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The management of benign biliary strictures

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ABSTRACT

The most common cause of Benign Biliary Stricture is post cholecystectomy bile duct injury. Following introduction of the laparoscopic cholecystectomy procedure the incidence of bile duct injury and stricture has increased. The studies suggest that the incidence remained stable even after the improved learning curve. The early diagnosis and prompt management is the key in preventing devastating sequelae of this benign condition. The management of post cholecystectomy biliary strictures involves a multidisciplinary approach. Our review aims to describe the present strategy in management of post cholecystectomy biliary strictures.

Key words: Benign biliary stricture; Multidisciplinary management; Post cholecystectomy biliary strictures.

INTRODUCTION

Benign Biliary Strictures (BBS) mostly occur following bile duct injury after some upper abdominal operations mainly laparoscopic cholecystectomy and the increasing use of this procedure explains the recent rise this complication[1,2]. Population based data from the USA suggest that the incidence of post cholecystectomy bile duct injury ranges from 0.1 to 0.5%[3,4]. Studies also suggest that this incidence has remained stable in spite of an improved learning curve as well as technical advances[5,6]. About 30-60% of patients with bile duct injury can develop strictures[7,8,9]. Benign Biliary Stricture following injury can result in serious complications like cholangitis, hepatolithiasis, liver atrophy, secondary biliary cirrhosis and portal hypertension. Our review aims to describe the present strategy in management of Benign Biliary Strictures with the main focus being post cholecystectomy biliary strictures.

Causes of Benign Biliary Strictures

The most common cause of a BBS is iatrogenic and among these laparoscopic cholecystectomy tops the list. Benign Biliary Strictures can also be seen in 3-6% of patients who have undergone liver transplantation[10,11] and approximately 3-23% of patients with advanced chronic pancreatitis can have symptomatic biliary strictures[12]. The causes of BBS are shown in table I.

Classification

The most comprehensive and commonly used classification (Figure 1) was proposed by Strasberg and can be applied irrespective of the duration of the bile duct injury[7]. The Type E class in the Strasberg classification is adapted from the Bismuth

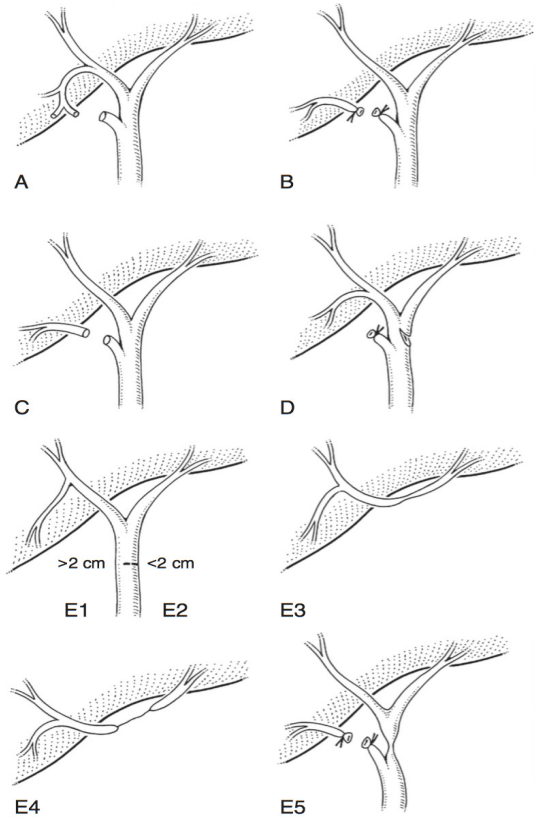

Figure 1. Bismuth-Strasberg classification of bile duct injury
A. Bile leak from the minor duct still in continuity with the common duct. B. Ligation of an aberrant duct. C. Bile leak from a minor duct not in continuity with common duct D. Lateral injury to the extra hepatic bile duct. E. Adapted from Bismuth's classification of biliary strictures. E1. Common hepatic duct (CHD) stricture with stump length >2 cm. E2. CHD stricture with stump length < 2 cm. E3. Hilar stricture but communication between right and left ductal system maintained. E4. Hilar stricture with separation of right and left ductal system. E5. Stricture of aberrant right sectoral duct with or without common duct injury.

