

## NEW CLASSIFICATION OF MAJOR BILE DUCT INJURIES ASSOCIATED WITH LAPAROSCOPIC CHOLECYSTECTOMY

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### Abstract

A new, five-grade classification of bile duct injuries associated with laparoscopic cholecystectomy, based on repeat operations carried out by the authors, is presented. Special attention was paid to the treatment of loss injuries involving the regions high above the level of the hepatic duct bifurcation. The procedures used in accordance with the classification system are described in selected cases.

### Key words

Five-grade classification, Iatrogenic injury, Hepatocholedochus, Laparoscopic cholecystectomy

### INTRODUCTION

Today's general surgery is characterised by the development of minimal invasive intervention, by highly qualified interdisciplinary cooperation, by an increase in the number of acute operations and also by the serious nature of acute repeat operations.

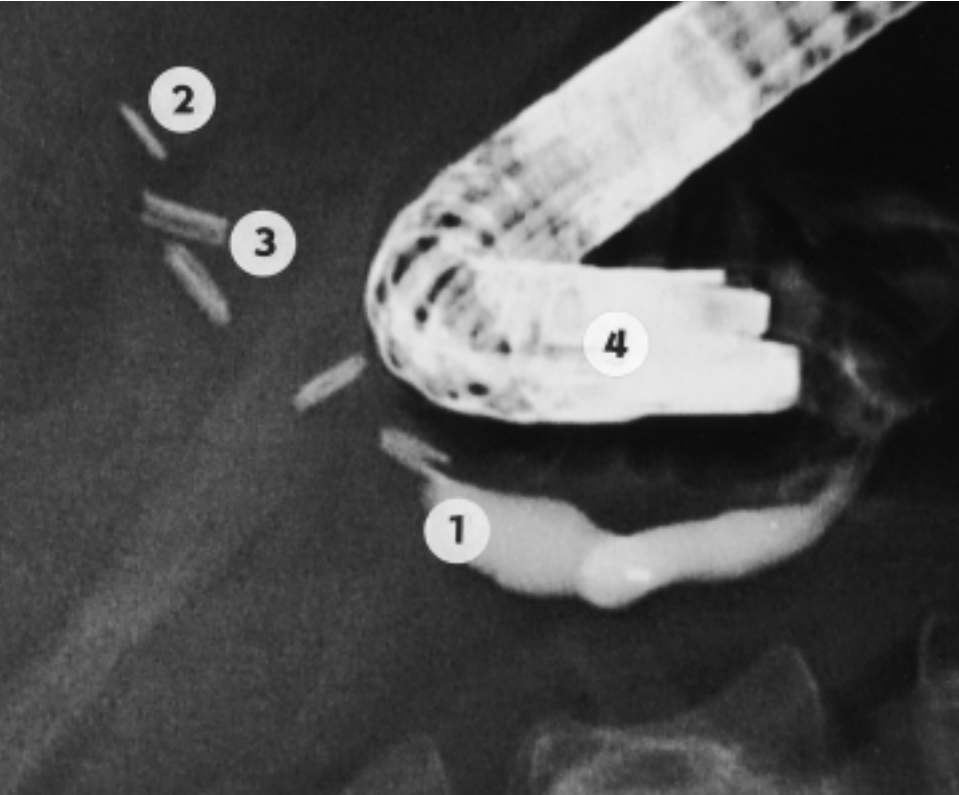
With the increasing use of laparoscopic cholecystectomy, reports from leading surgical institutions have drawn attention to intraoperative and postoperative problems and complications associated with this procedure (1,2,3,4). Over a hundred reports have been published on repeat operations on the bile duct initially treated by laparoscopic cholecystectomy, but a classification of these injuries was made only occasionally. A four-grade rating system was published by *Siewert* in 1994 and a nine-grade classification was reported by *Strasberg* (5).

