PERCUTANEOUS TREATMENT OF BENIGN BILIARY STRICTURES AND BILIARY MANOMETRIC PERFUSION TEST

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Background: Benign biliary strictures are usually treated surgically or endoscopically. When these strictures are not accessible by endoscope or when open repair is not possible, percutaneous dilatation treatment is indicated. The efficacy of treatment is usually evaluated by clinical trial which includes leaving a small non-functional catheter in situ and following liver function tests. The evaluation may be effectively done by the biliary manometric perfusion test.

Aim: The aim of this paper is to emphasize the importance of percutaneous dilatation treatment of benign biliary strictures with focus on the role of the biliary manometric perfusion test and its future prospects.

Methods and Results: Based on the literature and our own experience, this article gives a short overview of percutaneous treatment of benign biliary strictures, indications, techniques, complications and results. The treatment of these strictures has an overall success rate between 60 to 90 %. This article also explains the biliary manometric test, the technique and its importance in evaluation of treatment success.

Conclusion: Benign biliary strictures of the hepatic duct junction or bilio-enteric anastomosis are difficult to treat surgically and are endoscopically inaccessible. Percutaneous treatment by balloon dilatation and long term external-internal drainage is feasible in the majority of these patients. It is minimally invasive, safe and effective. The evaluation of the treatment success may be more effectively done by the manometric perfusion test. It is easy, reliable, less time-consuming giving immediate results, and relatively safe.

INTRODUCTION

Benign biliary strictures have relatively a wide spectrum of causes. Benign strictures can be traumatic, post-operative, infectious (bacterial or parasitic), inflammatory and others. Post-operative strictures are the most frequent. They can occur after iatrogenic injuries during cholecystectomy (especially laparoscopic), after anastomotic operations for benign or malignant diseases or after liver transplantation. Such strictures are notoriously difficult to treat and the treatment options vary.

Iatrogenic injury is still the most frequent benign indication for anastomotic operation which is the first treatment of choice. The cause of benign postoperative strictures is fibrosis at the site of anastomosis between the small bowel and biliary tree. If open repair of the stricture is impossible or unsuccessful or the stenosis itself is the result of surgical treatment, endoscopy is the next treatment of choice. The endoscopic treatment is almost always successful if the stricture is situated near the papilla of Vater. Endoscopic treatment of strictures located in the region of hepatic duct junction is more difficult. A limiting factor for endoscopic treatment in these cases is the mechanical difficulty of relieving the stricture (transfer of force over endoscopic working channel is less effective than via percutaneous access) and inaccessibility

of papilla of Vater and bilio-enteric anastomosis. In such situations when open surgical repair and endoscopic treatment are impossible or unsuccessful, percutaneous treatment is fully indicated. Percutaneous treatment includes initial drainage and dilatation of the stricture by balloon angioplasty catheters of different diameters.

Indication for benign biliary stricture treatment is given by the unfavorable impact of biliary obstruction to liver function resulting in biliary liver cirrhosis with all the negative consequences to patients' prognosis *quod vitam*. Balloon dilatation or balloon dilatation with long-term external / internal drainage are generally accepted as the treatment of choice for benign biliary strictures. The primary insertion of a metallic stent is not currently recommended¹.

Whatever the treatment options, the long-term success of the treatment depends on the functional system of the distal anastomotic conduit. And the functional status of any functional distensible conduit system is determined by physiological variables like flow, volume and pressure². Presently, evaluation of percutaneous treatment is assessed by clinical trial after treatment. This includes installation of a thin non-functional safety catheter through the dilated stenosis into the bowel loop for about 7-10 days and following liver function tests. If the liver function tests are within the normal range, the safety catheter is

withdrawn. Additional intervention is done in patients with increased values of liver function tests. The efforts to objectively evaluate the stricture treatment and predict the long-term outcomes have led to the introduction of manometry after percutaneous dilatation. The evaluation comes from the presumption that if the pressure inside the bile duct system is not higher than 20 cm of water during perfusion test after dilatation and long-term drainage, then it is possible to consider dilatation as successful and other interventions are unnecessary³.

