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ROLE OF MAGNETIC RESONANCE CHOLANGIOPANCREATOGRAPHY IN THE MANAGEMENT OF MAJOR BILE DUCT INJURY AFTER LAPAROSCOPIC CHOLECYSTECTOMY

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Background: *Traditionally, endoscopic retrograde cholangiopancreatography (ERCP) and percutaneous transhepatic cholangiography (PTC) have been the most reliable method for recognition of bile duct injuries after laparoscopic cholecystectomy. However, these procedures are invasive and carries a risk of complications. This study describes the role of magnetic resonance cholangiopancreatography (MRCP) in the management of patients with bile duct injury after laparoscopic cholecystectomy.*

Methods: *From January 1999 to July 2001, 15 patients (14 females and one male) with average age 41 (range 22-60) years where referred to our unit with bile duct injury after laparoscopic cholecystectomy. MRCP was performed within 24 hours before ERCP or PTC or both. The findings of MRCP and conventional cholangiography were compared.*

Results: *The diagnosis of biliary injury was made 4-14 days after laparoscopic cholecystectomy in all but three diagnosed 30-45 days after the initial procedure. The presentation of these patients was pain, jaundice and with or without cholangitis (in 12 patients) and bile leakage & development of biliary peritonitis (in 2 patients), and development of external biliary fistula (in one patient) . The Bismuth levels of bile duct injuries were type I in one, type II in 5, type III in 8 and type IV in one. The MRCP images were of higher diagnostic value than conventional cholangiographic images in 12 patients with frank bile duct injury, as MRCP demonstrated the entire biliary system proximal and distal to amputated or stenotic sites simultaneously . The technique of the repair was by utilizing Roux-en-y hepaticojejunostomy with establishment of mucosa-to-mucosa anastomosis. Early outcome of therapy for these bile duct injuries has been favorable. All patients are alive and well, no complications occurred in the immediate postoperative period. Only 2 patients developed stricture 4 months after surgery, treated conservatively in one and repeated dilatation and stenting in another.*

Summary: *MRCP is an ideal diagnostic test when bile duct injury following laparoscopic cholecystectomy is suspected. Hepaticojejunostomy is the procedure of choice for repair of bile duct injuries and provides adequate biliary drainage.*

Key words: *Bile duct injury, Laparoscopic cholecystectomy , Magnetic resonance cholangiopancreatography*

INTRODUCTION

Laparoscopic cholecystectomy (LC) has become the procedure of choice for symptomatic cholelithiasis .However, this minimally invasive technique may result in serious biliary complications. Iatrogenic biliary injury following LC remains one of the devastating complication seen in the current surgical practice [(1)]. Endoscopic retrograde cholangiopancreatography (ERCP) or percutaneous transhepatic cholangiography (PTC), or both, is the most important diagnostic test in recognition of bile duct injuries after laparoscopic cholecystectomy. However, these procedures are invasive and have the potential for

serious complications, such as acute pancreatitis, haemorrhage, infection, perforation and adverse reactions to contrast media or pre-medication [2]. Magnetic resonance cholangiopancreatography (MRCP) has recently emerged as an attractive, non-invasive diagnostic modality for comprehensive evaluation of biliopancreatic diseases [3].

This study describes the role of magnetic resonance cholangiopancreatography (MRCP) in the management of patients with bile duct injury after laparoscopic cholecystectomy.

PATIENTS AND METHODS

Fifteen consecutive patients with major bile duct injury following laparoscopic cholecystectomy were reviewed. These patients were referred between January1999 and July 2001 to hepatobiliary unit at Liver Institute, Menoufya University, Egypt. All patients were referred to our center from other hospitals by their primary physicians for definitive management. Only patients with major bile duct injuries sustained during laparoscopic cholecystectomy are included in this study, while patients with minor bile leaks and those with cystic duct stump leaks are not included. As a part of the management of these patients, all medical records and operative reports were reviewed when available. The level and severity of bile duct injuries were graded according to the Bismuth classification [4]. As regard the diagnostic and therapeutic interventions performed at our center among those patients, biochemical markers of liver function were analyzed for each case, all patients underwent liver sonography . To test the diagnostic efficacy of MRCP in detection of bile duct injury following laparoscopic cholecystectomy, MRCP was performed within 24 hours before ERCP or PTC or both.. MRCP images were assessed independently by a single radiologist, who was not a ware of the results of ERCP and PTC. The ERCP was assessed independently by a single endoscopist. The information from these two imaging modalities was then compared .The diagnosis was confirmed during laparotomy.

