To Stent or Not to Stent Bilioenteric Anastomosis After Iatrogenic Injury

A Dilemma Not Answered?

Miguel Angel Mercado, MD; Carlos Chan, MD; Héctor Orozco, MD; Gumaro Cano-Gutiérrez, MD; Juan Manuel Chaparro, MD; Erick Galindo, MD; Mario Vilatoba, MD; Gilberto Samaniego-Arvizu, MD

Background: Bile duct injury is a complex and serious complication whose frequency has not diminished. A bilidigestive anastomosis (Roux-en-Y hepaticojejunostomy) is usually needed after complex injuries. Placement of an anastomotic stent is a matter of debate and to our knowledge there is no study that compares the results between stenting and not stenting the anastomosis.

Design: A retrospective review of medical records of patients operated on for biliary reconstruction after iatrogenic injury.

Setting: Tertiary care academic university hospital.

Patients: A comparative study was performed of patients operated on between 1995 and 1999, who were referred to our hospital for acute or elective reconstruction of the biliary tract following iatrogenic injury. All patients underwent Roux-en-Y hepaticojejunostomy. The patients were divided into 2 groups: those who underwent Roux-en-Y hepaticojejunostomy with a transanastomotic stent and those who underwent Roux-en-Y hepaticojejunostomy without a transanastomotic stent.

Main Outcome Measures: Operative mortality, anastomotic dysfunction, biliary fistula, reoperations, postoperative complications, postoperative liver function tests.

Results: Sixty-three patients with high and complex biliary injuries (Bismuth type III, IV; Strasberg D, E). Thirty-seven cases had reconstruction with the placement of a transanastomotic stent and 26 did not have a stent placed. No operative mortality was observed. The postoperative outcomes of both groups were compared and no differences found. Good results were observed in more than 80% of the patients. Reoperations were more frequent in the nonstented group (15% vs 5%) and complications were more frequent in the stented group (16% vs 7%).

Conclusions: Good results are obtained with a Roux-en-Y hepaticojejunostomy after complex injuries. The use of transanastomotic stents has to be selective according to the individual characteristics of each patient and the experience of each surgeon. We recommend their use when unhealthy (ie, ischemic, scarred) and small ducts (<4 mm) are found.

Arch Surg. 2002;137:60-63

Bile duct injury during cholecystectomy, either laparoscopic or open, is a complex and serious complication, observed with a frequency of 0.2% to 0.4%. The frequency has not diminished and probably will not. Even as the knowledge advances, lesions continue to occur. Less than half of these injuries are recognized during the operation; most of them are recognized in the early postoperative period. A variety of strategies are performed after the injury that are shaped according to different scenarios: type of injury and recognition, patient’s health status, surgeon’s experience, hospital’s facilities, etc.

In many instances, when the duct has not lost continuity, a radiologic and/or endoscopic approach can be used with good results. Nevertheless, in many cases (Bismuth type III, IV; Strasberg D, E), complete sections of the duct require surgical reconstruction. Among the surgical strategies for repair, hepaticojejunostomy yields the most favorable results. End-to-end repair (unlike that done in liver transplantation) has a high failure rate, with late stenosis and/or dysfunction consequent to loss of substance from the duct and ischemia secondary to the dissection.

An anastomosis with a Roux-en-Y jejunal loop to prevent reflux of intestinal contents to the anastomosis site is the best option for reconstruction. The anastomosis has to be performed with careful apposition of the biliary epithelium with the intestinal mucosa, using nonreactive absorbable sutures. The placement of anastomotic stents has been a matter of debate. Experienced groups have shown good
METHODS

During a 4-year period (1995-1999), patients with bile duct injury were treated by our surgical team and the following features were analyzed:

- Complex bile duct injury (Bismuth type III, IV; Strasberg D, E)
- Acute duct injury that required hepaticojejunostomy
- History of attempted reconstruction (duct-to-duct, hepaticojejunostomy) with late stricture
- No sepsis
- No organ failure
- No preexistent liver disease
- No associated primary biliary disease (sclerosing cholangitis, cholangiocarcinoma)

