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Reviw Article

CLASSIFICATION AND MANAGEMENT OF IATROGENIC BILE DUCT INJURY

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Abstract

The laparoscopic cholecystectomy is considered the gold standard for the treatment of benign gall bladder disease, which is associated with an increased incidence of biliary injuries. These types of injuries are multicausal, and anatomical variations or anatomical perception errors are the most common risk factors. Iatrogenic bile duct injuries are complex alterations and constitute one of the most serious complications of a cholecystectomy and require a comprehensive approach, proper drainage and timely referral to adequate treatment to improve long-term prognosis. Reconstruction and treatment techniques have been evolving. The selection of adequate treatment will impact on the patient´s quality of life.

Introduction

Iatrogenic biliary injuries during cholecystectomy are serious complication that can have devastating consequences, including a significant risk of early death[1]. Iatrogenic biliary injuries are feared complications reported to occur in approximately 0.2-0.3% in open cholecystectomy Era, but incidence increasing following the introduction of laparoscopic cholecystectomy, with a mean bile duct injuries when including both minor and major injuries up to 0.9% [2].

Traditionally, surgery has been the gold standard for the management of biliary injuries. Recently, various endoscopic and radiological intervention methods have been used as the preferred modalities of these patients, as they permitted a less invasive approach with similar or reduced morbidity [3]. The management outcome of iatrogenic biliary injuries is better when such injuries are managed at specialized hepatobiliary center equipped with multidisciplinary service [4].

The choice of surgical reconstruction and timing of surgical repair are decisive for long-term course and require close interdisciplinary cooperation of gastroenterologists, radiologists, and surgeons.

Bile duct injury classification

Bismuth-Corlette

The first classification of bile duct injury is authored by H. Bismuth in 1982. The Bismuth classification is a simple classification based on the location of the injury in the biliary tract.

Here BDI classified according to the distance from the hilar structure especially bile duct bifurcation, the involvement of bile duct bifurcation, and individual right sectoral duct[5].

Type I- involves the common bile duct and low common hepatic duct (CHD) >2 cm from the hepatic duct confluence.

Type II- involves the proximal CHD <2 cm from the confluence.

Type III- hilar injury with no residual CHD confluence intact.

Type IV- destruction of the confluence when the right and left hepatic ducts become separate.

Type V- involves the aberrant right sectoral hepatic duct alone or with concomitant injury of CHD.

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Strasberg classification

The Strasberg classification allows differentiation between small (bile leakage from the cystic duct or aberrant right sectoral branch) and serious injuries of biliary tree. Type E of the Strasberg classification is an analogue of the Bismuth classification[6]. The Strasberg classification be easily applied to bile duct injuries. The major disadvantage of the Strasberg classification is that it does not describe additional vascular involvement at all.

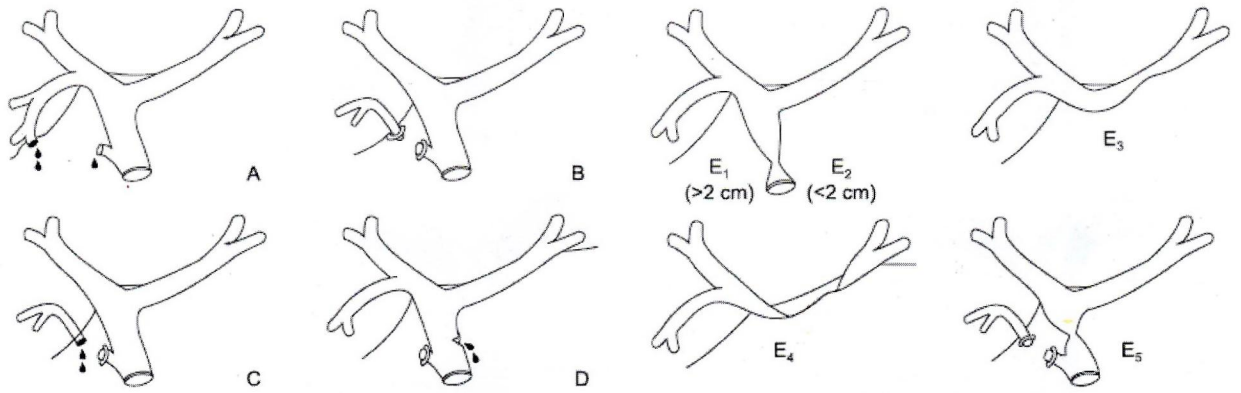

Fig. 1. Strasberg classification.

