

Hepatectomy for bile duct injuries: When is it necessary?

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Author contributions: Jabłońska B wrote this paper.

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Received: June 28, 2013 Revised: August 30, 2013

Accepted: September 3, 2013

Published online: October 14, 2013

Abstract

Iatrogenic bile duct injuries (IBDI) are still a challenge for surgeons. The most frequently, they are caused by laparoscopic cholecystectomy which is one of the commonest surgical procedure in the world. Endoscopic techniques are recommended as initial treatment of IBDI. When endoscopic treatment is not effective, surgery is considered. Different surgical biliary reconstructions are performed in most patients in IBDI. Roux-Y hepaticojejunostomy is the commonest biliary reconstruction for IBDI. In some patients with complex IBDI, hepatectomy is required. Recently, Li *et al* analyzed the factors that had led to hepatectomy for patients with IBDI after laparoscopic cholecystectomy (LC). Authors concluded that hepatectomy might be necessary to manage early or late complications after LC. The study showed that proximal IBDI (involving hepatic confluence) and IBDI associated with vascular injuries were the two independent risk factors of hepatectomy in this series. Authors distinguished two main groups of patients that require liver resection in IBDI: those with an injury-induced liver necrosis necessitating early intervention, and those in whom liver resection is indicated for treatment of liver atrophy following long-term cholangitis. In this commentary, indications for hepatectomy in patients with IBDI are discussed. Complex biliovascular injuries as indications for hepatectomy are presented. Short- and long-term results in patients fol-

lowing liver resection for IBDI are also discussed. Hepatectomy is not a standard procedure in surgical treatment of IBDI, but in some complex injuries it should be considered.

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Key words: Hepatectomy; Bile duct injury; Cholecystectomy; Laparoscopic cholecystectomy

Core tip: Different surgical biliary reconstructions are performed in most patients with iatrogenic bile duct injuries (IBDI). Roux-Y hepaticojejunostomy is the commonest biliary reconstruction. However, in some patients with complex IBDI involving disruption of hepatic confluence and injuries associated with concomitant vascular damage, hepatectomy is required. In this commentary, indications for hepatectomy in patients with IBDI are discussed. Complex biliovascular injuries as indications for hepatectomy are presented. Short- and long-term results in patients following liver resection for IBDI are also discussed. Hepatectomy is not a standard procedure in surgical treatment of IBDI, but in some complex injuries it should be considered.

Jabłońska B. Hepatectomy for bile duct injuries: When is it necessary? *World J Gastroenterol* 2013; 19(38): 6348-6352
Available from: URL: <http://www.wjgnet.com/1007-9327/full/v19/i38/6348.htm> DOI: <http://dx.doi.org/10.3748/wjg.v19.i38.6348>

COMMENTARY ON HOT TOPICS

I have read with great interest the recent article Li *et al*^[1] analyzing the factors that had led to hepatectomy for patients with bile duct injuries after laparoscopic cholecystectomy (LC). I would strongly recommend this article to the readers.

Iatrogenic bile duct injuries (IBDI) are still a chal-

lenge for surgeons. The most frequently, they are caused by laparoscopic cholecystectomy which is one of the commonest surgical procedure in the world^[2,3]. The early and proper diagnosis of IBDI is very important for surgeons and gastroenterologists, because unrecognized IBDI lead to serious complications such as biliary cirrhosis, hepatic failure and death^[3,4]. Endoscopic techniques are recommended as initial treatment of IBDI. When endoscopic treatment is not effective, surgery is considered. Different surgical biliary reconstructions are performed in most patients in IBDI. Roux-Y hepaticojejunostomy is the commonest biliary reconstruction for IBDI. However, in some patients with complex IBDI, hepatectomy is required. Complex IBDI involve disruption of hepatic confluence and injuries associated with concomitant vascular damage^[1,5]. The incidence of arterial injury in patients in IBDI ranges between 12% and 47%^[6,7]. Distal IBDI are accompanied by damage of axial arteries (10%-15%) and proximal IBDI are usually associated with damage of the proper hepatic artery and its branches (most frequently right hepatic artery) (40%-60%)^[2,6]. The incidence of complex biliovascular injuries has risen since the introduction of LC^[8]. According to Li *et al*^[1], most complex IBDI such as Strasberg types E4 and E5 IBDI, either as an isolated condition or in combination with injury to vascular structures, can be effectively repaired by Roux-Y hepaticojejunostomy. However, in some patients with liver necrosis or lobar atrophy and fibrosis, hepatectomy is required^[1].