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classification[13]. Stewart Way's classification is based on the mechanism and anatomy of the injury which also takes vascular trauma into account[14].

Clinical presentation

The symptoms of a BBS depends on the interval it occurs after the injury. In a study of 300 patients who had undergone operative management for BBS Sikora et al reported a median injury-to-stricture repair interval of 7 months (range 0.2 to 360 months)[15]. Seventy percent of the patients had jaundice at presentation and nearly half had pruritus. There was either a history of cholangitis or it was present at the initial encounter in 70% of patients. External biliary fistulae were seen in 22% and portal hypertension in 3.7%.

EVALUATION OF BBS

Laboratory testing

Liver function tests usually reveal a conjugated hyperbilurubinaemia with elevated alkaline phosphatase levels. Patients with obstructive jaundice and elevated serum CA19/9 levels are more likely to have a malignant rather than a benign cause. Other investigation results favouring a malignant aetiology as reported by Saluja et al are a serum bilirubin level > 8.4 mg/dl. This has sensitivity of 83% and specificity of 70%. A raised CA 19/9 level > 100 U/L had a sensitivity of 45% and a specificity of 88%[16]. However in the presence of obstructive jaundice CA 19/9 levels can be elevated and should be repeated 2 to 3 weeks following the relief of jaundice. In benign strictures the level falls.

RADIOLOGICAL TESTS

Abdominal ultrasound (USG)

This is a low cost, readily available tool for the evaluation of BBS. Abdominal USG helps in identifying the intrahepatic biliary radical dilatation and the level of obstruction with a sensitivity reaching nearly 100%. It is however a poor investigational tool for diagnosing the cause of strictures or any masses[17,18]. Duplex ultrasound is useful especially in proximal strictures and when a coexisting vascular injury is suspected.

Computed tomography (CT)

In biliary strictures CT will not only confirm an obstruction but can also diagnose malignancy. Shanbhogue et al demonstrated that the significant findings on multiphase CT which suggested malignancy were - a wall thickening of 1.5 mm suggestive of a mass, rim-like contrast enhancement in either the arterial or portal phase, a long stricture (1.8 cm vs 0.7 cm), higher proximal dilatation (2.2 cm vs 1.8 cm) and lymph node enlargement 1 cm[19]. CT angiography (Figure 2) can also help to identify co-existent vascular injuries.

