International Journal of Sciences: Basic and Applied Research (IJSBAR)

ISSN 2307-4531
(Print & Online)

http://gssrr.org/index.php?journal=JournalOfBasicAndApplied

Radiologic Procedures in Diagnosing and Treating Patients with Detected Benign Biliary Stricture after Laparoscopic Cholecystectomy

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Abstract

There are many reasons for benign biliary strictures.Laparoscopic cholecystectomy constitutes the main cause. In this study radiologic procedures in diagnosing and treating patients with detected benign biliary stricture after laparoscopic cholecystectomy are discussed. The study was designed as a retrospective investigation. The study group included 30 patients who were referred with biliary strictures after laparoscopic cholecystectomy. The group consisted of 21 women and 9 men. The patients were admitted most frequently with symptoms of jaundice and cholangitis. In all patients, ultrasound and magnetic resonance cholangiopancreatography imaging were performed. Prior to surgery, percutaneous transhepatic cholangiography and a drainage procedure were performed in all patients except two. Two patients underwent balloon dilation. In one patient a biloma was detected on the computed tomography scan and this was drained percutaneously. In one patient an arteriovenous fistula was detected and a fistula embolization was performed. In one patient in whom an intrahepatic abscess was detected, drainage was performed using ultrasound.

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The group was evaluated for accompanying vascular injuries using computed tomographic angiography. Digital subtraction angiography was performed on 10 patients in whom vascular injury was detected on the computed tomographic angiography and the diagnosis was confirmed.

Laparoscopic cholecystectomy can result in high rates of bile duct injury. Diagnostic and interventional radiological procedures such as US, CT, MRI, MRCP, PTC and ,PTC drainage can be used in the diagnosis and treatment. Bile duct injuries accompanied by arterial injuries can be detected with CTA and DSA procedures. As a conclusion we can say that the Diagnostics and interventional radiologic modalities are often used in diagnosing and treating patients with detected benign biliary injury after laparoscopic cholecystectomy.

Keywords: Laparoscopic Cholecystectomy; Benign Biliary Stricture; Radiologic Procedures; Diagnosing; Treating.

1. Introduction

There are many reasons for benign biliary strictures. Surgery is the most common reason for these injuries and laparoscopic cholecystectomy constitutes the main cause of them. The first laparoscopic cholecystectomy was performed in 1980 by Mühe, Dubois and Perissat in Europe, and by Reddick and Olsen in America. After the first attempt at laparoscopic cholecystectomy in 1980, the number of these initiatives increased rapidly. By the late 1980s, laparoscopic cholecystectomy had become the preferred treatment for acute cholecystitis and symptomatic gallstone disease, due to the fact that compared to open cholecystectomy patients required a shorter hospital stay, experienced better cosmetic results and less post-operative pain, and were able to return to daily activities sooner. However, laparoscopic cholecystectomy can result in high rates of injury. Given the high number of laparosopic cholecystectomies it is easy to see why the number of biliary injuries is so high. In this study, radiologic procedures for diagnosing and treating patients with detected benign biliary injury after laparoscopic cholecystectomy are discussed.

2. Material and Methods

The study was designed as a retrospective investigation. The study group included 30 patients who were referred with biliary strictures after laparoscopic cholecystectomy.

3. Results

The group consisted of 21 women and 9 men and the average age was calculated as 47.2, ranging between 29 and 75. The patients were admitted most frequently with symptoms of jaundice and cholangitis. Prior to surgery, percutaneous transhepatic cholangiography (PTC) and a drainage procedure were performed in all patients except two, in order to relieve clinical symptoms and to determine stricture levels. Bismuth' type 3 and Bismuth' type 4 biliary injury were detected in 25 patients. Two patients underwent balloon dilation. In one patient a biloma was detected on the computed tomography (CT) scan and this was drained percutaneously. In one patient an arteriovenous fistula was detected and a fistula embolization was performed. In one patient in whom an intrahepatic abscess was detected, drainage was performed using ultrasound (US). The group was

evaluated for accompanying vascular injuries using computed tomographic angiography (CTA). Vascular injury was detected in 10 of the 30 patients. Right hepatic artery injury was observed most frequently. Digital subtraction angiography (DSA) was performed on 10 patients in whom vascular injury was detected on the CT angiography for the purpose of verification, and the diagnosis was confirmed.