In this paper we present a new classification system, using five grades of injury, based on our clinical experience gained from repeat surgeries and options for reconstructive procedures on the bile duct system, particularly in high loss injuries involving the regions high above the level of the hepatic duct bifurcation.

### CASE REPORTS AND METHODS

A total of 244 cases of laparoscopic cholecystectomy have been performed in the Traumatological Hospital in Brno; of these, 14 showed postoperative complications and bile leaks. Two patients were referred to our hospital after initial surgery at outside surgical wards. The management of injuries sustained at laparoscopic cholecystectomy is described in the following cases.

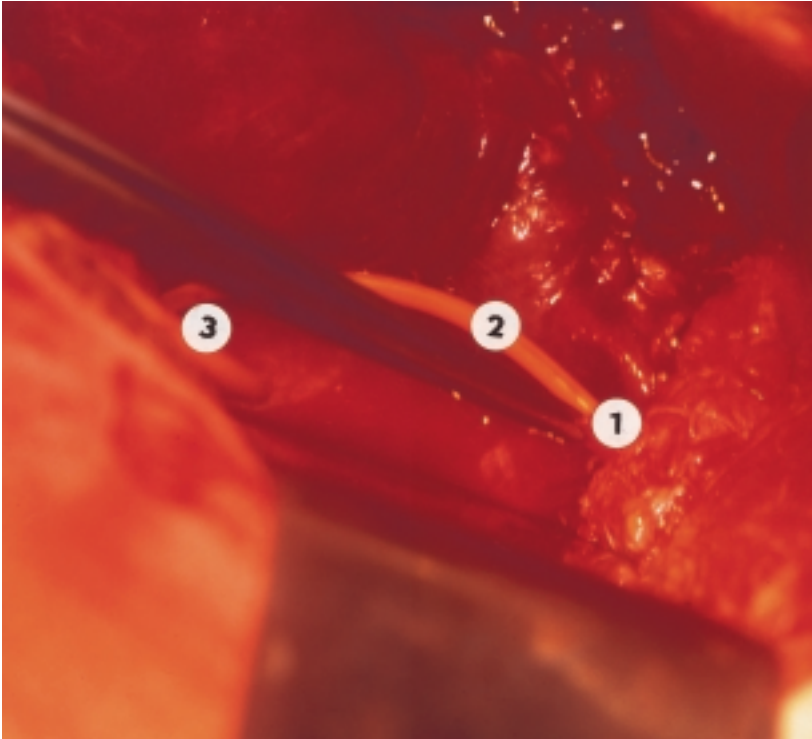
Patient no.1 was referred to our hospital on day 7 after laparoscopic cholecystectomy. She had a drain inserted in the subhepatic region and bile secretion was 500 ml per day. She had fever, jaundice and confined biliary peritonitis with bile retention in the abdominal cavity, as revealed by sonographic and CT examination. Because of a suspected intraoperative lesion in the bile duct, we carried out endoscopic retrograde cholangiopancreatography (ERCP), which confirmed a loss injury to the bile duct (*Fig. 1*). After an appropriate preparation, we immediately performed a reparative operation that revealed circumscribed peritonitis and subphrenic and subhepatic abscesses. It was also revealed that the remaining part of the distal choledoch duct was closed with a clip that was left in place and that the patient sustained loss injury to the whole hepatic ductal system, extending high into the porta hepatis; two clips closing the left and right hepatic ducts at a distance of 1 cm from the bifurcation were found, causing necrosis of the hepatic duct walls and bile leaks. This state was classified as grade V injury. Because both the right and left hepatic ducts were drawn deep into liver parenchyma and were very thin, we performed resection of the second liver lobe, with separation of the fine left hepatic duct and its subsequent dilatation. A silastic stent was inserted through the left hepatic duct and the other peripheral part was placed through an anastomosis with the stomach, as



*Fig 1*

High loss injury of the common hepatic duct above the union of the right and left bile ducts, classified as grade V on the basis of endoscopic retrograde cholangiopancreatography.