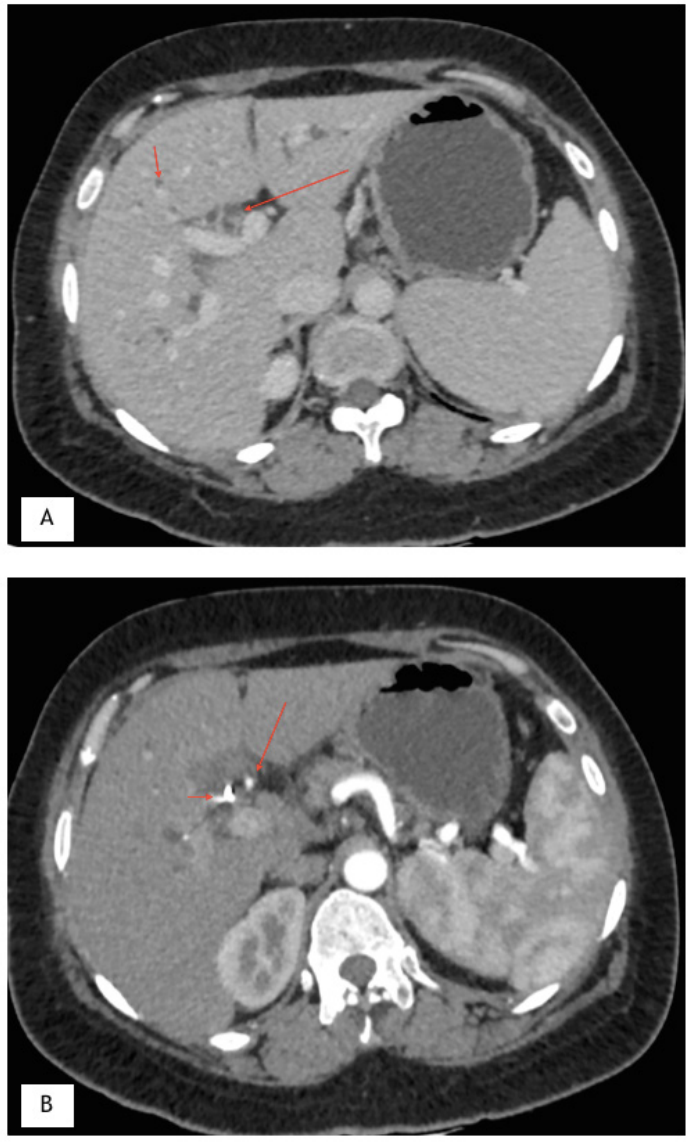

Figure 2A. CT angiogram abdomen: *showing dilated intra (small red arrow) and extra hepatic biliary (long red arrow) radicals. B. Arterial phase image showing left hepatic artery (long arrow) with non-visualization of right artery and metallic clips (small arrow) in situ. (Source:Department of Radiology, Sir Ganga Ram Hospital, New Delhi)*

Magnetic resonance computed tomography (MRCP)

MRCP (Figure 3) is a non invasive diagnostic modality widely used in cases of biliary obstruction which accurately delineates its level and length. It helps to plan the management even before subjecting the patient to an invasive ERCP[20]. Associated biliomas or a collapsed biliary tree in case of an external biliary fistula can hamper the findings and a wide variation of its sensitivity in differentiating benign and malignant strictures has been reported[18,21].

Figure 3. MRCP *Showing smooth stricture at the hepatic confluence (block arrow) with dilated right and left hepatic duct (white arrows). (Source:Department of Radiology, Sir Ganga Ram Hospital, New Delhi)*

Figure 4. ERCP image *showing CBD stricture (arrow head) with proximal biliary tree dilatation (Source:Department of Gastroenterology, Sir Ganga Ram Hospital, New Delhi)*

Endoscopic retrograde cholangio pancreatography (ERCP)
ERCP (Figure 4) is an important modality for the overall management of bile duct injury. However in patients requiring surgical repair for BBS it is not very useful as in complete obstruction it does not demonstrate the upper end of the block.

Percutaneous transhepatic cholangiography (PTC)
PTC (Figure 5) plays a major role in the management of high biliary strictures. It not only delineates the site and possible nature of the stricture but also facilitates preoperative biliary drainage and placement of catheters which helps locate the ducts during operation.

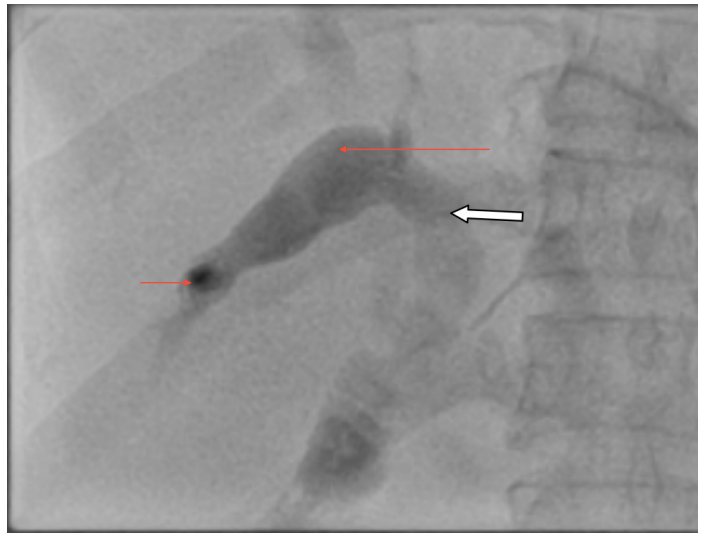

Figure 5. Percutaneous cholangiogram *depicting hepaticojejunostomy site stricture (block arrow) and non visualisation of left hepatic duct due to stricture with dilated right hepatic duct(long arrow) and stone in the dilated duct (small arrow). (Source: Department of Interventional Radiology, Sir Ganga Ram hospital, New Delhi)*

Hepatic scintigraphy with immune diacetic acid (HIDA scan)
The sensitivity of a HIDA scan in obstruction is high. However very little additional details are obtained with scintigraphy to help in the evaluation and management of Benign Biliary Strictures. The problems associated with HIDA are that its secretion depends on the hepatocyte function which can be deranged in cases of prolonged obstruction and its excretion is reduced in patients with hyperbilirubinaemia.