There are very few articles in terms of predictive tests of long term success after the treatment has been completed. The reasons for this fact is two fold: first, few tests if any other than biliary manometric perfusion test and clinical trial have been evaluated for this entity and second, because patients with biliary strictures can present as late as 20 years after an apparently successful treatment intervention, long term follow up and documentation of actual treatment success rate in this patient group is difficult.

The aim of our article is to review the results and literature on percutaneous dilatation treatment and manometric perfusion test after the treatment of benign biliary strictures.

Benign biliary strictures

Clinical signs

The clinical findings of benign biliary strictures may range from subclinical derangement of liver function to the full picture of hepatic obstruction with jaundice, biliuria and pruritus. The pattern of presentation may be either asymptomatic bile duct obstruction with only elevated liver function tests and no jaundice or delayed presentation with recurrent cholangitis and slow progress-

ing biliary cirrhosis. Gall stones form above the stricture and provide an excellent nidus for persistent and recurrent infection. Recurrent cholangitis is a potentially life threatening complication. Some of these patients develop biliary cirrhosis and portal hypertension despite all interventions and finally end up in liver transplantation⁴.

The clinical picture of decompensated bile duct obstruction includes colic attacks manifested by right upper quadrant pain, jaundice and fever with chills. Elevated levels of direct (conjugated) bilirubin and alkaline phosphatase indicate the presence of cholestasis and allow some quantification of degree of obstruction. Frequently we can see subclinical increase in liver function tests – so called anicteric cholestasis, in which the bilirubin level is normal. The parameters for hepatic synthetic function are levels of plasma albumin and clotting factors, as assessed by the prothrombin time, but these will be changed only in advanced decompensated stages. However, gamma glutamyl transferase is the most sensitive indicator for hepatocellular damage⁵. Hepatic scintigraphy with iminodiacetic acid compounds is highly sensitive to biliary obstruction, but in practice they add little information over biochemical and radiological investigations.

Percutaneous treatment and dilatation

Indications

Percutaneous treatment of benign biliary strictures is performed in almost all patients with strictures after hepaticojejunostomy with Roux-en-Y reconstruction. The surgical treatment of benign biliary strictures after hepaticojejunostomy is difficult with a relatively high mortality rate and endoscopic treatment is impossible because of the inaccessibility of bilio-enteric anastomosis to the

Fig. 1. Stenosis of the hepaticojejunostomy before the percutaneous treatment with no flow of contrast to the jejunal loop in cholangiography.

Fig. 2. Balloon dilatation of the biliary stricture.

endoscope. Percutaneous treatment is also indicated in anastomotic and non-anastomotic strictures after liver transplantation. It is a good alternative for patients after transplantation at high risk for surgical correction. Other benign indications include suppurative cholangitis, chronic pancreatitis, intrahepatic or common bile duct stones and pre-operative biliary drainage⁶.

Contraindications

The few contraindications of percutaneous treatment include an uncorrectable bleeding diathesis and marked ascites displacing the liver from the abdominal wall and increasing the difficulty of catheter insertion. Other relative contraindications include obese and uncooperative patients.

Technique

The technique of biliary drainage has been well described earlier in literature. Once established it allows simple access to the obstruction and is useful for repeated procedures and follow-up cholangiograms. Percutaneous biliary drainage is always performed by standard micro puncture technique. Under aseptic conditions, either from the right intercostal or subxiphysternal approach, access is gained to the biliary system. A right or left approach for the biliary drainage is chosen depending on the biliary anatomy, bile leak topography and possibility of puncturing a dilated intrahepatic duct⁷. After gaining access to

the biliary system, cholangiography is performed to assess the stenosis (Fig. 1) and a guide wire is advanced through the biliary stenosis into the bowel loop. A small biliary drainage catheter (6 F or 7 F) with side holes is inserted through the biliary tree into the bowel loop to enable internal external biliary drainage and the catheter is left in situ for 3 to 5 days. If the access to the bowel loop is not achieved, the catheter is placed proximal to the level of obstruction for external drainage and a second attempt is made after 48 to 72 hrs¹. Often the subsequent decrease in the duct caliber and resolution of edema in the area of obstruction allow a successful second manipulation through the stenosis and into the bowel loop. All drainage procedures are performed under the cover of broad spectrum antibiotics.