In their study, Li *et al*^[1] analyzed the medical records of 76 patients who had received surgery for IBDI following LC from April 1998 to September 2007. Hepatectomy was performed in 10 of 76 patients (13.2%), with IBDI either as isolated damage or in combination with vascular injury (VI). Proximal IBDI (defined as disruption of the biliary confluence) and injury to the right hepatic artery were found to be independent risk factors of hepatectomy. When both injuries occurred, 72.7% (8/11) of their referred patients required hepatectomy. Five patients required early liver resection (within 5 wk post-LC) to control sepsis caused by confluent liver necrosis or bile duct necrosis. In five patients, hepatectomy was indicated during long-term follow-up (over 4 mo post-LC) to effectively manage recurrent cholangitis and liver atrophy. Based on their own observation, authors distinguished two groups of patients with IBDI that require hepatectomy: those with an injury-induced liver necrosis necessitating early intervention, and those in whom liver resection is indicated for treatment of liver atrophy following long-term cholangitis.

Another interesting aspect of this study is analysis of short- and long-term results in 10 patients undergoing hepatectomy. Authors noted high postoperative morbidity (60%) and mortality (10%), and satisfactory long-term results (with median follow-up of 34 mo) with either no or only transitory symptoms in 67% of the patients^[1].

There are a number of publications regarding the

use of hepatectomy in surgical treatment of complex IBDI^[5-22]. Hepatectomy is one of therapeutic possibilities in patients with complex IBDI. Right hepatectomy is the most frequently performed liver resection in patients with IBDI because of the highest incidence injuries of the right hepatic artery^[5,6,22]. Li *et al*^[1] presented the following indications for hepatectomy in patients with IBDI: vascular injury causing liver necrosis without the possibility of vascular reconstruction, uncontrolled bile leakage due to a destructed segmental or sectional hepatic duct without the possibility of biliary reconstruction and recurrent cholangitis (more than four episodes) refractory to endoscopic management and not effectively amenable to bilioenteric anastomosis due to imaging evidence of atrophy or cirrhotic changes of the liver parenchyma. These indications are similar to literature data^[5-22]. Most frequently, liver atrophy or necrosis, sepsis, and unreconstructable hepatic ducts, as complications of complex IBDI, and multiple failed previous repairs are indications for hepatectomy. Liver resection removes the fibrotic, atrophic segment and the diseased biliary confluence and allows good access to the remnant bile duct for a safe healthy anastomosis^[5,6].

Laurent *et al*^[5] presented aims of hepatectomy in patients with complex IBDI involving biliary confluence (Bismuth IV, Strasberg E4). The aim of partial liver resection in patients with complex IBDI was to remove fibrotic and atrophic liver parenchyma with a high risk of secondary complications because of vascular or septic lesions. The other aim of hepatectomy was to remove completely the biliary stricture at the early stages of the disease for preventing progressive liver damage and potential malignancy caused by bile stasis and repeated cholangitis. Authors presented the following indications for hepatectomy: simultaneous ipsilateral portal and arterial injuries, stenosis of the hilar confluence involving secondary biliary confluence; presence of liver atrophy and presence of metallic stent.

Mercado *et al*^[9], based on their 20 years experience in surgical treatment of IBDI including 512 patients with complex IBDI (Strasberg E), performed major hepatectomy in patients with chronic biliary obstruction, liver atrophy, and persistent or recurrent cholangitis, with 1 to 3 previously failed attempts of surgical repair before arriving at their hospital. In remaining patients, Roux-Y hepaticojejunostomy without major liver resection was possible to perform. Authors pointed that in 2 patients, acute recurrent cholangitis, with pericholangitic abscess involving one hemi-liver that had not responded to medical and radiologic treatment, was the indication for major liver resection. In these cases, the liver parenchyma was not possible to rehabilitation, in spite of absence of disruption of hepatic influence. Based on the above mentioned two studies^[8,9], complex IBDI involving hepatic influence without vascular injury can be managed successfully with Roux-Y hepaticojejunostomy without major liver resection.

According to Thomson *et al*^[10], most patients are managed successfully with a Hepp-Couinaud hepaticojejunostomy because the left hepatic duct remains readily accessible. However, complications such as hepatic infarction, sepsis, anastomotic stricture, and intrahepatic stone formation can require hepatic resection, or even transplantation. Authors presented the following indications for hepatectomy in patients with IBDI: vascular injuries leading to partial liver devascularization, major injuries to the right hepatic duct that could not be repaired by conventional methods, and severe atrophy or sepsis of the hepatic lobe resulting from vascular injury or prolonged biliary obstruction that could not be drained effectively by Roux-Y hepaticojejunostomy. Liver transplantation was performed in combined biliary and vascular injuries leading to acute liver failure and in secondary biliary fibrosis with chronic liver failure.