TREATMENT OPTIONS

Preoperative management
Preoperative management includes patient optimisation with respect to cholangitis, hyperbilirubinaemia, fluids and electrolytes, coagulopathy, intrabdominal collections, external biliary fistulae and nutrition.

Preoperative biliary drainage
Preoperative biliary drainage is rarely indicated for hyperbilirubinaemia in BBS. It is mainly done in the setting of BBS with cholangitis. The drained bile is sent for bacterial culture and antibiotics are modified accordingly. Preoperative biliary drainage can be achieved by an endoscopic or percutaneous approach and timely endoscopic placement of a single plastic stent can sometimes be life saving . The percutaneous approach is reserved for instances when the endoscopic route fails or in high biliary strictures.

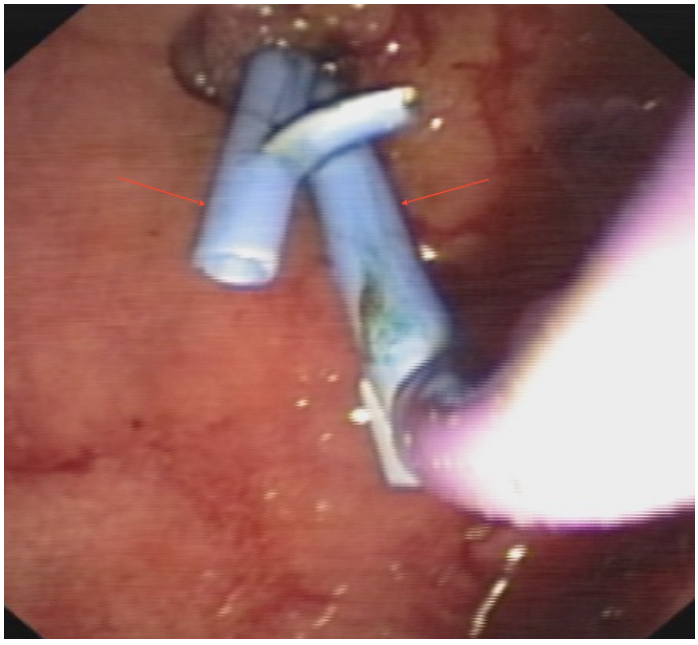

Figure 6. *Image showing endoscopic placement of CBD stents (two in number) (Source: Department of Gastroenterology, Sir Ganga Ram Hospital, New Delhi)*

DEFINITIVE TREATMENT OPTIONS

Endoscopic treatment options

An earlier study by Pitt et al had shown poor results with endoscopic balloon dilatation compared to surgery[22]. However Davids et al then reported that the placement of 1 or 2 plastic stents with 3 monthly stent exchanges over 1 year showed a success rate of 83% at a mean follow up period of 42 months. Their study concluded that endoscopic therapy was a useful strategy in patients with concomitant external biliary fistulae[23]. A long term follow up study of endoscopic placement of 2 plastic stents by Bergman et al., showed a failure rate of 20% all of which occurred within 2 years of stent removal[24]. Better results with endoscopic treatment have been seen in patients who develop early post operative biliary strictures. In a retrospective analysis Draganov et al demonstrated that endoscopic balloon dilatation and sequential insertion of an increasing number and size of plastic stents yielded a success rate of 80% in patients with Bismuth level I and II strictures which was comparable with surgical repair [25]. Most reports on endoscopic therapy have shown a success rate of 74- 90% after 12 months. Specific complications reported have been recurrent cholangitis occurring in 11-70% of patients due to long term stenting and other rare complications include stent migration which is seen in 6% of cases[24,25,26].

Aggressive dilatation with an increasing number of stents (Figure 6) by Costamagna et al with a longer follow up of patients showed that the mean number of stents inserted increased to 3.2 with a stent exchange rate of once in 3 months. Clinical remission was seen in 97% of patients[27]. Long term follow up of these patients for a period of 10 years showed low stricturing rate and the study also concluded that the recurrences can also be managed endoscopically[28].

