Original Research Article

Managing bile duct injuries sustained during cholecystectomies

Vijai Prakash Srivastava, Shwetank Agarwal*, Ajai Agarwal, Jagadamba Sharan

Department of Surgery, Rajshree Medical and Research Institute, Bareilly, Uttar Pradesh, India

Received: 04 November 2017
Accepted: 09 December 2017

*Correspondence:
Dr. Shwetank Agarwal,
E-mail: shwetankagarwal17@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Medical science is a blend of Art and Science. Technology evolved conceived presumably to improve the medical science. Increasing incidence of bile duct injury during laparoscopic cholecystectomies proved otherwise. Multiple factors e.g. cognitive psychology, laparoscopic environment and no proper algorithms to manage, factor may be responsible for these results. To understand properly the mystique, we under took this study.

Methods: This study was conducted on 200 cases which underwent laparoscopic cholecystectomies. 12 cases developed bile duct injury during laparoscopic cholecystectomies and 10 cases of bile duct injury sustained through open cholecystectomies were studied in detail results noted and analyzed.

Results: All these cases 12/200 laparoscopic cholecystectomy, 10/200 open cholecystectomies were followed up, sign and symptoms noted, USG studies, ERCP stenting, sphincterotomy studies reviewed and sequence of management underlined.

Conclusions: Early realisation of bile duct injuries remains the hallmark of s/he success. Even in cases detected late, conservative procedure and stenting with or without sphincterotomy given relief in number of cases. Finally, if surgery is contemplated Roux-Y-biliary enteric procedure gives much better results.

Keywords: Bile duct injuries, Bilioma and biliary fistula, Laparoscopy and open cholecystectomy

INTRODUCTION

Bile duct injuries always have been a problem to understand. Anatomical variation, aberrant duct, abnormal and deformed anatomy, misidentification proved to be the reason to this tragedy. Laparoscopy introduction has raised the hope of providing a better solution, unfortunately the incidence of bile duct injuries proved to be more in laparoscopic cholecystectomy than in open cholecystectomy, an observation accepted globally.1

Injuries caused are both major and minor in nature.2 Clip slip, clip application in confusion, laparoscopic environment, inadequate biliary defaults, video view illusion added to the causation.3 The bile duct injuries in laparoscopic cholecystectomy are more active than passive in nature.4

In absence of fixed algorithms to define the injuries as major or minor, active or passive, development of biliary leak and bilioma with or without jaundice and symptoms of fever, pain, sepsis, peritonitis, it is difficult to manage bile duct injuries even though USG, MRCP, CV-ITC are available investigation, but it is the Endoscopic retrograde cholangio pancreatectography has been the most dependable diagnostic and therapeutic has proved.5-8

Management included endoscopic and surgical or both either singularly or in combination. The endoscopic stenting and sphincteroplasty cure the majority of cases; it is only in major cases which fails to respond needed
surgery. The surgical procedure hepatic jejunostomy provides the best answer so far.

**METHODS**

During 2010-2015, 400 cases operated at Rohilkhand Medical College, Bareilly U.P., undertaken for study. 200 cases under went laparoscopic cholecystectomy (LC) and another 200 cases operated upon by open cholecystectomy.

Patients who were having fibrosis, small gall bladder, densely adhered are operated upon by open cholecystectomy. Patient having malignant gall bladder, hydrated disease was excluded firm study. The ages of the patients were among 25-50 years mean age being 37.5-year female and male ratio was 4:1, 380 females and 80 were males.

12/200 operated upon by LC, 10/200 cases of open cholecystectomy (OC) developed bile duct injuries. These results are similar to the observation made by other authors also. Bilioma, biliary leak, combination of bilioma and leak were the presenting signs. In our series in laparoscopic group, 3/12 cases presented as bilioma, 7/12 bilioma and leak, 2/12 only leak. In OC group bilioma in 2 cases, leak in 6 cases, bilioma with leak 2 cases. On the basis of amount of leak and duration we tried to divide the injuries as minor or major. Wherever the leak was <300 ml per day and duration was 7-8 days we labeled it as a case of minor injuries. Whereas the leak >300ml persisting for long periods, it is labelled as major injuries. Clinically developments of pain, fever, nausea, vomiting, distention were the main symptoms developing during 1-7 days in both groups. Raised value of WBC alkaline phosphates, hyper bilirubinaemia noted in most of the patients. 3/12 cases of LC, 3/10 OC cases were also having jaundice too. Two patients developed nausea, anorexia till one month with raised alkaline phosphates and serum bilirubin.