OPERATIVE TECHNIQUE

All patients whose injury was not acute had preoperative evaluation of biliary anatomy by means of percutaneous transhepatic cholangiography and/or magnetic resonance cholangiopancreatography. Patients with acute injury had transperitoneal cholangiography to evaluate the biliary anatomy. During the operation, after complete dissection of the hepatic hilus, a section of the hilar plate was performed to allow the exposure of the infrahepatic ducts. Seventeen partial resections of segment IV and at the level of the gallbladder plate were performed to allow complete exposure of the infrahepatic bile ducts. Careful exploration of both left and right hepatic ducts was done and the cephalic dissection was stopped when non-scarred, inflamed, and/or ischemic ducts were reached.

An end-to-side anastomosis was performed between the ducts and the defunctionalized jejunal loop. In some instances, when the junction was not available any more for a single reconstruction, independent anastomosis of the left or right duct was performed. The anastomosis was done with 5-0 hydrolyzable sutures (polyglycolic acid, 5-0) with interrupted stitches.

When no stent was placed, a posterior and then an anterior row of sutures was placed. When a transhepatic stent was placed, a modified biliary dilator (No. 3) was introduced inside the ductal lumen and exteriorized through the hepatic dome. After exteriorization, a Silastic (Dow Corning, Auburn, Mich) or latex tube (10F) was fixed to the tip and then delivered through the duct. The distal tip of the stent was placed in the intestinal lumen and the anastomosis was completed (Figure 1).

After hemostasis was achieved, closed suction drains were placed, the stent was exteriorized, and the abdominal wall was closed. In the postoperative period, liver function tests were obtained. Patients were discharged when no fever or sepsis was found, when normalization of intestinal transit was demonstrated, and no hospital dependence was considered.

Patients with a transanastomotic stent received follow-up cholangiography. The stent was scheduled to be removed between the fifth and sixth postoperative months. Patients without a stent received follow-up abdominal ultrasound and liver function tests. When necessary, percutaneous hepatic cholangiography was performed. Anastomosis dysfunction was considered in cases of obstructive jaundice; progressive elevation of alkaline phosphatase and direct bilirubin; and cholangitis.

RESULTS

Our hospital is a tertiary care center to which many of the biliary injuries across the country are referred. Between January 1990 and July 2000, a total of 183 reconstructions had been performed.

A total of 63 patients were included in this study. Three of them had acute injuries sustained elsewhere and reconstructed by our team in the same operative stage. Sixty patients were referred for reconstruction after a previous operative repair attempt (duct-to-duct, hepaticojejunostomy, or external drainage) (Table 1). Thirty-seven patients had a transhepatic transanastomotic stent and 26 patients had no stent. General data on patients and their outcomes are presented in Table 1.

Patients received a stent if (1) a healthy duct (ie, without scar, inflammatory, or ischemic lesion) was not available, (2) the duct was smaller than 4 mm, or (3) separate anastomosis was necessary. In the immediate postoperative period, the stents were connected to external drainage. Patients were discharged with the transhepatic stent closed and were instructed to flush the stents periodically in the postoperative period (twice per week) with 0.9% isotonic sodium chloride solution. Patients were discharged from the hospital between the 5th and 12th postoperative days according to their individual progress. They were followed up on an outpatient basis. The stents were replaced by the radiologists when necessary. Between the fifth and sixth postoperative months, stents were removed after a cholangiogram. If necessary, stents were reinserted and anastomoses were dilated. If reinsertion was necessary, the stent was removed 2 to 4 months later.

Postoperative complications are presented in Table 2. Two patients in the stented group required a reoperation at the 18th and 33rd postoperative months. Four cases in the nonstented group required a reoperation because of anastomotic dysfunction at the 6th, 10th, 12th, and 13th postoperative months. Reoperations were indicated when obstruction of the anastomosis was demonstrated and not able to be managed by the radiologist. These reoperations consisted of new hepaticojejunostomy with a transanastomotic stent in all cases.

Eight patients were lost to follow up: 5 from the stented group and 3 from the nonstented group. They were analyzed and included in the study until that time.