The role of Fully Covered Self Expanding Metallic Stents (FCSEMS)

In a large multi institutional prospective study by Devière et al successful removal of FCSEMS was possible in 75% of patients after stricture resolution. This study has shown the feasibility and success of stent placement in BBS secondary to chronic pancreatitis[29]. Another pilot study by Kahaleh et al. has shown

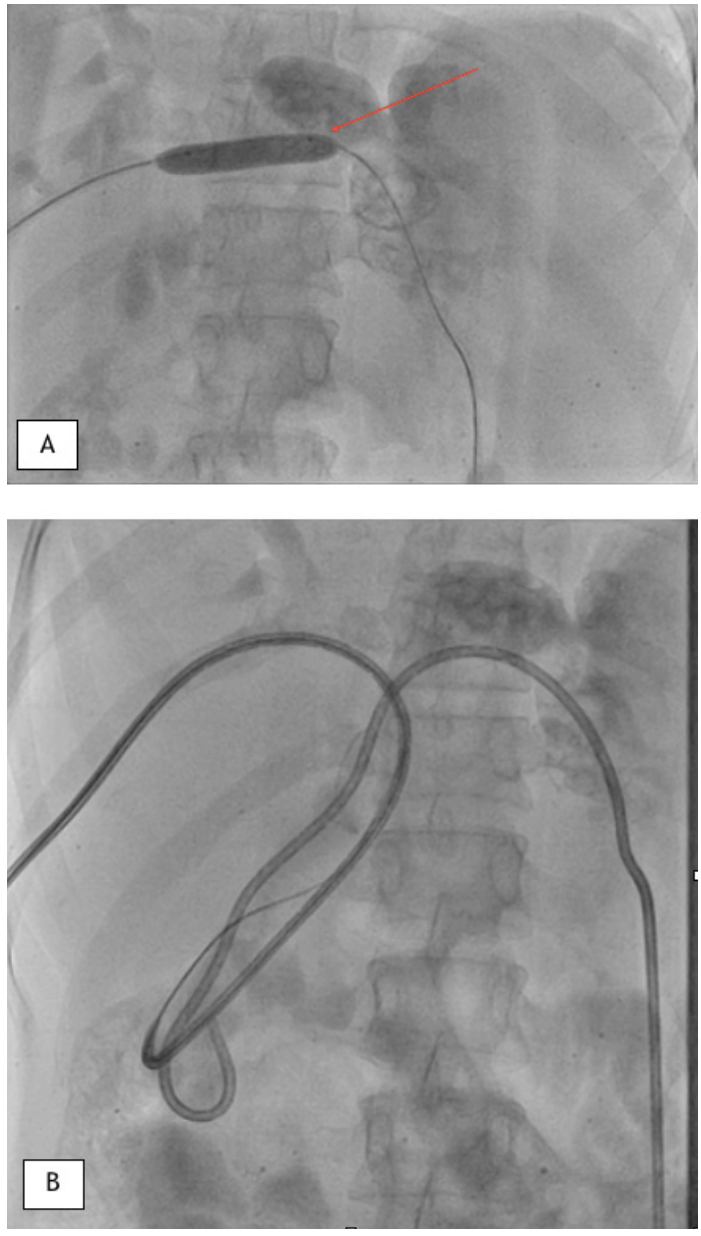

Figure 7A. *Image showing percutaneous balloon dilatation of hepaticojejunostomy stricture and B. showing placement of external biliary stents on both ductal system (Source: Department of Interventional Radiology, Sir Ganga Ram Hospital, New Delhi)*

a success rate of 75% on an intention to treat analysis. However most of these studies have focused on BBS secondary to chronic pancreatitis where the FCSEMS have shown results which were better than with plastic stents[30].

Thus endoscopic aggressive dilatation with an increasing number of plastic stents can be a useful option in early postoperative Bismuth level I/level II strictures and in patients who are willing to undergo repeated interventions. The role of a covered SEMS in a candidate who is otherwise fit for surgery has yet to be supported by data.

Percutaneous transhepatic cholangioplasty (PTC) and stenting (Figure 7)

The role of PTC as a primary modality of treatment in post operative biliary strictures is controversial with some studies showing a 90%-98% success rate with this approach[31,32]. However long term follow up studies have shown stricture recurrence in up to 60 % of patients[22].