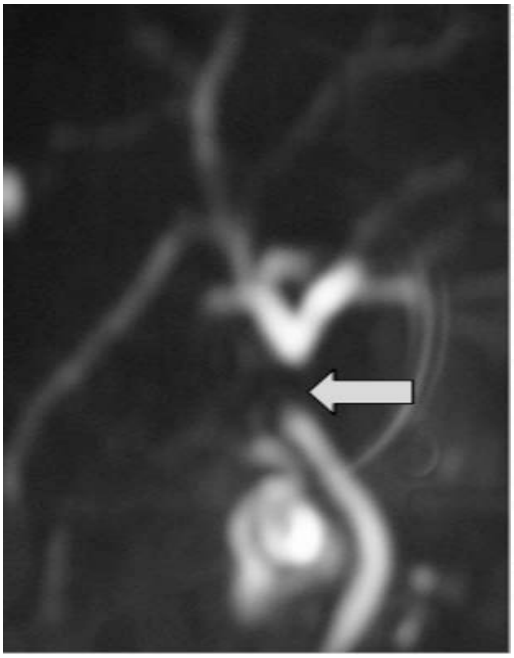

Figure 1A: Bismuth' type 3 biliary stricture.

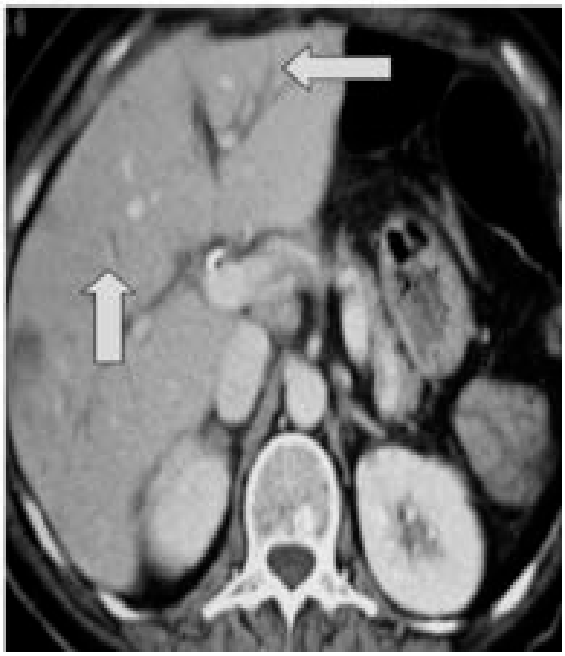

Figure 1B: Bile duct dilatation.

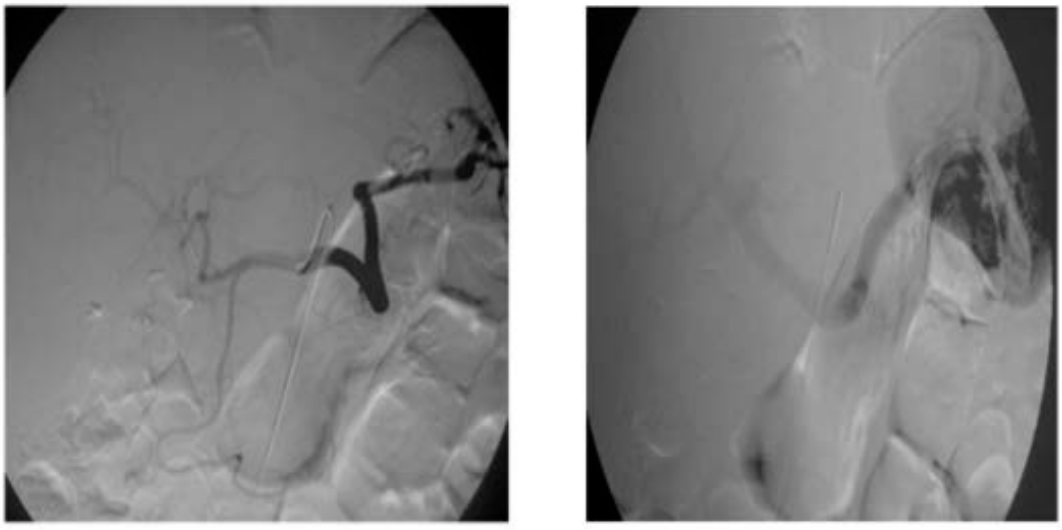

Figure 1C: Right hepatic arterial injury and normal portal vein on DSA.

