Bile Duct Injury - Parameters and Indicators for a Successful Outcome: A Study of 17 Cases

Ashok Chattoraj* and Nikhilesh Kundu
Tata Main Hospital, Jamshedpur, Jharkhand, India

Abstract
Bile duct injury is a known devastating complication following surgery upon the biliary tract; most commonly occurring after cholecystectomy. The injuries are more severe following laparoscopic cholecystectomy than open cholecystectomy. Various classifications are used to describe the different types of bile duct injury; Bismuth, Strassbourg, Brisbane are some of them. More proximal the injury more challenging it is for the surgeon to treat with poor outcomes. Biliary sepsis is a dangerous development, which adds to the morbidity and mortality of the patient. Surgical intervention is done when the sepsis is controlled; the patient is stable and fit for surgery. Roux-en-Y hepaticojejunostomy is the surgery of choice in most cases.

There were 10 females and 7 males in this series. The age group varied from 28 years to 61 years old. 14 patients were operated upon. Three patients were in biliary sepsis with MODS and could not be operated. Various indicators like \( P^H \), PT/INR, serum proteins, serum lactate were assessed in predicting the outcome of these patients.

Keywords: Laparoscopic cholecystectomy; sepsis; Multi-organ failure; Bile duct injury

Introduction
Bile duct injury is a known devastating complication following surgery upon the biliary tract; most commonly occurring after cholecystectomy. The injuries are more severe following laparoscopic cholecystectomy than open cholecystectomy. Various classifications are used to describe the different types of bile duct injury; Bismuth, Strassbourg, Brisbane are some of them. More proximal the injury more challenging it is for the surgeon to treat with poor outcomes. Biliary sepsis is a dangerous development, which adds to the morbidity and mortality of the patient. Surgical intervention is done when the sepsis is controlled; the patient is stable and fit for surgery. Roux-en-Y hepaticojejunostomy is the surgery of choice in most cases.

There were 17 cases treated for bile duct injury from 2010 until 2018 in Tata Main Hospital, Jamshedpur. 15 cases referred to us from other centres.

Materials and Methods
There were 10 females and 7 males in this series (Figure 1). The age group varied from 28 years to 61 years (Figure 2). The median age was 42 years. 4 patients had Bismuth Type 1 injury, 12 patients had Bismuth Type 2 injury and 1 patient had Bismuth Type 4 injury (Figure 3).

Patients were referred to us ranging from 2 days to 8 days following the primary surgery. All these patients underwent the following investigations (Table Ia and Table Ib)

1. Complete blood picture with haematocrit
2. Serum LFT, PT/INR, Serum proteins with Alb/Glob ratio
3. Random blood glucose and Serum Creatinine
4. Serum Electrolytes
5. Blood culture where biliary sepsis was suspected
6. Ultrasound of the abdomen to detect bilioma and collections
7. MRCP
8. Arterial blood gas

USG guided bilioma drainage was done in 13 cases.
Laparotomy with Roux-en-Y hepaticojejunostomy was done in 14 cases.
Observations

Two cases of BDI, which occurred in our hospital, were diagnosed during the primary laparoscopic cholecystectomy and were immediately converted to Roux-en-Y hepaticojejunostomy. Both patients had Mirizzi’s type 2 disease and during the gall bladder dissection there was bile duct injury-Bismuth Type 1. Both patients recovered well and discharged.

The remaining 12 cases were from other centres and had altered CBC, serum LFT, PT/INR and low serum albumin. Serum creatinine was deranged in four cases, which improved during treatment. None of them needed haemodialysis.

The patients were treated with Inj. Piperacillin+Tazobactam 4.5 Gm/Inj. Meropenem 1 Gm, Inj. Metronidazole, TPN with IV amino acid

Table Ia: Biological parameters.