(A) Bile leak from cystic duct stump or minor biliary radical in gallbladder fossa.
(B) Occluded right posterior sectoral duct.
(C) Bile leak from divided right posterior sectoral duct.
(D) Bile leak from main bile duct without major tissue loss.
(E1) Transected main bile duct with a stricture more than 2 cm from the hilus.
(E2) Transected main bile duct with a stricture less than 2 cm from the hilus.
(E3) Stricture of the hilus with right and left ducts in communication.
(E4) Stricture of the hilus with separation of right and left ducts.
(E5) Stricture of the main bile duct and the right posterior sectoral duct.

McMahon classification

McMahon et al. proposed another classification of bile duct injuries after laparoscopic cholecystectomy. They classified the injury by the width of bile duct injury. Based on the McMahon classification, lacerations under 25% of the common bile duct (CBD) diameter or cystic- CBD junction was classified as minor injury, whereas transection or laceration over 25% of CBD diameter and postoperative bile duct stricture were classified as major
Injury[7].

Stewart-Way classification

Bile duct injuries fall into four classes based on the Stewart-Way classification[8].

Class I injury occurs when CBD is mistaken for the cystic duct, but the error is recognized before CBD is divided.

Class II injuries involve damage to CHD from clips or cautery used too close to the duct. This often occurs in cases where visibility is limited due to inflammation or bleeding.

Class III injury, the most common type, occurs when CBD is mistaken for the cystic duct. The common duct is transected and a variable portion including the junction of the cystic and common duct is excised or removed. Class IV injuries involve damage to the right hepatic duct (RHD), either because this structure is mistaken for the cystic duct, or because it is injured during dissection (Fig. 2).

Both complex bile duct and vascular injuries were included in the Stewart- Way classification.

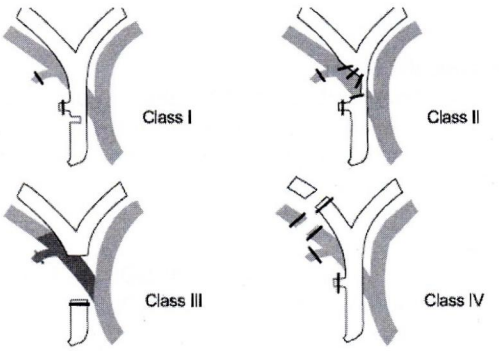

Fig. 2. Stewart-Way classification.

Hannover classification

Bektas et al. proposed a new classification system named Hannover classification. In the Hannover, bile duct injuries were divided into five types from A to E[9].

Type A is peripheral bile leakage.
Type B is stricture of CHD or CBD without injury.
Type C is lateral CHD or CBD injury.
Type D is total transection of CHD.
Type E is bile duct stricture of the main bile duct without bile leakage at postoperative state.
Vascular injuries are included in Type C and Type D.