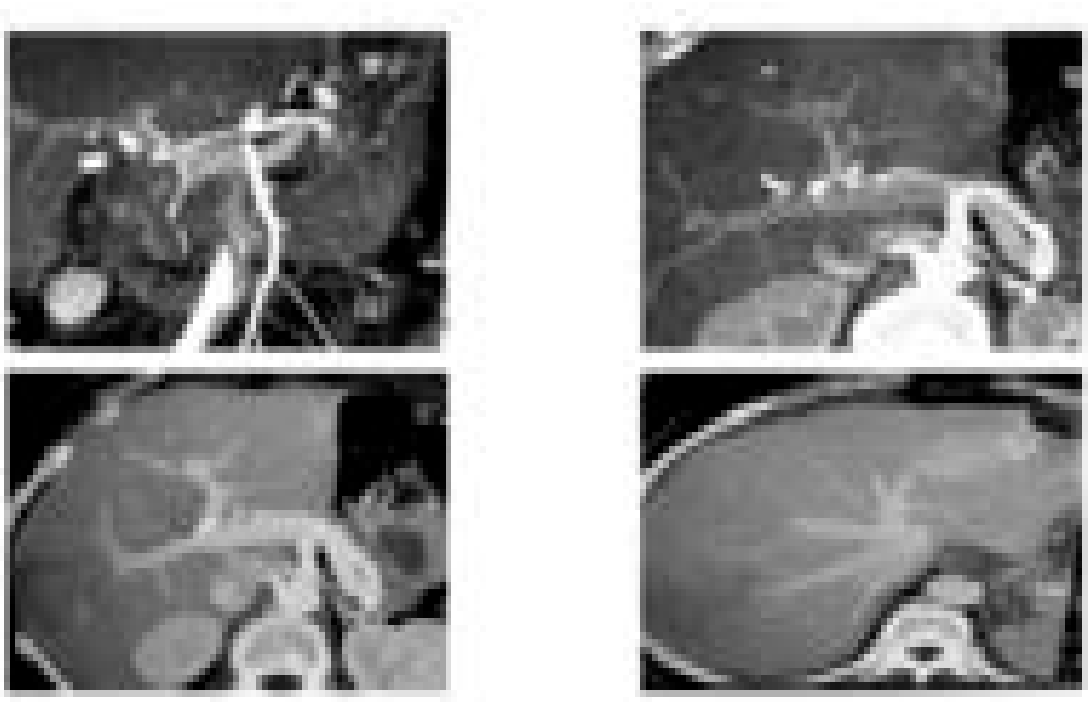

Figure 1D: CTA reconstruction images showing hepatic arterial injury, normal hepatic veins and portal vein.