After initial drainage the dilatation of the stricture is performed by angioplasty catheter (Fig. 2). The diameter of the balloon is 10 or 12 mm according to the stricture location. A pressure of up to about 10 atmospheres for 3 minutes is usually applied. The dilatation is usually performed three times per procedure. Following the balloon dilatation, an external/internal drainage catheter of 12 F is inserted and left in situ for stricture remodeling and internal drainage¹. After 3 months, dilatation is repeated and long-term drainage by external internal 14 F catheter is maintained for next three months (Fig. 3). The success of the treatment is evaluated usually by clinical test which consists of installation of a thin safety nonfunctional 4 F

Fig. 3. Long term biliary drainage by 14 F catheter after balloon dilatation.

Fig. 4. Follow up cholangiography before the manometric perfusion test after the balloon dilatation showing the free flow of contrast to the jejunal loop.

Fig. 5. A 10 F sheath inserted into the biliary tree with connection to the manometer and angiographic injector by a three-way stopcock for the manometric perfusion test.

catheter through the dilated stenosis into the bowel loop for 7 days. The levels of bilirubin and liver enzymes are measured. The safety catheter is removed when the liver enzymes are within the normal range. If the liver function tests are increased, additional intervention with subsequent dilatation and long-term internal/external drainage for three months is performed and again clinical test is repeated.

Complications

Complications of the percutaneous transhepatic biliary drainage procedure range from skin discomfort to life threatening arterial haemobilia⁸. Major acute complications include septic shock, bile peritonitis, intraperitoneal hemorrhage, renal failure and death while subphrenic abscess, hepatic arteriovenous fistula, hyponatremia, pneumothorax, empyema are less common⁶. Patients with hepatic failure, bleeding diathesis, biliary sepsis and ascites are the most difficult to treat and have the highest morbidity and mortality rates. Rarely accidental puncture of hepatic artery can occur which leads to intrahepatic hemorrhage or haemobilia which is potentially dangerous and is treated by selective embolisation of the hepatic artery. Delayed and minor complications can occur in approximately 20 % of patients. Catheter dislodgement, cholangitis, persistent or recurrent jaundice and bile leakage are the most frequent problems.

Methodology of biliary manometric perfusion test

Although important recent advances have been made in the detection of biliary obstruction by ultrasound, computed tomography, endoscopic retrograde cholangiography and magnetic resonance cholangio-pancreatography, these methods provide strictly morphological data, with little or no functional information. The functional status of the distal conduit is determined by physiological variables including flow, volume and pressure. The pressure inside the biliary system is directly proportional to the obstruction. Therefore the manometric perfusion test is increasingly done nowadays after bile duct stricture dilatation treatment and is most helpful in assessing the adequacy of the same^{9, 10}. The introduction of manometry after the treatment has helped to objectively evaluate the stricture treatment and predict long-term results. It is presumed that if the pressure inside the bile duct system is not higher than 20 cm of water during pressure test after dilatation, then the treatment is considered to be successful³. Therefore manometry is now gaining popularity for its predictive value and for its value in treatment evaluation.