1, clip closing the distal part of the choledoch duct; 2, clip attached to the left hepatic duct; 3, clip attached to the right hepatic duct; 4, duodenoscope inserted up to the Vateri papilla.

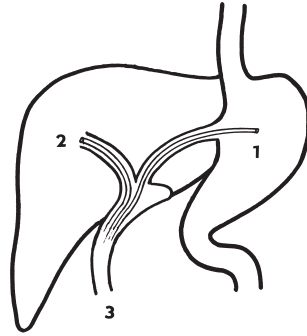


*Fig. 2*

Postoperative finding of a high loss injury (grade V) of the ductus hepatocholedochus; a catheter was inserted into the distal bile duct. 1, retroduodenal part of the choledoch duct; 2, catheter replacing the missing ductus hepatocholedochus; 3, catheter inserted in the porta hepatis.

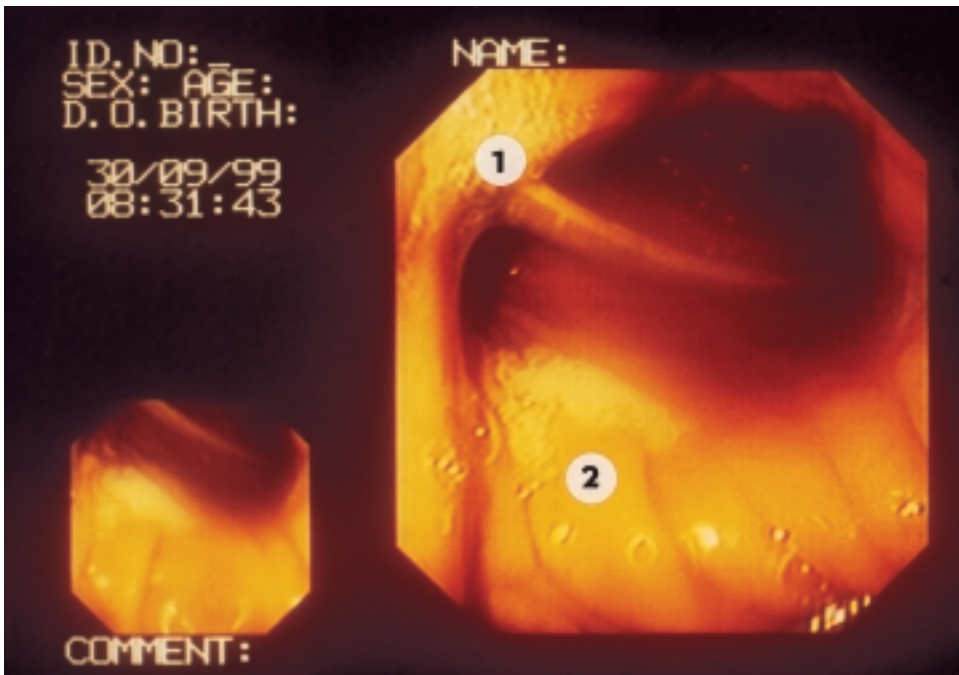
modified by Dogliotti. A branch of the right hepatic duct was dissected and placed in front of the gallbladder bed, a silastic stent was inserted into the right hepatic duct, and the two stents leading from the right and left hepatic ducts were connected with a Roux-en-Y limb of jejunum created in a retrocolic position. In this reconstructive procedure, one suture anastomosis with the stomach and two non-suture anastomoses with the Roux-en-Y limb of jejunum were used. The operation was completed with drainage to Winslov's foramen. The postoperative course was uncomplicated, stools were choleic but laboratory data did not show cholestasis. The patient was discharged to home care after 4 weeks. At follow-up two years later, it was ascertained by gastrofibroscopy that the stent in the left hepatic duct was still open to passage of bile (*Figs 2,3,4*).

