and the development of new accessories in the field of endoscopic ultrasound has revolutionized the management of biliary strictures by providing an alternative approach to its management. Some indications for endoscopic ultrasound guided biliary drainage include palliation for malignant biliary obstruction in patients with failed ERCP due to inaccessibility of the papilla (altered gastrointestinal anatomy or duodenal obstruction)4. Advantages of endoscopic ultrasound over ERCP for biliary drainage include multiple access points into the biliary tree from the gastrointestinal tract without the requisite of an accessible papilla4. Several studies have proven the safety and efficacy of endoscopic ultrasound in the management of biliary strictures. Two studies comparing EUS-BD and PTBD have shown almost equivalent success rates of PTBD and EUS-BD with lower adverse events in the EUS biliary drainage group5,6. A meta-analysis by Sharaiha et al12 demonstrated that there was no difference in technical success between EUS biliary drainage and PTBD11. Results from this meta-analysis also showed that there was a higher clinical success rate and lower complication rates in the EUS biliary drainage than in the PTBD group. A retrospective study comparing EUS-BD and PTBD demonstrated a higher complication rate (18.2% vs 39.2%, p=0.08) and higher cost ($9,218 vs $8,216 , p=0.004 ) of PTBD10.

**EUS-BD Techniques**

There are several ways of providing biliary drainage via endoscopic ultrasound. The first method is by access via the intrahepatic bile duct. This can be done through the transpapillary route via antegrade and rendezvous method or transmural via hepaticogastrostomy. The other method of endoscopic ultrasound guided biliary drainage is by access through the extrahepatic bile duct again through transpapilliary via the antegrade and rendezvous method or transmural through choledocoduodenostomy5. A study by Khashab et al showed that there were fewer stent occlusions from the transluminal approach to biliary drainage than the transpapillary approach. Fully covered self expanding metallic stents are used for the procedure.



Dhir et al, Endoscopic Ultrasonography-guided Biliary and Pancreatic Duct Interventions. Digestive Endoscopy 2017; 29; 472-485

**Objectives of the study**

There are numerous studies in the literature demonstrating the safety and efficacy of EUS-BD in patients with malignant biliary strictures. However, there is a paucity of such data in patients with BBS with failed ERCP due to difficult cannulation or altered GI anatomy. Therefore, we aim to perform a pilot study to assess the safety and efficacy of EUS-BD in patients with BBS.

**General Objectives**

To determine the efficacy and safety of endoscopic ultrasound biliary drainage for the management of benign biliary strictures

**Primary Aim**

To determine the clinical success of EUS biliary drainage defined by a reduction in serum bilirubin by 50% at 2 weeks

**Secondary Aims**

1. To determine the technical success of EUS guided stent placement as defined by the ability to insert a stent across a fistula between the biliary tree and the gastrointestinal tract
2. To determine the incidence and severity of adverse events as defined by the American Society of Gastrointestinal Endoscopy
3. To determine the average cost of endoscopic ultrasound guided biliary drainage by noting the quantity and cost of accessories used during the procedure and length of hospital stay
4. To determine stent patency defined as time interval between stent placement and its occlusion
5. To determine the rate of biliary re-intervention which is defined as any intervention done to improve biliary drainage6

**Significance of the Study**

This study aims to determine the efficacy and safety of biliary drainage via endoscopic ultrasound for benign biliary strictures. Based on the data to be collected, this will help to establish the utility of this procedure and aid the clinician on decision making whether to send a patient for endoscopic ultrasound for biliary drainage rather than PTBD after failed ERCP.