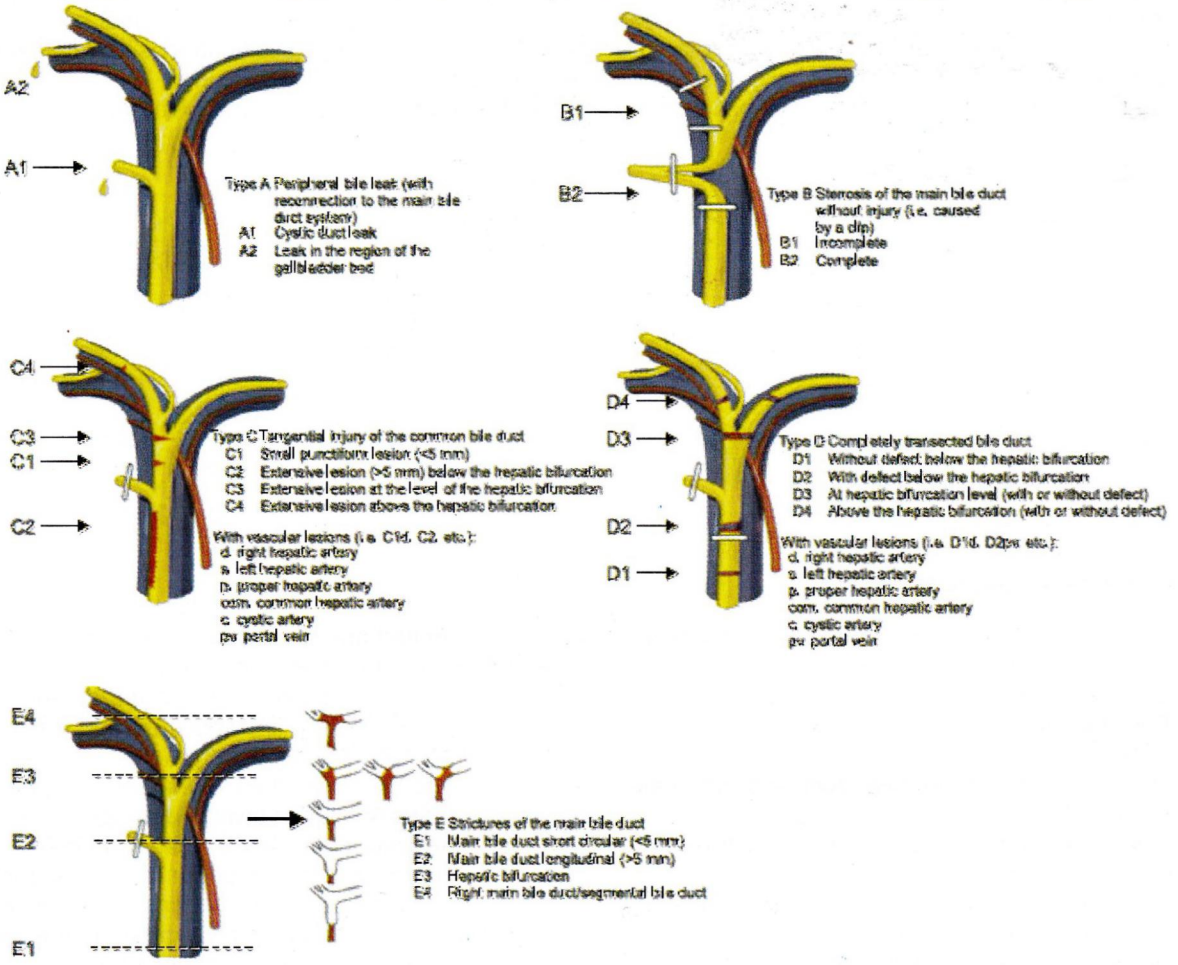

Fig. 3. Hannover classification.

Mattox classification

The Mattox classification of BDI takes into consideration the types of injuring factors (contusion, laceration, perforation, transection, diversion or interruption of the bile duct or the gallbladder)[10].

Diagnosis

The two most frequent scenarios of BDI are bile leak and bile duct obstruction. Most of BDIs after laparoscopic cholecystectomy are recognized peroperatively or in the immediate postoperative period. Bile leak is easily recognized during the first postoperative week. Constant bile effusion is documented through surgical drains, surgical wounds or laparoscopic ports. Patients usually complain of diffuse abdominal pain, nausea, fever and impaired intestinal motility. In addition, bile collections, peritonitis, leukocytosis and mixed hyperbilirubinemia may be part of the clinical setting. An obstructive pattern in liver function tests accompanied by jaundice is frequent in the biliary obstruction scenario.

However, if not identified during the first postoperative week, patients have an insidious evolution with relapsing abdominal pain and cholangitis. Jaundice is not always present immediately after bile duct injury. Some partial stenosis and isolated sectorial right duct lesions (Strasberg B and C) present with abdominal pain, pruritus, general weakness, fever and intermittent alteration of liver function tests. The late clinical course of bile duct injury leads to chronic liver disease, cirrhosis and portal hypertension.

Different methods can help the diagnosis of bile duct injuries peroperatively and in postoperative period. Intraoperative cholangiography helps early detection of biliary tract injury during the primary operation, improves survival.