Patient no. 2 underwent laparoscopy for diagnosed cholelithiasis. During the procedure, infiltration of the hepatic duct was found and the patient was converted to an open procedure; the hepatic duct was excised up to the hepatic duct bifurcation (grade IV injury). At reconstruction, both ducts, with stents inserted, were sutured into a Roux-en-Y limb of jejunum. The stents were placed using Völkner's drainage. The stent leading into the right hepatic duct fell out too soon and, therefore, transhepatic stenting of the right hepatic duct was performed. A conclusion was drawn that stents placed intraoperatively should be fixed with atraumatic sutures in order to prevent their untimely disconnection. The patient healed without signs of cholestasis and continued to be checked up at regular intervals (*Fig. 5*)



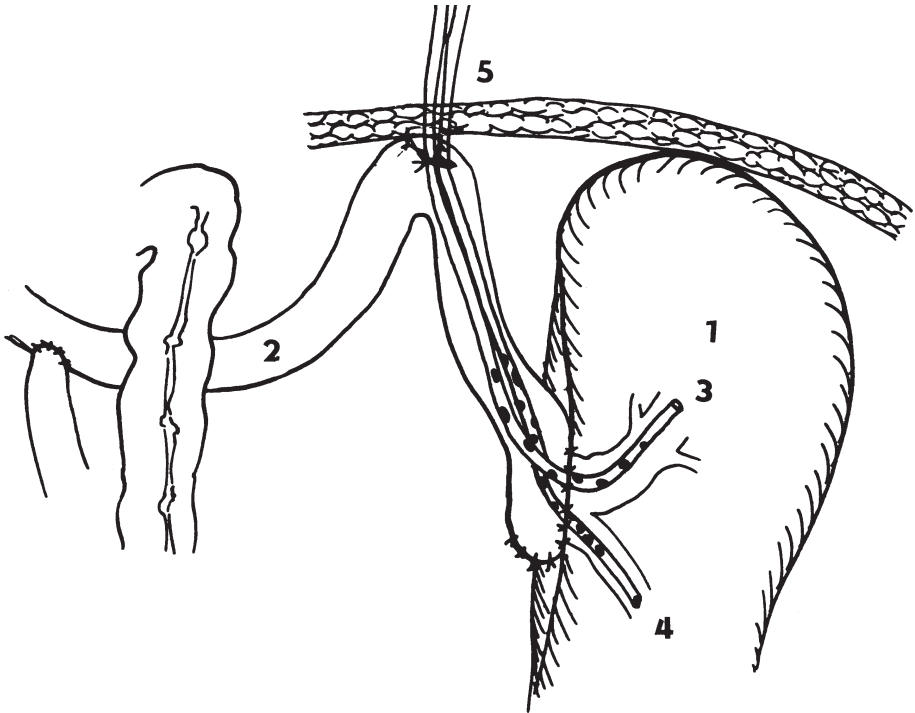
*Fig. 3*

Schematic drawing of reconstruction by means of anastomoses used in a high ductal injury above the level of the bile duct confluence (Grade V). 1, stent inserted through an anastomosis with the stomach and left hepatic duct sutured centrally to a Roux-en-Y limb of jejunum; 2, stent inserted through the right hepatic duct sutured centrally to the Roux-en-Y limb of jejunum; 3, Roux-en-Y limb of jejunum.



*Fig. 4*

Gastrofibroscopic finding at 2 years after reconstructive surgery involving hepatico-gastrostomy. A stent from the left hepatic duct allows passage of bile. There are no clinical or laboratory signs of cholestasis. 1, stent inserted through an anastomosis of the left hepatic duct with the stomach; 2, stomach content with biliary secretion.