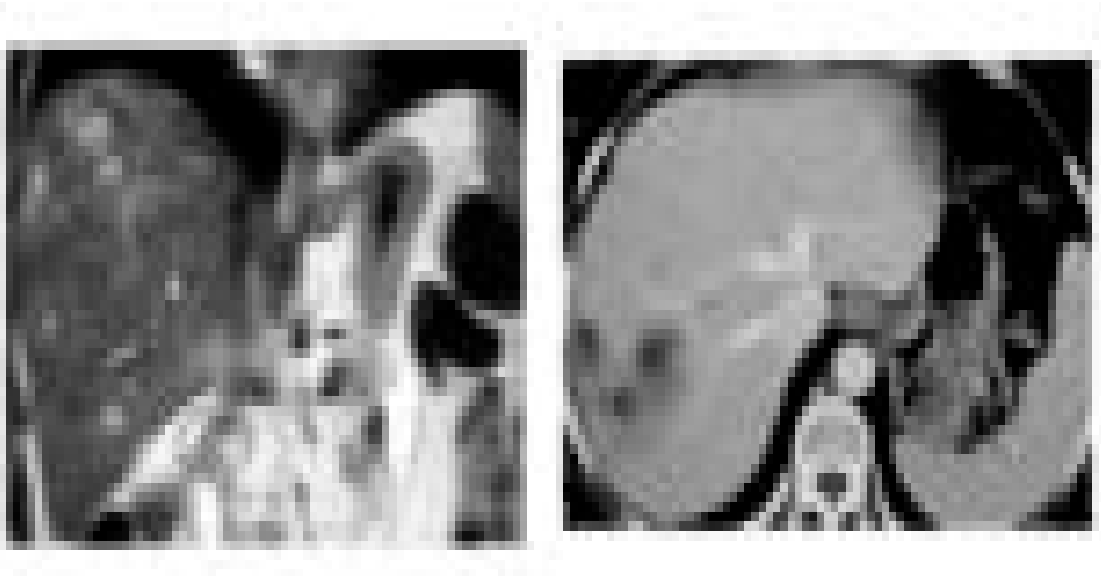

Figure 1E: Right hepatic lobe abscess.

4. Discussion

There are many reasons for benign biliary strictures. Post-surgery strictures, post-traumatic strictures,papillary stenosis, biliary atresia, choledochal cysts, hepatic cysts, polycystic liver disease, sclerosing cholangitis, cholangiohepatitis, cholangitis after chemotherapy, cholangitis secondary to AIDS, parasitic infections, tuberculosis, sarcoidosis, acute and chronic pancreatitis, impacted biliary calculi and Mirizzi syndrome can all be counted as causes of benign biliary strictures. Surgery is the most common reason for these injuries and

laparoscopic cholecystectomy constitutes the main cause.

Figure 2: Bismuth' type 4 biliary stricture on MRCP and PTC images.

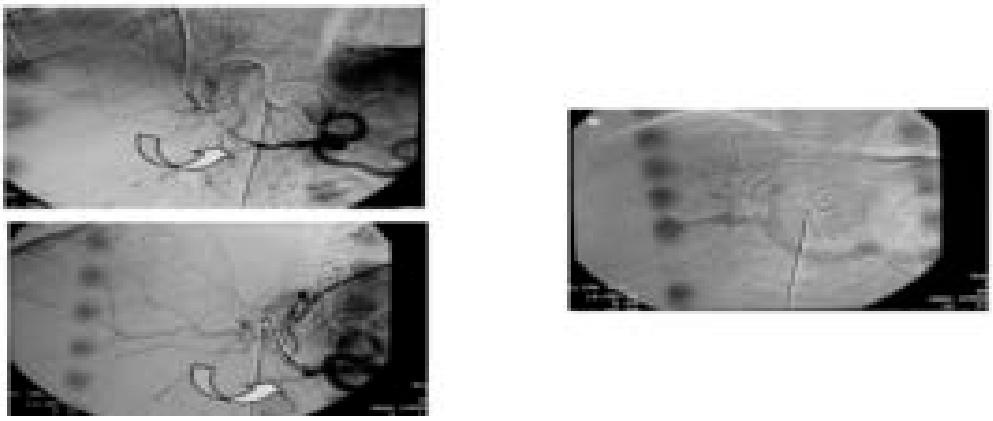

Figure 3: Right hepatic artery injury, portal vein normal on DSA.

Figure 4: Post-surgical restenosis and bile duct dilatations on PTC images.

The first cholecystectomy was performed in 1882 by Langebuch. The first laparoscopic cholecystectomy in Europe was performed in 1980 by Mühe, Dubois and Perissat, and in America by Reddick and Olsen. After the first attempt at laparoscopic cholecystectomy in 1980, the number of these initiatives increased rapidly. By the late 1980s, laparoscopic cholecystectomy had become the preferred treatment for acute cholecystitis and symptomatic gallstone disease, due to the fact that compared to open cholecystectomy, patients required a shorter hospital stay, experienced better cosmetic results and less post-operative pain, and were able to return to daily activities sooner.