Mean follow up for each group was 26 months (range, 12-60 months). Good long-term results (clinically asymptomatic) were obtained in 33 (90%) of 37 patients in the stented group and in 21 (83%) of 26 in the nonstented group.
When the 2 groups were compared, only statistically significant differences were observed when reoperation (5% in the stented group vs 15% in the nonstented group) and postoperative complications (6/37 [16%] vs 2/26 [7%]) were analyzed. In 4 of the patients in the stented group, stone formation was observed, requiring radiologic management. In 1 patient in the nonstented group, stone formation and obstruction were detected that required percutaneous drainage and subsequent manipulation when a tract for manipulation was matured. Abdominal collection was a complication recorded in both groups. Percutaneous radioimage-guided drainage was the procedure of choice to drain them.

Two complications in particular in the stented group were observed. Arteriobiliary fistula occurred late when the stent was changed in the third postoperative month. Considerable bleeding was observed through the tract of the stent, with hemodynamic consequences. Reinsertion of the tube and performance of a selective angiography was performed, confirming the fistula (Figure 2). Embolization of the artery solved the problem. The patient was asymptomatic at the time of this report. The second postoperative complication in the stented group, biliopleural fistula complicated with empyema, occurred when the stent was exteriorized through the wall between the ribs, injuring the costophrenic angle of the pleura and resulting in effusion. Drainage was performed and the fistula closed spontaneously.

**Table 1. Procedure and Patient Characteristics**

<table>
<thead>
<tr>
<th>Procedure</th>
<th>No. of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open cholecystectomy</td>
<td>36</td>
</tr>
<tr>
<td>Laparoscopic cholecystectomy</td>
<td>27</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Patient Characteristic</th>
<th>No. of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute laparoscopic cholecystectomy</td>
<td>3</td>
</tr>
<tr>
<td>History of duct-to-duct anastomosis</td>
<td>21</td>
</tr>
<tr>
<td>External biliary fistula</td>
<td>6</td>
</tr>
<tr>
<td>History of hepaticojunostomy</td>
<td>33</td>
</tr>
</tbody>
</table>

![Figure 1. Hepatojejunostomy (Roux-en-Y) with a transhepatic T tube. The large distal arm is placed in the jejunum and the short distal arm is placed in the left hepatic duct. The large arm of the tube is placed in the right hepatic duct and delivered through the hepatic anterior surface.](image1)

*Data are given as number of patients unless otherwise indicated. AST indicates aspartate transaminase; ALT, alanine transaminase.

**Table 2. Postoperative Complications**

<table>
<thead>
<tr>
<th></th>
<th>Stent (n = 37)</th>
<th>No Stent (n = 26)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operative mortality</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Anastomosis dysfunction</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Biliary fistula</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Reoperations</td>
<td>2 (18, 33 mo)</td>
<td>4† (6, 10, 12, 15 mo)</td>
</tr>
<tr>
<td>Complications</td>
<td>10</td>
<td>4†</td>
</tr>
<tr>
<td>Postoperative lithiasis</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Subhepatic collection</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Subphrenic collection</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Arteriobiliary fistula</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Biliopleural fistula</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Liver function tests (6 mo)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal, %</td>
<td>82</td>
<td>80</td>
</tr>
<tr>
<td>Elevated alkaline</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>phosphatase and/or AST, ALT, %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lost to follow-up</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Asymptomatic</td>
<td>31/33</td>
<td>19/23</td>
</tr>
</tbody>
</table>

Biliary reconstruction after iatrogenic injury is a complex issue for both the surgeon and the patient, leading in many instances to medicolegal problems. Reconstruction of biliary injury in tertiary care centers, where a multidisciplinary approach can be taken, has been recognized as the best choice because postoperative results are better in this setting.10

Among the wide spectrum of surgical repair procedures for complex lesions, a bilioenteric anastomosis with a large defunctionalized loop (Roux-en-Y) has shown the best results. This type of loop prevents reflux of intestinal contents into the anastomosis. The placement of stents through the anastomosis has been a matter of debate. Transanastomotic stents play an important role in biliary tract reconstruction centers. Some centers use them in a routine fashion and some centers avoid and oppose them in the same fashion.
There are pros and cons for the use of stents. Stents maintain patent anastomoses. During several weeks' time, healing of the anastomosis around the stent prevents stenosis (at least to the diameter of the stent) and allows manipulation and/or dilatation of the anastomosis in the postoperative period. Also, stents enable radiologic control of the anastomosis. In the early postoperative period, some patients develop cholestasis with obstruction. Radiologic control rules out obstruction. Another reason for the placement of stents is the added assurance it gives many surgeons. Although development of complications is infrequent without a stent, the decision to place a stent is an individual one. No convincing evidence-based answer is obtained from some surgeons when asked why a stent was placed.