The methodology of the manometric perfusion test is as follows⁹. After follow up cholangiography (Fig. 4), with patient in supine position on the angiographic table, biliary catheter left peripheral to the treated stenosis is connected by tubing and a three way stopcock to a manometer and a standard angiographic injector (Fig. 5). The tubing is flushed to clear any air and the manometer is zeroed at the level of mid axillary line. With the three-

way stopcock off to the injector, the baseline intrahepatic biliary pressure is measured and recorded. The injector is loaded with the contrast material and diluted to 50 % by saline. The biliary tree is then perfused with this diluted contrast material at the following rates; 2ml/min × 5 min, 4 ml /min x 5 min, 8 ml/min x 5 min, 15 ml/min × 3 min and 20 ml/min x 2 min. At the end of each infusion, the stopcock is immediately turned off from the angiographic injector and on to the manometer. The intra-biliary pressure is measured and recorded. The procedure is discontinued if the patient experiences nausea, vomiting, right upper quadrant pain, chills or biliary pressures greater than 20 cm of water. If patients have more than one catheter spanning a single treated ductal site or surgical anastomosis, one catheter is used for the infusion and other is connected by the tubing to the manometer for a continuous pressure read-out. If the patients have two catheters each spanning a different site or surgical anastomosis, each site is tested independently with its own biliary manometric perfusion test⁹.

Long-term results

The success rate and long term results of percutaneous treatment of benign strictures are reviewed and discussed in a number of articles^{1, 5, 7, 9, 11-16}. The percutaneous treatment of these strictures by dilatation has a success rate from 60 to 90 %¹. Better results are generally expected for the treatment of strictures after iatrogenic bile duct injuries without anastomosis than those with bilio-enteric anastomosis. The long-term results confirm the procedure as a valid alternative to surgery and can also be performed where surgery and endoscopy are not successful. It is also helpful in patients with high strictures where surgical repair has been difficult. It is a procedure with minimal morbidity and mortality and without the need for general anesthesia. Anastomotic and non-anastomotic strictures after liver transplantation are also found greatly resolved by the percutaneous dilatation treatment. It is a good alternative for patients at high risk for surgical correction after transplantation.

The evaluation of long-term results of the benign biliary stricture treatment using manometric perfusion test is less discussed in the literature as there are very few studies done in this regard⁹. More research needs to be done to establish the value of the perfusion test. Savader et al. used the manometric perfusion test for objective assessment of percutaneous treatment^{9,10}. They compared manometric perfusion test with clinical test and concluded that it has the same value for predicting the long-term patency of benign biliary strictures treated by dilatation and drainage. They recommended using the manometric test instead of the clinical test for its simplicity, lower costs and immediate results. The value of perfusion test lies not only in its ability to predict post treatment patency but also in its ability to identify potential treatment failures, thereby reducing the number of patients who might present later with strictures, after the treatment is completed⁹.

CONCLUSION

Benign biliary stricture can be a complicated problem for the team of physicians treating these patients. The complications are usually trouble-some and enduring. Restricturing, the need for re-operation and other treatment procedures with significant morbidity and mortality are often encountered. Benign biliary strictures of hepatic duct junction or bilioenteric anastomosis are difficult to treat surgically and are endoscopically inaccessible. Percutaneous dilatation by balloon dilatation and long-term internal/external drainage is feasible in the majority of these patients. Advances in techniques and instruments and clinical management have established the effectiveness of percutaneous biliary drainage as an alternative to conventional surgical treatment of biliary obstruction. It is minimally invasive, effective, reliable, relatively safe and a popular method of direct opacification of the bile ducts.

Manometric perfusion test is gaining popularity nowadays for its long-term predictivity of the dilatation treatment of the strictures. The available few studies show that they have the equal predictive value as a clinical test. Having the same predictive value as the clinical test, it allows patients to avoid clinical test and other tests to verify treatment success. It is also cost effective as the patients can save money for safety catheters and other examinations before safety catheter extraction which include biochemical investigations. However much research is to be done in this regard and we need more investigations and data of biliary manometry to establish the facts. In future, refinements of technique and equipment should reduce complications and increase success of the procedure.

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