Also, there are various methods for postoperative diagnosis- transabdominal ultrasonography, endoscopic retrograde cholangiopancreatography (ERCP), percutaneous trans hepatic cholangiography, magnetic resonance cholangiopancreatography (MRCP). Among the laboratory tests are indicators of cholestasis and liver function: bilirubin, alkaline phosphatase. In patients with iatrogenic injury without complications or liver damage, do not rise aminotransferases.

Management

When reconstruction and repair is performed at a higher level in a facility with surgical experts, there is

greater success rate, shorter hospital stay, morbidity and mortality. The best time to repair an injury of primary biliary duct is during the initial intervention due to the absence of local inflammation, but the main problem is the size of the bile ducts, which are often thin and not dilated. When patient present late with sepsis then repair is delayed for sepsis control, improve the general condition of the patient and dilatation of proximal segment of bile duct.

BDI must be treated according to the type of injury. The Strasberg classification is a helpful tool to decide the best intervention for each case according to etiological mechanism of injury.

Strasberg A injury

As Strasberg A injuries maintain continuity with the rest of the bile ducts, they are easily treated through endoscopic intervention. The objective is to decrease intraductal pressure distal to the bile duct leak. If endoscopy is not available, a T tube could be useful. The last resource is to control the bile leak through subhepatic drains and refer to a specialized center with enough experience to treat BDI[11].

Strasberg B injury

If mild pain and elevation of liver function tests are present with no clinical impairment, conservative management is followed. The presence of moderate and severe cholangitis makes the drainage of the occluded liver segment necessary. Percutaneous drainage or surgical resections can be performed when cholangitis is not controlled with medical treatment. Long term prognosis is poor and there is a higher probability of bile colonization and cholangitis[12].

Strasberg C injury

As in Strasberg B injury, an accessory right duct is sectioned but the proximal stump is not detected with an unnoticed bile leak as a consequence. No continuity exists with the rest of the bile duct system, leaving endoscopy out of the therapeutic options. Subhepatic collections are frequent in the postoperative setting. These must be drained in order to avoid biliary peritonitis and septic shock.

It is common that the bile leak is occluded spontaneously with no other intervention maintaining a controlled bile leak through external drains.

Strasberg D injury

A partial injury of the common bile duct in its medial side and bile duct continuity is present. If a small injury with no devascularization is present, a 5-0 absorbable monofilament suture to close the defect is adequate. In these rare cases, external drainage must be left in place and mandatory endoscopic sphincterotomy and endoprothesis should be performed. In the setting of a devascularized duct, even if small 5-0 absorbable stitches are used, a bile leak will develop during the first postoperative week with concomitant bile collections. Management of these cases requires a multidisciplinary approach with endoscopy and radiological guided drainage as the first therapeutic options. Surgery is the last resource of treatment when a loss of bile duct tissue is present and migration of a Strasberg D to E injury has taken place.

Strasberg E injury

This injury is defined by a complete loss of common and/or hepatic bile duct continuity. Devascularization and loss of bile duct tissue obliges the surgeon to performa high-quality hepatojejunal anastomosis. The latter procedure guarantees well-perfused bile ducts and a low tension anastomosis.

The best postoperative outcomes are obtained when the hepatic confluence is preserved, allowing a highquality, wide, well vascularized hepatojejunal anastomosis. Partial resection of ? and ? segments facilitates identification of bile ducts and proper settling of the jejunal loop[13].

In the unfortunate situation of inadequate ducts to perform a hepatojejunal anastomosis, the jejunal loop

must be sutured to the liver parenchyma including ferulized bile ducts within the anastomosis similarly to a Kazai portoenterostomy[14].

Conclusion

The biliary injury is a serious event in laparoscopic surgery, and the prognosis will depend on the type of injury and the complexity of repair. Various techniques have been described for reconstruction and repair, grounded in the type of injury and surgical experience, therefore successful management depends on several factors, including early diagnosis and personalized service, and multidisciplinary management.

The bile duct injury lesions are associated with postoperative morbidity, with a significant impact on quality of life and long term psychologically, in the quality of life of patients. Among the things of vital importance for the prevention of iatrogenic injury is the detailed knowledge of the anatomy of the bile duct.

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