PTC has a role in biliary strictures which are inaccessible via endoscopy e.g patients with difficult papillary access, high strictures and those with an altered anatomy after previous surgery (eg. Roux-en-Y hepaticojejunostomy)

Surgery

Operative management is indicated in difficult cases and those in whom non surgical approaches have failed. The timing of surgery depends on the organisation of the fibrotic and dense connective tissue which generally requires a waiting period of 4 to 6 weeks[33]. The aim of operative management is to achieve a high quality bilioenteric anastomosis described by Hepp-Couinaud a technique (Figure 8) which establishes a high bilio enteric anastomosis irrespective of the level of injury resulting in a wide anastomosis with well vascularised tissue[34,35].

Most hepatobiliary surgeons do not recommend other types of bilioenteric anastomosis like choledochoduodenostomy

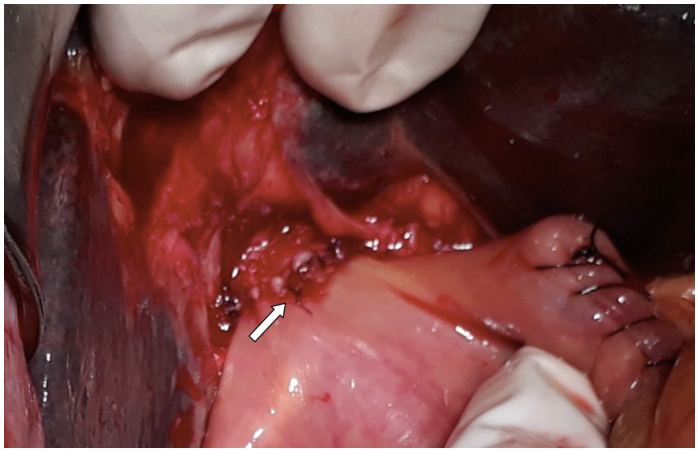

Figure 8. *Showing side to side Roux-en-Y Hepaticojejunostomy (block arrow) (Source: Department of Surgical gastroenterology and Liver Transplantation, New Delhi)*