RESULTS

Between January 1999 and July 2001, 15 patients have been referred from other hospitals to our unit because of major bile duct injuries (BDI) after laparoscopic cholecystectomy. There were 14 females and only one male with age range from 22-60 years with an average 41Ys.

All patients had confirmed bile duct injuries. These included misidentification of the common duct for the cystic duct, resulting in transection of the common bile duct (n=11), simple tenting injury of the common duct; resulting in biliary obstruction and leakage (n=3), and bile duct stricture resulted from misplaced metallic hemoclip in the region of the common duct (n=1).

The laparoscopic injuries to the bile duct were detected at variable times in relation to the original operation. None of the ductal injuries reported in this study were recognized at the time of initial laparoscopic procedure. The diagnosis of biliary injury was made 4-14 days after LC in all but three diagnosed 30-45 days after the initial operation. The clinical manifestations of such injuries were abdominal pain & obstructive jaundice with or without cholangitis (n=12), bile leakage with development of biliary peritonitis (n=2), and the development of external biliary fistula (n=1).

As regard of the initial surgical management before referral, two patients had biliary reconstruction in the form of hepatico-jejunostomy, these patients subsequently underwent re-operation at our center for revision of anastomotic stricture after 9-12 months postoperatively. Patients were transferred with a median of 8 (range 5-365) days after LC .

As regard the diagnostic and therapeutic interventions performed at our center among those patients after referral, higher levels of serum transaminases, bilirubin, and alkaline phosphatase have been demonstrated in most patients which correlate with clinical suspicion of obstructive jaundice cases. A leucocytosis usually accompanied the patient's fever. All patients underwent screening liver sonography, which revealed dilated bilateral intrahepatic ducts in varying degree in 13 patients and suspicion of intra-abdominal fluid collection in 2 patients. These 2 patients underwent additional CT scan to confirm the diagnosis. Aiming to establish the role of MRCP in the diagnosis of bile duct injury following laparoscopic cholecystectomy. MRCP was performed in all cases after being transferred to our center one day before ERCP or PTC.

The diagnosis of bile duct injury was established by MRCP in 12 patients. MRCP provided more diagnostic information than conventional cholangiography in 10 of the 12 patients with frank bile duct injuries. In these patients, ERCP showed only the cut-off sign of common bile duct (CBD) fig(1), therefore, PTC was needed to visualize the proximal biliary system. In contrast, MRCP showed the entire biliary system both proximal and distal to amputated or stenotic site simultaneously fig(2). In the remaining 2 patients, who developed anastomotic stricture after hepaticojejunostomy performed before referral to our center, MRCP and PTC yielded similar diagnostic information. Also the diagnosis was made by percutaneous transhepatic cholangiography (PTC) in 2 patients (with bile leakage & development of biliary peritonitis) after computerized tomography CT showed abnormal fluid collections, and in addition , by ERCP in one patient with bile duct stricture due to misplaced metallic hemoclip in the region of the CBD .

As a result of radiological and operative findings, bile duct injuries were classified based on Bismuth's classification: type I in one patient, type II in five patients, type III in eight patients, and type IV in one. Management was based on the imaging findings and included biliary enteric reconstruction in all patients.The technique of repair was carried out by utilizing Roux-en-Y hepatico-jejunostomy with establishment of mucosa to mucosa anastomoses . Temporary stenting of the anastomoses was performed by using paediatric feeding tube (8-10 f) or percutaneous transhepatic drainage catheter when it had already been placed .

Early outcome of therapy for these bile duct injuries has been favorable. All patients are alive and well, no complications occurred in the immediate post-operative period. Patients who had an elevation in serum bilirubin preoperatively had a decline to normal within 6 days after definitive surgery; alkaline phosphatase was still abnormal, although decreasing at the time of hospital discharge occurred in most patients.