**Study Design**

This will be a single center prospective pilot study of six patients who will undergo EUS-BD at the Royal Prince Alfred Hospital. Patients scheduled for biliary drainage will be interviewed and asked to participate in the study. Informed consent will be obtained prior to the procedure discussing the risks, benefits and alternative treatments to the patient. Subjects will be admitted to the hospital for observation after the procedure. Reasons for failed ERCP will be noted. Post procedure, patients will be monitored for abdominal pain, complications which include bleeding requiring blood transfusion or drop in hemoglobin >2/L, cholangitis, bile leak, peritonitis, pancreatitis, stent migration and death4. The American Society of Gastroenterology lexicon criteria for adverse events will be utilized. Mild adverse event included post procedure medical consultation, unplanned hospital admission or prolongation of hospital stay for >3 nights. Moderate adverse events included unplanned anesthesia/ventilation support meaning endotracheal intubation during conscious sedation, unplanned admission or prolongation for 4-10 nights, ICU admission for 1 night, transfusion, repeat endoscopy for an adverse event, interventional radiology for an adverse event, interventional treatment for integument injuries. Severe adverse event included unplanned admission or prolongation for >10 nights, ICU admission >1 night, surgery for an adverse event and permanent disability.

**Inclusion criteria**

1. Adult patients >18 years old
2. Patients with obstructive jaundice secondary to benign biliary strictures for biliary drainage
3. Failed ERCP to access the bile duct because of failed cannulation
4. Surgically altered anatomy requiring DBE-ERCP
5. Refusal of PTBD

**Exclusion criteria**

1. Pregnancy
2. Patients with bleeding tendency defined as having a platelet less than 50,000 or INR >1.5, PTT >50 seconds
3. Malignant biliary strictures

**Methodology**

The study will include patients scheduled for biliary drainage at Royal Prince Alfred Hospital. The procedure will be explained to the patient and written informed consents will be secured from those willing to participate. Endoscopic ultrasound guided biliary drainage will then be carried out on these patients. This modality involves the use of a linear echoendoscope and four essential steps:

1. The dilated bile duct will be viewed under endoscopic ultrasound and its diameter will be noted. It is then accessed via needle where the bile duct is punctured with a 19Gauge needle from the stomach into a dilated left intrahepatic bile duct or from the duodenum into the dilated common bile duct.
2. After the needle reaches the biliary tree, it will be aspirated to check for bile to determine correct placement of the needle. After which, a 0.025 inch (Visiglide, Olympus) guidewire is then introduced inside the biliary tree.
3. The fistulous tract will be created between the biliary tree and the gastrointestinal tract and then dilated with either a 4mm dilating balloon (Hurricane, Boston Scientific) or through a 6Fr cystotome (Endoflex)
4. A stent will then be deployed over the guidewire. A fully covered stent (Boston Scientific) will be placed for choledochoduodenostomy and fully covered or partially covered stents (Boston Scientific) for hepaticogastrostomy. Fully covered stents (Boston Scientific) will be used for antegrade transpapillary stent placement

**Description of Outcome Measures**

After endoscopic ultrasound guided biliary drainage has been carried out, technical success and clinical success as defined above, type of biliary drainage (whether EUS-HG, EUS-CD, EUS-RV), incidence and severity of adverse events, cost, biliary reintervention will be recorded. Changes in liver function tests which include serum bilirubin, alkaline phosphatase, GGT will also be recorded. Quality of life will be assessed using SF36 score.

**DATA COLLECTION FORM**

|  |  |  |
| --- | --- | --- |
| **Patient demographics** | | |
| Patient study code: | Sex: M / F | |
| DOB: | Age: | |
| Comorbidities: | | |
| Previous surgeries: | | |
| ASA: I / II / III / IV / V | Anticoagulants: Aspirin / Warfarin (or similar) | |
| Hospital | Recruitment No.: | |
| Diagnosis: |  | |
| Reason for Failed ERCP | |  |
| Admission symptoms: | | |
| Complete blood count (Hgb, WBC, Platelet): | | |
| APTT/INR: | | |
| Total bilirubin level: | | |
| Alkaline Phosphatase Level | | |
| GGT level: | | |
| Pertinent imaging findings: | | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **EUS-BD procedural details** | | | | | | | | | |
| Date of procedure: | | | Procedure time:\_\_\_\_\_\_\_\_\_\_\_ min | | | | | | |
| Type of BD: EUS-HG/ EUS-CD/ EUS-RDV | | | | | | | | | |
| EUS findings:   * IHD/ CBD diameter:   \_\_\_\_mm | |  | | | | | |  | |
| Scope position: long / short | | | | Needle: 19G / Other \_\_\_\_\_\_ | | | | | |
| GW: 0.025”/ Other \_\_\_\_\_\_\_\_ | | | | | |  | | | |
| Fistulous tract dilated via:  6 Fr cystotome(endoflex)/ 4mm dilating balloon (Hurricane) \_\_\_\_\_\_\_\_\_\_\_\_ |  | | | | | | | |  |
| Successful stent deployment: No / Yes | | | | | Difficulty encountered: No / Yes | | | | |
| Pls state reason if unsuccessful or difficult: | | | | | | | | | |
|  | | | | | | |  | | |
|  | | | | | | |  | | |
| Additional stent placed?: No / Yes | | | | | If yes, pls state reason: | | | | |
|  | | | | | | |  | | |
|  | | | | | | |  | | |