Results of ERCP detailed in table 5 and 6. The reason assigned for these injuries are aberrant ducts, distorted anatomy due to intense fibrosis and misidentification of CBD as cystic duct, thermal burn, causing clip slip due to cautery use.

**RESULT**

Patients who develop sign and symptoms after surgery underwent investigation and endoscopic study. The lesion identified and response of stenting only or with sphincterotomy are analysed. Changes in WBC, bilirubin, ALT, ALP was mildly increased in 9 out of 12 cases which resolved by stenting and sphincterotomy classified as minor injury cases. 3/12 cases where WBC count rise of bilirubin was marked, not responding to stenting and sphincterotomy were classified as major injury cases operated by laparoscopic procedure (Table 1).

| Age and sex | Presentation | Interval between surgery and ERCP | WBC | Bilirubin | ALT IU/L | ALP IU/L | ERCP | Treatment |
|-------------|--------------|----------------------------------|-----|-----------|----------|----------|------|-----------|
| 38 M        | Leak P       | 22 days                          | 8500| 5         | 215      | 136      | LBL  | Resolved  |
| 32 M        | Bilioma pain and J | 21 days             | 12000| 12        | 420      | 132      | CBD  | R-Y       |
| 40 F        | Bilioma pain and J | 21 days             | 9000 | 18        | 415      | 136      | RHD  | R-Y       |
| 42 M        | Biliary leak with P | 21 days             | 9200 | 3.8       | 315      | 152      | Retained stone | Resolved |
| 40 F        | Leak         | 21 days                          | 7800| 3.8       | 248      | 162      | Aberrant | Resolved |
| 43 F        | Leak P       | 20 days                          | 7200| 4         | 238      | 142      | LBL  | Resolved  |
| 45 F        | Bilioma pain and J | 20 days             | 14000| 15        | 385      | 134      | CBD  | R-Y       |
| 45 M        | Biliary leak with P | 20 days             | 8700 | 4.2       | 218      | 160      | Retained stone | Resolved |
| 48 F        | Bilioma      | 20 days                          | 8400| 4.00      | 320      | 172      |       |           |
| 42 M        | Leak         | 20 days                          | 8200| 4.8       | 235      | 156      | Aberrant | Resolved |
| 42 F        | Bilioma with leak | 20 days             | 8600 | 4.2       | 245      | 172      | Aberrant | Resolved |
| 52 M        | Bilioma      | 18 days                          | 12000| 5.2       | 415      | 182      | Stricture | Resolved |

| Laparoscopic cholecystectomies (12 cases) | Open cholecystectomies (10 cases) |
|------------------------------------------|-----------------------------------|
| Bilioma 3 cases >300ml/day for 7 days    | Bilioma 3 cases (2)               |
| Bilioma with leak <300ml/day for 7 days  | Bilioma with leak 2 cases (3)     |
| Leak only 2 cases <300ml/day for 7 days  | Leak only 3 cases >300 ml/day for 7 days |
| Bilioma 3 cases and bilioma with leak (7) | Bilioma 2 cases and bilioma with leak (2) |
| Leak = 2                                 | Leak = 04                        |
| Total = 12 cases                        | Total = 10 cases                 |
Comparative studies of clinical presentation of patients developing bile duct injuries after Laparoscopic cholecystectomies and open cholecystectomies. The amount of leak with duration, bilioma 3 cases + bilioma with leak 7 cases whereas two cases presented with leak only in Laparoscopic cholecystectomies. Bilioma with leak 2 cases, bilioma 2 cases, only leak 6 cases presented in cases where open cholecystectomies were performed. Cases done by Laparoscopic cholecystectomy developed bilioma in 3 cases where amount of leak >300 ml/day for 7 days classified as major injury cases. The cases operated by open cholecystectomy, development of bilioma with leak in 2 cases and 1 case of leak only amounting >300 ml/day for 7 days classified as major injury cases (Table 2).