The median inpatient stay after referral was 16 (range 14-70) days, and median follow-up was15 (range 6-30) months. At follow-up, 13 patients remain a symptomatic with normal liver function, and two patients developed stricture four months after surgery, treated conservatively in one and by repeated dilatation and stenting in another.

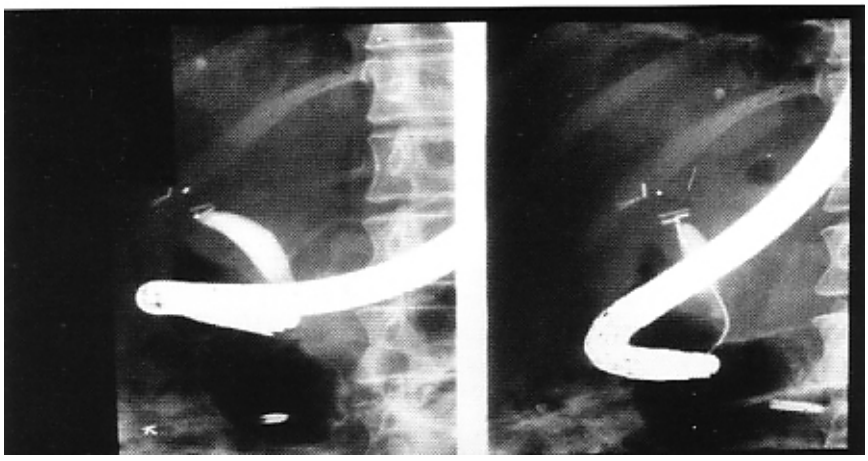

Fig (1): Endoscopic retrograde cholangiopancreatography (ERCP) showed only the cut-off sign of common bile duct injury at the site of hemoclips.

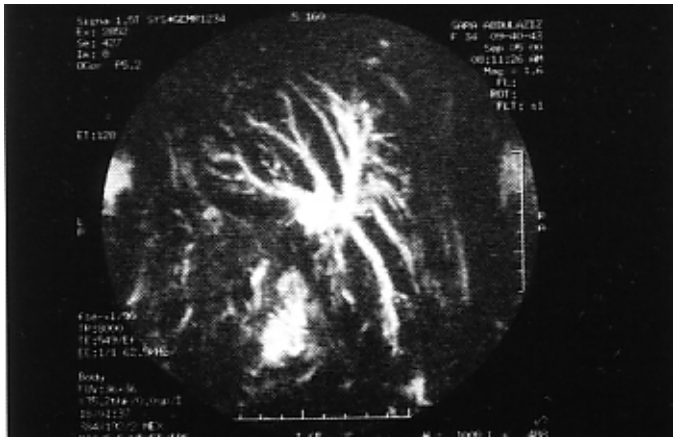

Fig (2) : Magnetic resonance cholangiopancreatography (MRCP) showed the entire biliary system both proximal and distal to amputated or stenotic site simultaneously.

DISCUSSION

Laparoscopic cholecystectomy (LC)is associated with a higher incidence of bile duct injury than open cholecystectomy, which was probably related to the relative surgeon's inexperience [5]. Although recent studies have shown a low incidence of bile duct injuries(BDI) during laparoscopic cholecystectomy [6,7], concerns including ours remain because of the sustained increase in the number of referrals for biliary reconstruction after the procedure[8].

The vast majority of the injuries seen in this review were a direct result of the surgeon misidentifying the anatomy. Common bile duct mistaken for the cystic duct was seen in 11 of the cases. In addition, excessive traction on the gallbladder resulting in tenting of the main bile duct and despite correct identification of the cystic duct, clips may incorrectly applied to the tented portion of the CBD was seen in 3 patients. Also bile duct stricture resulted from misplaced hemoclip in the region of the common duct resulting in partial obstruction was seen in one patient. Laparoscopic bile duct injury tends to be more severe than that which occurs during open cholecystectomy . A portion of the duct is typically resected, the proximal level of the injury is high (Bismuth type 3 or 4) and the duct diameter is usually small, all of which make for a poorer prognosis after repair [5]. We have also observed that BDI has become severe after LC. In the present study, there was only one patient with Bismuth type-I lesion, in contrast, five patients had a Bismuth type-II injury, eight patients hade type III, and one patient hade type IV.