*Fig. 5*

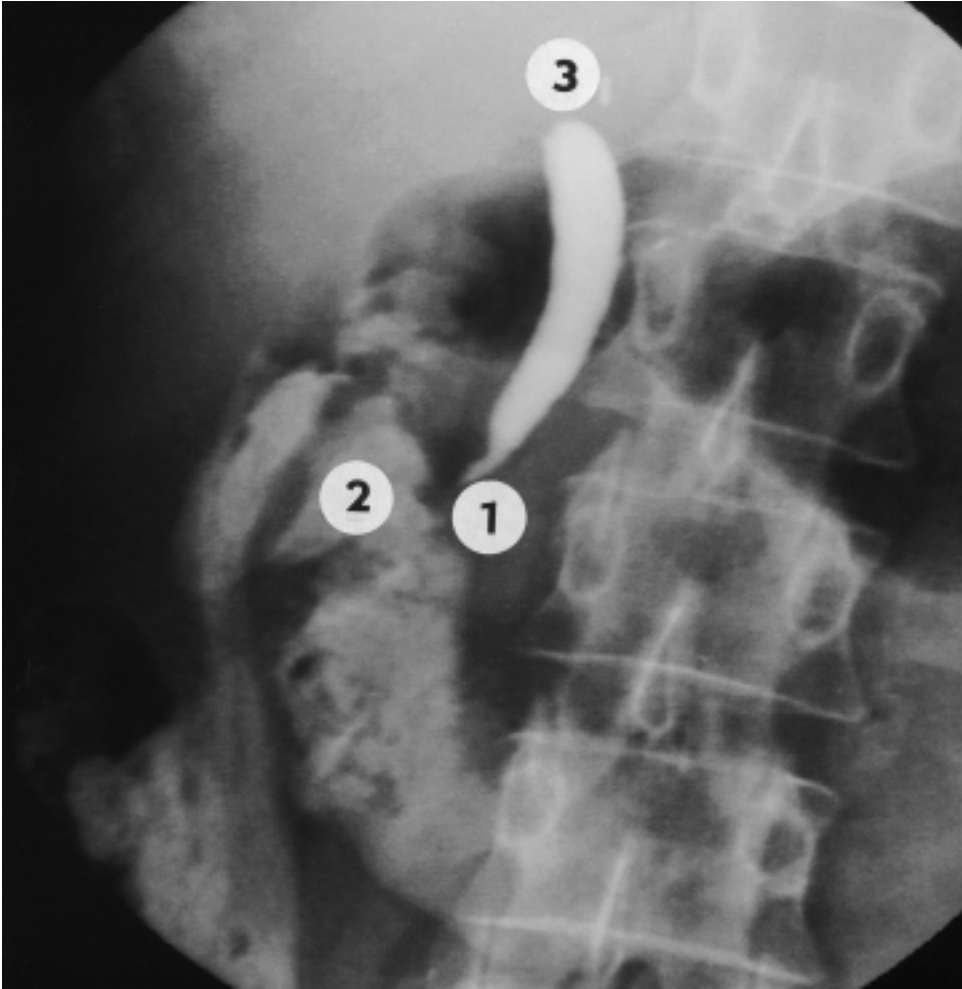
Scheme suggesting a reconstructive procedure for a grade VI lesion of the common bile duct. 1, liver; 2, Roux-en-Y; 3, catheter inserted in the right hepatic duct; 4, catheter inserted in the left hepatic duct.

Patient no. 3 was operated on for acute cholecystitis with cholelithiasis. During this surgery, the hepatic duct wall was severed over more than two thirds of the duct lumen (grade III). The intraoperative lesion was resolved by an end-to-end anastomosis with a stent placed through the anastomosis over the duodenal papilla. To ease the anastomosis, mobilisation of the duodenum according to Kochler was performed. The postoperative course was free from complications and signs of cholestasis and the patient continued to be followed up.

In the fourth patient, laparoscopic cholecystectomy revealed a lesion in the hepatic duct wall at the site of cystic duct insertion (grade II). The lesion was sutured up. The patient returned seven months later with the symptoms of recurrent jaundice and cholangitis. She was examined by ERCP and stenosis at the site of the suture was identified (*Fig. 2*). This condition was treated by hepaticojejunostomy with a temporary stent placed through the anastomosis. The patient healed without complications (*Fig. 6*).