<table>
<thead>
<tr>
<th>No.</th>
<th>Hb%</th>
<th>TLC</th>
<th>S. Bil</th>
<th>ALP</th>
<th>RBG</th>
<th>Creatinine</th>
<th>Alb</th>
<th>PT/INR</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9.4</td>
<td>14600</td>
<td>5.6</td>
<td>860</td>
<td>133</td>
<td>1.2</td>
<td>2.8</td>
<td>1.8</td>
<td>7.3</td>
</tr>
<tr>
<td>2</td>
<td>8.6</td>
<td>16300</td>
<td>6</td>
<td>760</td>
<td>115</td>
<td>2.0</td>
<td>2.2</td>
<td>2.1</td>
<td>7.2</td>
</tr>
<tr>
<td>3</td>
<td>9.8</td>
<td>12800</td>
<td>3.4</td>
<td>478</td>
<td>118</td>
<td>0.9</td>
<td>3.2</td>
<td>1.6</td>
<td>7.3</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>12800</td>
<td>3.2</td>
<td>450</td>
<td>120</td>
<td>1.2</td>
<td>3.4</td>
<td>1.4</td>
<td>7.4</td>
</tr>
<tr>
<td>5</td>
<td>9.8</td>
<td>12400</td>
<td>3.2</td>
<td>480</td>
<td>126</td>
<td>0.8</td>
<td>3.2</td>
<td>1.4</td>
<td>7.32</td>
</tr>
<tr>
<td>6</td>
<td>9.0</td>
<td>15400</td>
<td>4.2</td>
<td>480</td>
<td>126</td>
<td>1.8</td>
<td>2.6</td>
<td>1.2</td>
<td>7.26</td>
</tr>
<tr>
<td>7</td>
<td>9.6</td>
<td>13300</td>
<td>4.4</td>
<td>520</td>
<td>130</td>
<td>1.2</td>
<td>3</td>
<td>1.4</td>
<td>7.34</td>
</tr>
<tr>
<td>8</td>
<td>8.6</td>
<td>22000</td>
<td>5.6</td>
<td>600</td>
<td>320</td>
<td>2.8</td>
<td>2.0</td>
<td>2.2</td>
<td>7.1</td>
</tr>
<tr>
<td>9</td>
<td>9.6</td>
<td>13200</td>
<td>3.8</td>
<td>520</td>
<td>145</td>
<td>0.9</td>
<td>3.2</td>
<td>1.2</td>
<td>7.34</td>
</tr>
<tr>
<td>10</td>
<td>8.2</td>
<td>14400</td>
<td>5.4</td>
<td>670</td>
<td>130</td>
<td>1.3</td>
<td>1.8</td>
<td>2</td>
<td>7.2</td>
</tr>
<tr>
<td>11</td>
<td>9.4</td>
<td>15500</td>
<td>4.6</td>
<td>560</td>
<td>145</td>
<td>1.3</td>
<td>2.4</td>
<td>1.8</td>
<td>7.26</td>
</tr>
<tr>
<td>12</td>
<td>7.2</td>
<td>26000</td>
<td>5.8</td>
<td>700</td>
<td>152</td>
<td>3.0</td>
<td>1.6</td>
<td>2.2</td>
<td>7.1</td>
</tr>
</tbody>
</table>
solutions and 25% dextrose. Oral glucose powder 100 Gm daily was given to those who were not diabetics. Packed cell and FFP transfusion was given where required. In those patients having fever not responding to antibiotics or showing deterioration despite adequate antibiotic coverage repeat blood and urine cultures were sent. Blood culture was positive for E. coli in only one patient. Urine cultures were sterile in all the cases. 3 patients could not be operated upon since they developed severe biliary colic. Antibiotics or showing deterioration despite adequate antibiotic coverage. In those patients having fever not responding to antibiotics and dressing. 2 patients had a post-operative bile drain placed. Nutrition had improved and was in a stable condition. The albumin and PT/INR were monitored to improve them to normal levels. They were operated between 2 and 4 weeks of the BDI.

Roux-en-Y hepaticojejunostomy was done in all the cases. The anastomosis was done using 3-0 PDS (Figure 4).

Eight patients developed superficial wound infection which settled on antibiotics and dressing. 2 patients had a post-operative bile drain of >200 mL/day for 5 days which then gradually reduced and healed. Of the 14 patients 5 had come within 3 days of injury, 5 had come within 7 days of injury and 4 had come on the 12th day of injury.

The following observations were made in this study:

1. Those patients who were referred early (within 3 days of BDI) recovered faster and better than those who came on the 12th day of BDI.

2. Patients with metabolic acidosis took a mean of 12 days to recover following the Roux-en-Y hepaticojejunostomy while those with normal/near normal PPhs recovered within 7 days of Roux-en-Y hepaticojejunostomy. They needed higher antibiotics and elective ventilation till the acidosis settled.

3. Patients with altered serum albumin and PT/INR also had a recovery time of 12 days compared to those patients with a near normal albumin and PT/INR levels.

4. Aggressive treatment of sepsis needs to be done by drainage of bilioma along with broad-spectrum antibiotics. Nutrition of these patients is paramount.

5. Patients with fever, metabolic acidosis, on ventilator fared poorly as compared to the other patients.

There is a direct relation of recovery of the patients with level of metabolic acidosis, hypoalbuminemia, and altered coagulation profile.