Early recognition of BDI is crucial in further management. Although it would clearly better to recognize biliary injury at the time of LC, most injuries are not recognized at the time of operation. Also the extent of BDI was not defined in most patients by the time they were referred [9]. Our findings were the same as those that had been previously reported. In our series the clinical presentation of the patients was variable, depending on whether the injury was total bile flow obstruction or bile leakage. Eleven patients with total occlusion (clipping) of the bile duct, were presented early within two weeks postoperatively by abdominal pain, obstructive jaundice with or without cholangitis. In addition, one patient with bile duct stricture resulted from misplaced clips was presented late after 6 weeks from the original procedure by repeated episodes of cholangitis. On the other hand, three patients with biliary leakage after LC were presented by biliary peritonitis in two, and external biliary fistula in one. Patients with biliary peritonitis were presented early within one week after surgery , while the patient with biliary fistula was presented late within 4 weeks because of late referral.

The diagnosis of BDI is important in planning the strategy of surgical management, and requires extensive diagnostic evaluation [10]. Our study revealed an elevated levels of serum transaminases, total bilirubin, and alkaline phosphatase in most patients. Ultrasonography was helpful in the detection of fluid collection and bile duct dilatation in our cases. The diagnosis of BDI was established by MRCP in 12 patients, by percutaneous transhepatic cholangiography (PTC) in 2 patients after computerized tomography CT showed abnormal fluid collection , and by ERCP in one patient.

Endoscopic retrograde cholangiopancreatography (ERCP) is a useful diagnostic and therapeutic tool when the continuity of the extrahepatic biliary system has not been disturbed . In our study, ERCP is seldom of value in the precise diagnosis of complete high bile duct injury because there is usually discontinuity of the common bile duct preventing display of the intra-hepatic structures. However, the procedure is of value in demonstrating incomplete stricture or stenosis. In the classic injury involving bile duct transection, ERCP shows only the Cut-off sign of the CBD [2]. It is therefore essential that PTC is performed to determine the nature of the injury as well as to visualize the proximal biliary tree [11]. Nevertheless, PTC is associated with potentially serious complications, particularly in those who have cirrhosis, ascites, perihepatic bilious fluid collection and coagulopathy [12]. However, PTC should only be performed when percutaneous drainage is required or surgical intervention is planned [1].

In this article, we evaluate the usefulness of MR cholangiopancreatography (MRCP) in diagnosing BDI after laparoscopic cholecystectomy. MRCP is the imaging modality of choice for the work-up of suspected BDI as it outlining both the intra & extra-hepatic biliary tree, which can provide a better road map of the diagnosis of BDI and for planning reparative surgery than ERCP [13]. It has a higher diagnostic accuracy in the diagnosis of bile duct excision injuries than those of ERCP or PTC, with the advantage of avoiding the adverse effects inherent with conventional cholangiography [14]. MRCP is particularly useful for patients who are in poor clinical condition and not suitable for administration of contrast media or sedation and after gastrojejunostomy or biliary-enteric anastomosis (who are unable to undergo ERCP due to altered post-surgical anatomy), as well as for those with multiple separate biliary obstruction which would otherwise necessitate multiple PTC procedures [12]. Also it is of value when ultrasonographic examination shows a non-dilated ductal system. On other hand, MRCP is valuable during follow-up of patients after surgical repair, because it is non-invasive & can demonstrate anastomotic patency and function in patients in whom no tube has been left across the anastomosis at the time of repair, and postoperative bile duct stricture or obstruction can also be seen with MRCP [3].

Despite the many advantages of MRCP over conventional cholangiography, it is only a purely diagnostic tool . While MRCP may completely replace the diagnostic role of ERCP and PTC, subsequent biliary stent, placed either endoscopically or percutaneously, is still warranted to stabilize patients with biliary leak or biliary obstruction before any attempt at repair [2]. Our data are in agreement with reports [12,14] that recommend the early use of MRCP in the preoperative evaluation of patients with BDI to ascertain the diagnosis and to establish the need for a subsequent surgical, endoscopic or percutaneous procedure.