However, laparoscopic cholecystectomy can result in high rates of injury. The causes of injuries related to laparoscopic cholecystectomy are listed as technical factors and wrong interpretation of anatomy. Wrong interpretation of anatomy can be divided into two factors: mistaking the common bile duct for a cystic duct and mistaking an aberrant right hepatic duct for a cystic duct. Technical factors can be listed as: insufficiency in clipping a cystic duct, dissection into the liver, improper use of the cautery, excessive traction of the cystic duct, the misuse of a clip and inadequate ductal exploration. In 1971, Warren and his colleagues conducted a study that consisted of 958 patients in whom benign biliary stricture had been detected [1]. The reasons for the strictures were divided into three groups: previous biliary surgery (918 patients), gastric operation (nine patients) and pancreatic procedures (two patients). Only 29 patients had no history of surgery. In 1993, a study involving 77,604 patients revealed that bile duct injuries had decreased and this opinion was based on the increased experience of the operation team. However, currently when compared with an open operation, the injury rate during laparoscopic cholecystectomy has remained markedly high (0.2–0.3 % / 0.5–0.8 %) [2].

Fletcher et al. pointed out that in the years 1991–1994 injuries after laparoscopic cholecystectomies were reduced [3].

Schmidt et al., in 2002, published an article reporting on 170 patients who over the previous decade had still had high rates of complications after having undergone laparoscopic cholecystectomy [4].

Given the high number of laparosopic cholecystectomies, it is easy to see why the number of biliary injuries is so high. Whether biliary injuries are accompanied by vascular injuries after laparoscopic cholecystectomy is a point of interest.

Deziel et al., in a study consisting of 77,604 patients, reported that 16% of biliary injuries were accompanied by vascular injuries. Most frequently a right hepatic artery injury rate of 0.05% was observed in this group [5].

Buell et al. reported that vascular injuries increased mortality rates. However, in the same study, no relationship was established between the degree of stricture and vascular injuries [6].

Unlike biliary injuries, little attention is paid to vascular injuries because they do not lead to significant complications [7,8,9,10].

In recent years, studies have found that after laparoscopic cholecystectomy, hepatic abscess and bilioenteric anastomosis strictures have been reported in patients in whom bile duct injuries are accompanied by hepatic

arterial injuries, compared to patients who have suffered only bile duct injuries [11].

In the literature, four patients have been reported because of recurrent cholangitis, intrahepatic abscess formation and right hepatic lobe resection due to ischemic necrosis of the right hepatic lobe detected because of combined injury to the bile duct and hepatic artery during laparoscopic cholecystectomy [11]. In addition, two patients have been reported as needing liver transplantation due to secondary biliary cirrhosis because of combined biliary and vascular injury [12].

Although a consensus cannot be reached about the effect of bile duct injuries accompanied by arterial injuries, studies have shown that bile duct injuries accompanied by arterial injuries might cause liver necrosis or abscess and increase the risk of bleeding and recurrent stenosis during repair.

However, detecting accompanying vascular injuries is important because these can lead to difficulties in biliary repair, bleeding during surgery and post-operative septic embolic complications and recurrent strictures. In addition, for patients for whom hepatectomy is planned, hepatic vascular anatomy must be evaluated correctly. Today CTA is a minimally invasive modality, and with the developments in patients with biliary stricture, accompanying vascular injuries can be determined early with high accuracy rates.

Ease of treatment, operative risk and the result depend on the location and type of injury. Repair of the major hepatic duct and distal common bile duct located injuries is relatively easier. Bismuth classification is widely used to classify the level of injury [13]. From the classic scheme based on the distance to the hepatic duct confluence five types of injuries were described.

Bismuth classification of biliary stricture:

1- Distal common bile duct stricture – hepatic duct stump > 2 cm
2- Proximal bile duct strictures – hepatic duct stump < 2 cm
3- Residual ductless hilar stricture – hepatic channels of confluence are open
4- Hepatic duct confluence is closed – right and left hepatic ducts are divided
5- Involvement of aberrant right hepatic sector duct alone or involvement of aberrant right hepatic sector duct with common hepatic duct stricture

Successful treatment of bile duct injury after cholecystectomy requires careful planning. The surgeon must determine exactly the type and extent of the injury and should provide a threat of adverse and life-threatening conditions (such as sepsis, cholangitis, ongoing bile leakage and abscesses). Imaging methods play a central role in the evaluation of patients and should show if there is a subhepatic bile collection or abscess, if there is a continuing leakage of bile, if there is any additional vascular injury, if there is evidence of lobar atrophy and where the localization of the bile duct injury is [14].