There is no direct correlation with level of serum bilirubin, alkaline phosphatase with the outcome of these patients.

Discussion

A major challenge for all surgeons remains bile duct injury following cholecystectomy—both open and laparoscopic. Severe injuries such as bile duct transection or recurrent strictures need experienced surgeons capable of performing reconstructive surgery. Surgical repair can be complicated by biliary leak, sepsis, cholangitis, bleeding, anastomotic strictures and biliary cirrhosis with portal hypertension and end-stage liver disease. It is well known that bile duct injuries lead to prolonged morbidity, high costs, and an impaired quality of life [1-3]. Optimization of the management strategy can reduce these complications.

This article describes a consecutive series of 17 patients undergoing reconstructive surgery; Roux-en-Y hepaticojejunostomy for bile duct injury operated at our institution over 8 years. We analysed various conditions and predictors influencing the occurrence of major complications and outcome in this study. The index cholecystectomy was performed by the laparoscopic method in all 17 cases. Of these two cases of bile duct injury occurred in our institution. As the incidence of BDIs is higher in laparoscopic cholecystectomy than open cholecystectomy (0.1-0.2% vs. 0.4-0.6%) and tends to be more severe the technique of index cholecystectomy may indirectly affect the outcome after surgical repair in these patients [4,5].

There were 11 patients above the age of 40 years. Older age was not associated with occurrence of major complications after surgical repair as noted in a few studies [6-10]. It is now established that following successful management, quality of life is decreased and survival impaired especially in elderly patients [11]. The injury was recognized intra-operatively in 02 cases (12%) similar to other studies where the majority of biliary injuries are not recognized during the initial cholecystectomy [9]. After diagnosing injury 15 of 17 patients (88%) were referred to our centre.

The Gold standard of treatment of bile duct injuries is Roux-en-Y hepatico-jejunostomy (HI) and is the preferred method of repair. This was performed in all patients in this study. Repair in the presence of peritonitis is associated with poor outcome [12,13]. Our practice was to initially control sepsis via radiologic intervention or laparotomy/ laparoscopy and antibiotics and operate on patients later (2-4 weeks), after their index admission. This gives us time for the collections and inflammation to subside. The optimal timing of surgical repair remains controversial. Early surgical reconstruction performed several days to within 3 weeks after injury, on non-dilated bile ducts and inflamed tissues is thought more difficult with poorer short and long-term outcomes. However, many authors have failed to identify early repair as an individual risk factor [12,14,15]. In this series, early repair within 3 weeks was associated with the lowest incidence of major complications.
as reported in some other series also [16]. Patients with late repairs and repeat surgeries were associated with significantly higher incidence of major complications though timing of repair was not an independent predictor for outcome.

None of the patients in this series needed reoperation for failed repairs previously performed by a non-experienced surgeon. Reports suggest that 75% of primary surgeons attempt to repair the injury themselves [2]. Prior reconstructive surgery by the initial surgeon was found to be associated with an increased incidence of complications though it was not found to be an independent predictor in our series (02 patients). We feel that a surgeon’s experience and skill at managing this condition is an important factor affecting the outcome of the patient. Stewart and Way showed that the outcome of a surgical repair after BDI is successful in 94% of the patients if performed in a specialized center, whereas only 17% are successful when operated on by the initial surgeon [17]. A multicentre report by Woods et al. reported a similar rate of failure (94%) following repair prior to specialist referral [18]. In addition, the number of attempted repairs before referral was a significant predictor of poor outcome. Multiple attempts lead to a higher rate of failure and complications [19].

Other prognostic factors for successful repair of iatrogenic BDI include the level of injury and absence of injury to the right hepatic artery. It has long been recognized that higher the location of injury or stricture, the more difficult is the repair and the greater is the recurrence rate though we did not observe an association between level of injury and outcome, the relatively small number of patients within each injury sub-type makes it difficult to compare.

Stewart et al. reported that biliary injuries repaired by the primary surgeon are associated with a higher incidence of postoperative abscess bleeding, hemobilia, hepatic ischemia, and the need for hepatic resection but a similar increase in the complication rate was not seen in patients treated by hepatobiliary surgeons [20].

Conclusion

In conclusion, referral to a tertiary centre after therapeutic interventions was an independent negative predictor of outcome.

Reconstructive surgery after repair performed by non-experienced surgeons had a worse outcome. Our findings thus support early referral of patients to a tertiary hepato-biliary center after bile duct injury without intervention and specialist surgical repair.

Conflict of Interest

Authors have no conflict of interest to disclose.

References