Table 3: Presentation comparison - laparoscopic v/s open cholecystectomies.

|                     | Peritonitis | Fever | Sepsis | Alk PO4 IU/ml | Bilirubin | SGOT | SGPT |
|---------------------|-------------|-------|--------|---------------|-----------|------|------|
| **Bilioma**         |             |       |        |               |           |      |      |
| 3 LC                | +++         | +++   | +++    | 450-750       | 6.8-12.9  | 45.60| 42.50|
| 2 OC                | ++          | +     | +      | 450-750       | 4.0-10.2  | 45.50| 40.50|
| **Bilioma with leak** |             |       |        |               |           |      |      |
| 7 LC                | ++          | ++    | +++    | 350-400       | 3.4-4.2   | 45   | 60   |
| 2 OC                | ++          | +     | +++    | 380-460       | 3.2-4.8   | 48   | 70   |
| **Leak only**       |             |       |        |               |           |      |      |
| 2 LC                | ++          | +     | +      | 280-350       | 3.6-5.2   | 52   | 85   |
| 6 OC                | +           | +     | +      | 280-350       | 2.8-3.6   | 44   | 52   |

Clinical presentation along with relative pathological changes, reflected in WBC and LFT changes. It revealed that in bilioma cases (3-LC), 2 LC. WBC and LFT value were raised more than cases developed in bilioma with leak and leak only cases (Table 3).

Table 4: Post ERCP results of bile duct injuries.

| Laparoscopic cholecystectomy | Presentation | Stenting and sphincterotomy | Final |
|-----------------------------|--------------|-----------------------------|-------|
| Bilioma (3)                 |              | Not improved                | Major duct injuries |
| Bilioma with leak (3)       | Improved     | Minor duct injuries        |       |
| Leak only (6)               | Improved     | Minor duct injuries        |       |

Open cholecystectomy

| Bilioma with leak (2)      | Not improved | Major duct injuries       |       |
| Only leak (5)              | Not improved | Minor duct injuries       |       |
| Only leak (5)              | Improved     | Minor duct injuries       |       |
| Leak (T tube) (1)          | Improved     | Minor duct injuries       |       |
| Leak (subtotal) (1)        | Improved     | Minor duct injuries       |       |

Cases not improved with stenting and sphincterotomy 3/12 cases revealing major duct injuries whereas 9/12 cases improved with stenting and Sphincterotony classified as major duct injuries (Table 4).

ERCP based analysis revealing the injuries not improved with stenting and Sphincterotomy 3/10 cases termed as major injuries whereas 7/10 cases improved with stenting and Sphincterotomy classified as minor injuries cases in Open cholecystectomy (Table 4).

Nature of injuries caused to biliary tract and result of stenting and sphincterotomy. There may be overlapping of causes of injuries in some of the cases. Nature of injuries in caused to biliary tract and result of stenting and sphincterotomy during laparoscopic cholecystectomies. It is appreciated that the cautery inflicted injuries in both minor in 3 cases and major cases two, too. There may be overlapping of causes of injuries in some of the cases (Table 5).

Table 5: Analysis based on ERCP finding in bile duct injuries cases laparoscopic.

| Improved with stenting and sphincterotomy |
|------------------------------------------|
| Retain stone in CBD (2)                  | Clip slip                   | CAUTERY | Improved |
| Cystic duct clip (3)                     | Cystic duct clip            | Clip slip | CAUTERY | Improved |
| Liver bed leak (3)                       | Aberrant duct               | CAUTERY | Improved |
| Liver bed leak (1)                       | Accessory duct              | CAUTERY | Improved |
| Not improved with stenting and sphincteroplasty |
| CBD injury (1)                           | Clip on CBD                 | Mistaken as cystic duct | CAUTERY | Not improved |
| CBD injury (1)                           | Clip on CBD                 | Mistaken as cystic duct | Lateral wall of CBD | Not improved |
| Right hepatic duct (1)                   | Clip on right hepatic duct  | Mistaken as cystic duct | CAUTERY | Not improved |
Table 6: Analysis based on ERCP finding in bile duct injuries cases.