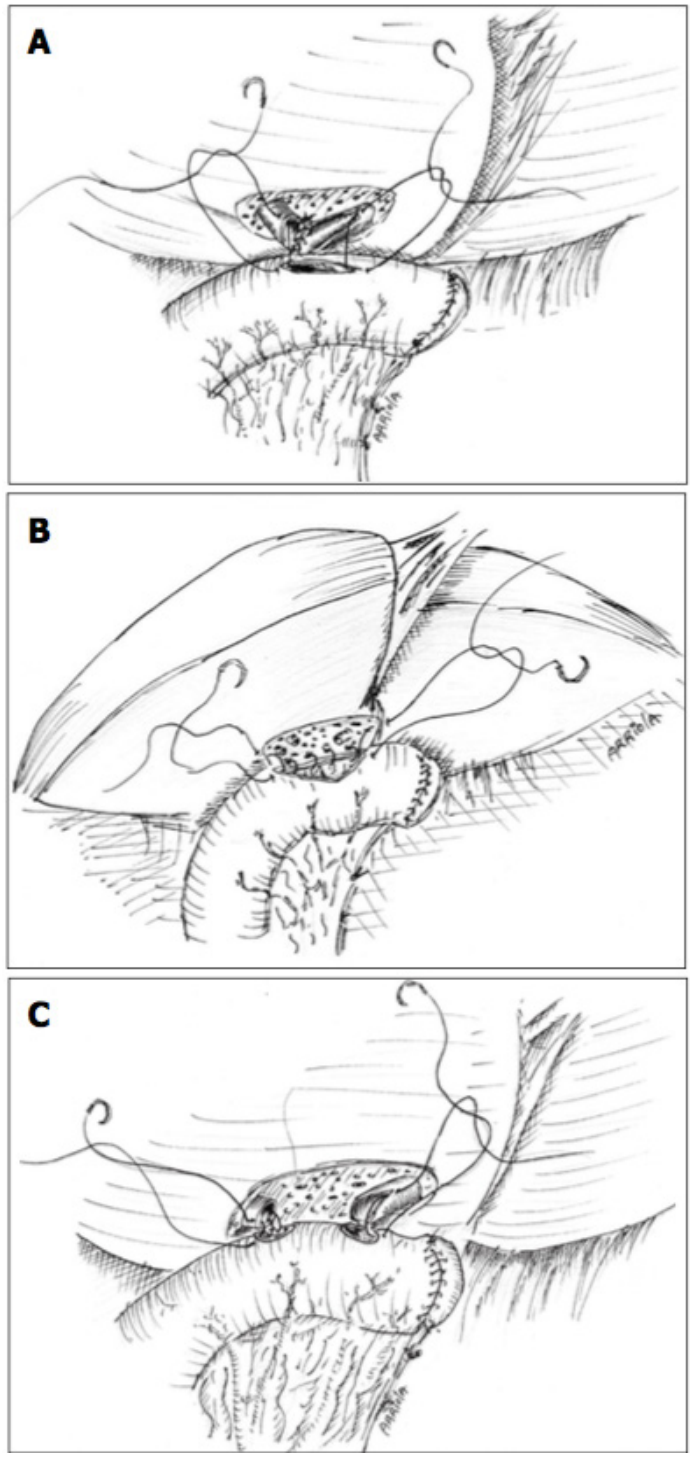

Figure 9. Hepaticojejunostomy. *A.Neoconfluence; B.Portoenterostomy; C.Double barrel anastomosis. (Source: Mercado et al. World J Gastrointest Surg 2015;7: 254-260)*

or hepaticoduodenostomy as it results in an anastomosis under tension due to loss of tissue and scarring at the cut ends[36].

Dilatation Vs Surgery

An earlier series by Pitt et al demonstrated a better outcome with surgical repair than endoscopic treatment[22] and Tocchi et al too who compared the outcomes of the endoscopic and surgical approach for BBS concluded that hepaticojejunostomy was the best option in patients with dilatation in whom it was intended to have a long term therapeutic outcome[37]. Another advantage of surgery is that it is also a one time procedure when compared with the endoscopic approach which involves multiple sessions. Long term follow up at a tertiary care centre reported a success rate of 90%-93%[38,39]. However recurrent strictures at the bilioenteric anastomosis have been reported in 8 to 40% of cases[40,41,42,43,44,45].

A high biliary stricture (Bismuth level III and above) can pose considerable difficulty in achieving a good bilioenteric anastomosis. To achieve an adequate exposure to the bile duct at bifurcation Mercado et al described partial resection of segment IV and V of the liver and showed a good long term outcome[46]. In a retrospective study of special situations in which there is a loss of confluence between the left and right bile ducts Mercado et al described the options of creating a neo confluence, double barrel anastomosis or portoenterostomy (Figure 9) to achieve better results[47].

Surgical options like liver resection in a selected group of patients with complex biliary strictures with vascular injury, recurrent cholangitis, lobar atrophy/abscess and failed hepaticojejunostomy have yielded good long term results in 70-100%[48,49].

Patients with secondary biliary cirrhosis constitute only 1% of all indications for liver transplantation with the largest multi centre series by Ardiles et al revealing that all patients who needed liver transplantation had biliovascular injury[50,51]. The majority of them had had multiple failed surgical repairs as well as endoscopic and percutaneous therapeutic interventions before transplantation. Their retrospective study showed a survival of 45% over 10 years following transplantation.

SUMMARY

The commonest cause of a Benign Biliary Stricture is injury during cholecystectomy. MRCP can accurately diagnose the level and length of the strictures. Endoscopic options act as a bridge therapy before surgical repair but may also serve as a definitive management modality in selected cases. Surgery remains the cornerstone of treatment in difficult situations and in patients in whom non operative approaches have failed. Proximal strictures can pose diagnostic and therapeutic challenges. Early identification and prompt management of Benign Biliary Stricture can prevent devastating sequelae like recurrent cholangitis and end stage liver disease needing transplantation.

Table I. Causes of benign biliary strictures

Common causes
Iatrogenic
Cholecystectomy (laparoscopic/open)
Common bile duct exploration
Orthotopic liver transplantation
Resection of choledochal cyst
Gastrectomy
Pancreatectomy
Primary sclerosing cholangitis
Chronic pancreatitis
Less frequent causes
Autoimmune pancreatitis
IgG4 related cholangiopathy
Autoimmune cholangitis
Mirizzi Syndrome
Infection (tuberculosis, viral, parasitic, HIV cholangiopathy)
Ischaemia
Vasculitis
Trauma
Radiation therapy

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