However, in some instances, it is very difficult to find a duct that has no scar, no inflammatory reaction, and no ischemia (it may be deep in the hepatic parenchyma). Moreover, some of these ducts are small in diameter (<4 mm). If an anastomosis is done in such a duct, a high probability of dysfunction and/or leakage is to be expected. The postoperative edema at the level of the anastomosis, although transitory, is enough to produce obstruction, high intraductal pressure and leakage, subsequent inflammation, and obstruction. In this situation, the stent relieves pressure and maintains a patent anastomosis. This situation has also been observed in living related donor transplants in which the usage of stents has diminished the biliary complication rate.11 Complication rates in patients with a stent are higher, as we found in our series, when compared with patients without a stent. Two serious complications were recorded in our series; one of them (arteriobiliary fistula) was also observed by Sarr et al.12 Many surgeons argue that if a safe anastomosis is done, there is no reason to use stents. However, if obstruction and/or leakage is observed even in the immediate postoperative period, a percutaneous stent can be placed and the anastomosis can be manipulated to remove debris and stones. Patients with a biloenteric anastomosis have colonized bile that promotes formation of sludge and stones. The addition of a foreign body through the anastomosis may have a negative effect, accelerating the process of obstruction of the stent and requiring it to be frequently changed. No benefit has been shown with the use of biliary acids to prevent stent occlusion13 (also, unpublished study by Mercado et al, 1999). Antibiotics are also probably useless.

The length of time the stent should be in place is also a matter of debate. Some groups argue that prolonged use of a stent is harmful because of the inflammatory process related to local irritation caused by the stent. A stent with a large diameter can produce pressure necrosis, so it is important to place a stent that is smaller than the duct. We have not observed this type of complication in our cases but we cannot rule it out in patients with stenosis after removal of the stents resulted in some type of ischemic injury and late fibrosis. The Johns Hopkins group recommends final stent removal to occur at different stages, ranging from 4 to 9 months, according to the individual characteristics of each patient. Most of their patients (62.7%) had a stent in place for more than 9 months. In this series, the analysis of factors predicting outcome after surgical resection showed that the length of stent placement did not influence the long-term outcome.14

Our group has a selective approach to the use of stents. We favor the placement of a stent if a difficult anastomosis has been done in an “unhealthy” duct with a small diameter. If the contrary is found, we do not use stents. Nevertheless, several complications were recorded in our series that were the consequences of both use and nonuse of a stent. It seems that with or without stents, some complications are to be expected as a consequence of communicating the bile epithelium to the intestinal mucosa.

This study has the disadvantage of not being a prospective, controlled, randomized trial. Absence of randomization in this situation makes the 2 groups different, for it is probable that the surgeon reached the decision to place or not to place a stent in the operating room just before the performance of the anastomosis. Thus, it is probable that the most difficult cases were those in which the surgeon placed the stent. On the other hand, randomization would not solve the problem because each injured patient has his or her individual anatomy, individual outcome, individual scarring, and individual inflammatory reaction, which also precludes the advantage of prospective randomization. The groups were comparable because all patients had a complex injury.

It will be very difficult to demonstrate whether stents should be used. Nowadays, the experience of the surgeon and the surgical team is the standard that delineates whether transanastomotic biliary stents should be placed.

Corresponding author and reprints: Miguel Angel Mercado, MD, Department of Surgery, Instituto Nacional de Ciencias Médicas y Nutrición, Salvador Zubirán, Vasco de Quiroga 15, Tlalpan, 14000 México, DF (e-mail: mercadiazma@yahoo.com).

REFERENCES