**Study intervention failure**

|  |  |  |  |
| --- | --- | --- | --- |
| Salvage procedure performed: | * PTBD |  | * others |
| Pls provide details: | | | |
|  | | | |

|  |  |  |
| --- | --- | --- |
| **Post-procedural details** | | |
| Date of resumption of diet: | |  |
| Analgesic required: \_\_\_\_\_\_tab | | |
| Technical Success: Yes/ No | | |
| Clinical Success: Yes/ No | | |
| Day 2 Hemoglobin: | | |
| Day 2 Serum Bilirubin: | | |
| Day 2 Alkaline Phosphatase: | | |
| Day 2 GGT: | | |
| Fulfill discharge criteria? No / Yes  *Afebrile*  *Flatus or bowel output*  *Able to tolerate diet*  No subjective complaints  No abdominal pain | | Date of discharge: |
| If No, Reason: | | |
| Treatment given: |  | |
| Total Cost of procedure: |  | |

|  |  |
| --- | --- |
| **Adverse events during admission:** | |
| **Procedure-related:** | |
| Pneumoperitoneum: No / Yes / Possible | Abdominal Pain: No / Yes |
| Date, Treatment or Comment: | Date, Treatment or Comment: |
|  |  |
|  |  |
|  |  |
| Bile leak: No / Yes / Possible | Bleeding: No / Yes / Possible |
| Date, Treatment or Comment: | Date, Treatment or Comment: |
|  |  |
|  |  |
|  |  |
| Pancreatitis: No / Yes / Possible | Others (pls specifiy): |
| Date, Treatment or Comment: | Date, Treatment or Comment: |
|  |  |
|  |  |
|  |  |
| **Stent-related** | |
| * Migration | * Malposition |
| Date, Treatment or Comment: | Date, Treatment or Comment: |
|  |  |
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|  |  |
|  |  |
| * Malfunction | Others (pls specifiy): |
| Date, Treatment or Comment: | Date, Treatment or Comment: |
|  |  |
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|  |  |
| Mortality: No / Yes | Date: |
| If Yes, cause of death: | |

**Follow Up Data 2 weeks post procedure:**

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| --- | --- |
| Date of follow up: |  |
| Stent patent?: |  |
| Subjective complaints: |  |
| Total bilirubin: |  |
| Alkaline Phosphatase: |  |
| QOL using SF36 score: |  |
| Other comments: |  |

**Follow up 30 days post procedure:**

|  |  |
| --- | --- |
| Date of follow up: |  |
| Stent patent?: |  |
| Subjective complaints: |  |
| Total bilirubin: |  |
| Alkaline Phosphatase: |  |
| QOL using SF36 score: |  |
| Other comments: |  |

**Stent Dysfunction / Failure**

|  |  |  |  |
| --- | --- | --- | --- |
| Date of Stent Failure |  | | |
| Type of imaging | USG / CT | Cause of obstruction |  |
| Findings from imaging: | | | |
| Rise in bilirubin/alkaline phosphatase noted? | | | |
| Treatment or Comment: | | | |
| PTBD done? | | | |

|  |  |
| --- | --- |
| **Cumulative number of events** | |
| Number of serious adverse events (peri-procedural): |  |
| Number of unplanned re-admissions or re-interventions (FU): |  |
| Total number of events: |  |

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