In studies conducted in 1994 by Madariaga *et al*^[14], and in the year 1996 by Majno *et al*^[15], they indicated hepatectomy in cases of liver-infected necrosis. Sauvanet *et al*^[16] described the following indications for hepatectomy: injuries from the confluence or higher with unilateral portal injury, right pedicle destruction, and liver atrophy. de Santibañes *et al*^[21] presented algorithm for management of lobar atrophy including patients with IBDI. In asymptomatic cases of lobar atrophy, authors recommended control. Liver resection was indicated for symptomatic lobar atrophy caused by vascular injury, combined vascular and biliary injury, and biliary stenosis not responded to balloon dilatation. According to Truant *et al*^[22] large review, the presence of a Strasberg type E4 or E5 BDI associated with hepatic artery injury was an independent risk factor for hepatectomy. Based on the analyzing studies in PubMed database authors presented the following indications for hepatectomy: recurrent biliary sepsis, biliary strictures caused by continuous cholangitis, intrahepatic abscesses, non-visualization and/or unsuitability of the proximal stump of the injured bile duct(s) for anastomosis, intrahepatic injuries of an aberrant right hepatic duct, anastomotic strictures and intrahepatic lithiasis, right hepatic lobar atrophy, secondary biliary cirrhosis, primary non-diagnosed Klatskin tumor.

It should be emphasized that immediate arterial reconstruction of biliovascular injuries recognized intraoperatively or at least within 4 d is recommended in order to avoid liver devascularization^[8]. In another study, Li *et al*^[11] presented hepatic rearterialization, with vascular reconstruction with or without vascular graft, when it was technically possible. Authors carried out hepatic resection only in patients with partial liver atrophy or necrosis. Only early recognition of vascular injury allows to perform rearterialization. In late recognized injuries, partial hepatectomy is required.

Partial hepatectomy is not only performed in patients with damaged liver parenchyma, such as liver ischemia, atrophy and necrosis. A minor partial hepatectomy is

used in order to improve biliary reconstruction in high intrahepatic IBDI. Mercado *et al*^[23-27] described partial liver resection of segments IV and V that allowed adequate exposure of the bile duct at its bifurcation with an anterior approach of the ducts in order to perform a high quality anastomosis. The first partial-segment IV resection was performed in 1994.

The interesting phenomenon described by Li *et al*^[11] was a higher incidence of vascular injuries, involving a right hepatic artery, in proximal IBDI compared to distal ones. In this series, 11/33 high injuries were associated with arterial injury but only 9/43 distal injuries were. Authors explained this phenomenon by the fact that the high biliary injury involving the confluence was more likely to damage the hilar component of the choledochal hilar plexus and thus prevent compensatory flow from the left artery. A high risk of concomitant vascular injury in patients with proximal IBDI has been also reported in other studies on LC-related complications^[11,12,28-32]. Two arterial plexuses play important roles in adequate vascularization of the extrahepatic biliary system. One is the arterial plexus on the surface of the common bile duct and the common hepatic duct, connecting the posterosuperior pancreaticoduodenal artery and the right hepatic artery (most frequently, the 3 o'clock and 9 o'clock axial arteries). The other one (described by Vellar^[33]) is located within hilar plate on the inferior surface of the hilum of the liver. It is formed by the collateral vessels coming from the right hepatic left hepatic arteries^[33,34]. In patients with an occluded right hepatic artery combined with major bile duct injury, the arterial plexus on the bile duct is totally transected, and the hilar plate plexus might be jeopardized. In these cases, necrosis of the bile duct, dehiscence and stenosis of the biliary anastomosis, or a syndrome of multiple peripheral strictures within the biliary tree with jaundice and recurrent cholangitis, can occur^[11].

In the commented study, high morbidity and mortality rates and good long-term results were reported. It is associated with presence of serious complications in patients with complex IBDI requiring hepatectomy, such as peritonitis, sepsis with multi-organ insufficiency, and liver failure. Good long-term results show that liver resection should be considered in patients with complex IBDI that do not respond to other treatment. According to literature, hepatic resections in patients with IBDI can be performed successfully with low (0%) mortality, although with significant morbidity (50%-60%), and with excellent long-term success of 94%^[6].

In conclusion, depending on the time of surgical intervention, two groups of indications (early and late) can be distinguished. In the early postoperative period after cholecystectomy, hepatectomy is necessary in patients with liver necrosis or abscesses and bile leakage, in order to control peritonitis and sepsis. In remaining patients, hepatectomy is required in cases of recurrent cholangitis, that do not respond to standard therapy, and

symptomatic lobar atrophy. Although hepatectomy is not a standard procedure for patients with IBDI, it should be considered as a part of the surgical armamentarium for the repair of a selected group of patients in post-cholecystectomy injuries.

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P- Reviewers Carnovale CE, Shindoh J **S- Editor** Song XX
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ISSN 1007-9327



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