With ultrasound, intrahepatic duct dilatation, subhepatic space fluid collection and signs of vascular damage can be shown but not enough information can be obtained about stricture [15]. The value decreases with biliary decompression. CT can be used at the start of work. The bile duct dilatation and the level of injury can be

demonstrated on CT images. Additionally, CT shows liquid deposits or acid, vascular damage and lobar atrophy. In patients with biliary stricture, the exact anatomy of the injury must be demonstrated. All branches of the right and left intrahepatic biliary tree should be displayed. This is particularly important in high-level strictures and recurrent strictures after reconstruction.

PTC accurately depicts the location and nature of major bile duct injuries in most patients [16]. PTC is superior to endoscopic retrograde cholangiopancreatography (ERCP) in a standard study. Recently magnetic resonance cholangiopancreatography (MRCP) has been shown to be potentially a useful tool that can be used for determining proximal bile duct injury [17].

ERCP is not very useful in complete bile duct injury because interruptions that hinder the demonstration of the intrahepatic duct system can ocur.ERCP is useful in the detection of incomplete strictures and damage to the sphincter due to common bile duct exploration or papillary stenosis or other periampullary pathologies. ERCP is useful in the diagnosis and treatment of bile leakage from a cystic duct or common bile duct due to lacerations. [18]. These patients may also have intra-abdominal fluid collection, which can be shown on CT images. After percutaneous biliary drainage scintigraphy (HIDA) can be used to determine the continued leakage of bile [19]. Stent placement can reduce or eliminate bile leakage. Most bile leakage can be treated only by percutaneous drainage.

Arteriography and late-phase portography should be performed if there is excessive bleeding during cholecystectomy, if there is a suspicion of portal hypertension on physical examination and if there is evidence of vascular injury in the initial study. Portal hypertension associated with biliary injury increases morbidity and mortality dramatically. A combination of biliary and vascular injury may cause segmental or lobar atrophy. [20] Decreased perfusion and dilated irregular bile ducts are seen on atrophic lobes on US and CT. Isotope analysis is seen as filling defects in the affected area. Detecting accompanying vascular injuries is important because these can lead to difficulties in biliary repair, bleeding during surgery and post-operative septic embolic complications and recurrent strictures [21]. In addition, for patients for whom hepatectomy is planned, hepatic vascular anatomy must be evaluated correctly.

Cholangitis is common with biliary strictures. For severe cholangitis that does not respond to antibiotic treatment, percutaneous drainage is needed.

There may be several complications of bile duct injury. Bile peritonitis, subphrenic or subhepatic abscess, erosive gastritis, upper gastrointestinal bleeding due to oesophageal varices and hepatic failure secondary to fibrosis can occur. Treatment for these complications has to be performed before biliary reconstruction. Intra-abdominal abscess drainage and gastrointestinal bleeding control are the priority. If systemic sepsis occurs secondarily to biliary obstruction then percutaneous drainage has to be performed urgently. In critically ill patients, rapid percutaneous drainage, resuscitation and treatment with antibiotics prevent kidney failure.

The coexistence of biliary strictures with portal hypertension represents a very difficult situation. Patients with biliary stricture with splenomegaly or previous history of bleeding should be investigated immediately for portal

hypertension. Non-operative stenting or balloon dilation can be performed on patients with jaundice who are seriously ill before definitive repair. If ongoing bleeding varices are present, bleeding should be controlled with emergent splenorenal shunt or TIPS (transjugular intrahepatic portosystemic shunt); biliary reconstruction should be performed at a later date. If there is an enlarged biliary tree, biliary injury and biliovenous shunt may occur during the process. Therefore it must be drained percutaneously or balloon dilatation of the bile ducts should be carried out in advance.

5. Conclusion

Diagnostics and interventional radiologic modalities are often used in diagnosing and treating patients with detected benign biliary injury after laparoscopic cholecystectomy.

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