Ten other patients who had undergone laparoscopic cholecystectomy showed transient biliary secretion that subsided within four days. Repeat laparoscopy had to be performed only occasionally, usually in the case of a minute, aberrant bile duct in the gallbladder bed.

The five-grade classification of hepatic duct lesions we suggested on the basis of our experience is defined as follows:



*Fig. 6*

Grade II lesion of the hepatic duct at the confluence with the cystic duct treated by suture, and a subsequent stenosis of the common bile duct. 1, stenosis of the choledoch duct resulting from suturing the severed duct wall; 2, wall of the descending choledoch duct; 3, liver.

Grade I – transient biliary fistula, usually from an aberrant bile duct in the gallbladder bed, with a good prognosis.

Grade II – late stenosis of the hepatic duct, usually following coagulation or wall suture.

Grade III – tangential lesion of the hepatic duct.

Grade IV – complete transection of the hepatic duct often associated with a vascular lesion.

Grade V – major hepatic duct injury at the level above the hepatic bifurcation, usually associated with a vascular lesion.

## DISCUSSION

Iatrogenic injury to the hepatic and bile ducts occurs in about 0.2 to 0.7 % of patients undergoing open cholecystectomy. In a paper by *Topal et al.*, 16 patients have been reported to sustain injury to the hepatic duct during laparoscopic cholecystectomy (1). Similar findings have been reported by *Regoly-Mereti et al.* who, in a statistical evaluation of 26 440 laparoscopic cholecystectomies, have recorded 148 complications related to injured hepatic ducts (6). Similar results have been described by *Di Mauro et al.* (3). *Siewert et al.* reported 28 repeat operations and *Lillemoe et al.* described 89 repair interventions following laparoscopic cholecystectomy (5, 4). In the Czech literature, the issue of revision laparoscopy has been discussed by *Šefr et al.* (7,8).

Today, interventional radiology and laparoscopic techniques, namely, transhepatic cholangiography and dilatation including stent insertion, are becoming useful methods that have been estimated to resolve more than 80% of postoperative stenosis (4). An important contribution to the treatment of bile duct lesions is ERCP, together with diagnostic retrograde cholangiography and stent insertion. The treatment of loss injuries affecting the duct system high above the level of the hepatic bifurcation and duct system reconstructions are complex procedures involving hepaticojejunostomy with a Roux-en-Y limb of jejunum. In our hospital this was preferred to anastomoses. The advantage of the reconstruction performed in the first patient was seen in the use of three anastomoses: left hepaticogastrostomy and separate right and left hepaticojejunostomy.

Laparoscopic cholectectomy is currently a fully accepted and much used method in surgery of the hepatobiliary duct system. However, it also has some disadvantages and potential complications. Surgeons should be aware of these facts and, if a loss injury happens to occur, this complication should be identified intraoperatively and bile duct reconstruction should follow. Statistical data from large surgical centres in the USA and Germany as well as our own clinical observations indicate that the number of these injuries will decrease with increasing experience of the surgeons involved. It is estimated that, in the future, their rate may drop below 0.6 % (2, 5).

NOVÁ KLASIFIKACE PORANĚNÍ HEPATOCHOLEDOCHU PŘI LAPAROSKOPICKÉ  
CHOLECYSTEKTOMII

S o u h r n

Autoři uvádějí novou pětistupňovou klasifikaci poranění hepatocholelochochu při laparoskopické cholecystektomii, ke které dospěli na základě vlastního klinického materiálu s reoperacemi. Zvláštní pozornost věnují ošetření vysokých ztrátových poranění nad vidlicí hepatických. Tuto klasifikaci dokumentují vlastními diagnostickými a operačními postupy u vybraných případů.

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