In our study, since the site of most total bile duct lesions is the hepatic duct (Bismuth II, III, and IV), reconstruction with Roux en-Y hepatico-jejunostomy offers the best surgical treatment. Early reconstruction was undertaken in 13 of our patients after appropriate assessment and before sepsis disrupts the operative field. Late reconstruction was undertaken in 2 patients with biliary peritonitis after 6-8 weeks by which time the intra-abdominal sepsis has subsided.

MRCP or PTC was used postoperatively to assess the patency of the anastomoses and to exclude bile leakage. Early results of bile duct reconstruction for biliary injury are satisfactory. There was no procedure-related mortality. Symptomatic and radiological resolution were achieved in all patients except two. These two patients developed stricture 4 months after surgery, treated conservatively in one and by repeated balloon dilatation and stenting in another. Our results are comparable with the others [9,10].

Conclusion:

MRCP is an ideal diagnostic test when bile duct injury following laparoscopic cholecystectomy is suspected.. Hepatico-jejunostomy is the procedure of choice for repair of bile duct injuries and provides adequate biliary drainage.

REFERENCES

1. Soper NJ, Flye MW, Brunt LM, Stockmann PT, Aliperti G 1993 Diagnosis and management of biliary complications of laparoscopic cholecystectomy. Am J Surgery, June; 165 (6): 663-9.

2. Lillemoe KD, Martin SA, Cameron JL, Yeo CJ, Talamini MA, Kaushal S 1997 Major bile duct injuries during laparoscopic cholecystectomy. Follow-up after combined surgical and radiologic management. Ann Surg; 225:459-71.

3. Lomanto D, Pavone P, Laghi A, Panebianco V, Mazzocchi P, Fiocca F 1997 Magnetic resonance cholangiopancreatography in the diagnosis of biliopancreatic diseases. Am J Surg; 174:33-8.

4. Bismuth H. 1982 Postoperative strictures of the bile duct. In: Blumgart LH, ed. The biliary tract. Edinburgh: Churchill Livingstone. Clinical surgery International. 5:209-18.

5. Mc Mahon AJ, Fullarton G, Baxter JN, O' Dwyer PJ. 1995 Bile duct injury and bile leakage in laparoscopic cholecystectomy. Br J Surg; 82:307-313.

6. Richardson MC, Bell G, Fullarton GM 1996 Incidence and nature of bile-duct injuries following laparoscopic cholecystectomy- an audit of 5913 cases; Br J Surg; 83:1356-1360.

7. Nair RG, Dunn DC, Fowler S, Mc Cloy RF. 1997 Progress with cholecystectomy: improving results in England and Wales. Br J Surg; 84:1396-1398.

8. Asbun HJ, Rossi RL, Lowell JA, Munson JL. 1993 Bile duct injury during laparoscopic cholecystectomy: mechanism of injury, prevention and management. World J Surg ; 17: 547-552.

9. Mirza DF, Narsimhan KL, Ferraz Neto BH, Mayer AD, Mc Master P, Buckels JAC. 1997 Bile duct injury following laparoscopic cholecystectomy : referral pattern and management. Br J Surg.; 84: 786-790.

10. Keulemans YCA, Bergman JJGHM, Wit de LT. 1998 Improvement in the management of bile duct injuries ? J Am Coll. Surg.;187: 246-254.

11. Branum G, Schmitt C, Baillie J. 1993 Management of major biliary complications after laparoscopic cholecystectomy. Ann Surg ;217: 532-41.

12. Yeh T.-S, Jan Y-Y, Tseng J.-H, Hwang T.-L, Chen M.-F. 1999 Value of magnetic resonance cholangiopancreatography in demonstrating major bile duct injuries following laparoscopic cholecystectomy. Br J Surg. ; 86: 181-184.

13. Khalid TR, Casillas VJ, Montalvo BM, Centeno R, Levi JU. 2001 Using MR cholangiopancreatography to evaluate iatrogenic bile duct injury. AJR Am J Roentgenol .177(6):1347-52.

14. Taylor AC, Little AF, Hennessy OF, Banting SW, Smith PJ, Desmond PV. 2002 Prospective assessment of magnetic resonance cholangio-pancreatography for noninvasive imaging of the biliary tree. Gastroitest Endosc ; 55(1): 17-22.