| Improved with stenting and sphincteroplasty | Aberrant accessory duct | Cautery | Improved |
|-------------------------------------------|-------------------------|---------|-----------|
| Liver bed leak                             |                         |         |           |
| Thermal burn                               |                         |         |           |
| Cystic duct leak                           |                         |         |           |
| T-tube k                                   |                         |         |           |
| Not improved with stenting and sphincteroplasty |                         |         |           |
| Segmental stricture CBD                    | Cystic duct leak        | Cautery | Not improved |
| CBD ligated and fibrosed (2)               | Mistaken as cystic duct | Cautery | Not improved |
| Right hepatic duct ligated (1)            | Mistaken as cystic duct | Cautery | Not improved |

Causation of the injuries based on ERCP procedure, response of stenting and sphincterotomy in bile duct injuries during open cholecystectomies. Thermal burn 5 cases liver bed leak as a result of excessive dissection and cauteryization stands the maximum number of injuries in open cholecystectomies. Some of the cases were having more than one factor responsible for injury seen (Table 6).

DISCUSSION

Laparoscopic surgery considered to be latest and safe technique in hepatobiliary surgeries, but reports are confirming the fact that incidence of bile duct injuries has increased from pre-lap period.17 80 injuries in LC were noted in cholecystitis than in cholelithiasis or in other condition.

The development of fever paid sepsis distention and tenderness with raised WBC, alkaline phosphates and bilirubin in serum noted in 70% of cases but clinical presence of jaundice noted only in 30%, 3/12 cases. Obvious more in cases operated by laparoscopy than by open method, our observation matches with others.18

Development of biliary fistula 10/12 LC cases and 8/10 in OC is a most common feature whereas bilioma 3/12 cases. Mistaken as cystic duct as cystic duct in bile duct injuries during open cholecystectomies. Am J Surg. 1993;165:533-5.

Author relied more on ERCP than cholangiography. Cholangiography, for not only being accepted universally but technically difficult procedure also, hence it is avoided. ERCP followed by stenting and sphincteroplasty were done and results analysed. We have seen that low output fistula where leak was <300ml/day 7-10, has improved with procedure hence they are classified as cases of minor injuries.20 The cases who have not improved by the procedure were having leak >500ml/day and more than 10 days, they were classified as cases of major injuries and undergone surgery i.e. R-Y anastomosis.

ERCP study revealed leak from cystic duct in 41% cases, leak from liver bed in 33% cases and leak from slip of clip 26% of cases, Cystic duct leak is caused by mainly as a result of cautery burn at dissection sight. In 2 cases where the leak was caused by back pressure due to stone in CBD not detected before operation.21 Leak from liver bed resulted in patients who underwent deep dissection and excessive use of cautery, because of fibrosis, adhesion and to stop bleeding. ERCP showed the presence of aberrant duct, accessory or sectoral duct as noted elsewhere by Strasberg et al, and depicted as type ABC injuries.22 These types of injuries were not recognized under bismuth classification.23

Clamp application was another big factor in causing the incidence of injuries. The complexity such as mirrizi syndrome, fibrosis adhesions, vascular bleeding which distorted anatomy so much that it leads to clamp application on CBD in disguise of cystic duct.24 This has happened more in cases of simple cholecystitis than in cholelithiasis.25

Finally, we can say that it’s not only oblivious but distorted anatomy are responsible for bile duct injuries and also the laparoscopic environment fixed restricted view of laparoscope and excess cautery use are the causes of increasing number of injuries in laparoscopic era than pre-laparoscopic era.

CONCLUSION

We tried to establish the stepwise proceedings to reach conclusively as the injury is minor or major in nature and how best it can be managed without much complication. We go with opinion expressed by Roslyn et al, that number of series shown in the past the excellent long-term results in the management of the bile duct injuries before laparoscopy, but the result will be transferred to lap cholecystectomies has to be seen (Kei-D. Lille Moe).

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Bernard HR, Hartman TW. Complication after laparoscopic cholecystectomies. Am J Surg. 1993;165:533-5.
2. Soper NJ, Flye M, Brunt LM. Diagnosis and management of biliary complication of laparoscopic cholecystectomies. Am J Surg. 1993;16:663-9.
3. Stewart L, Way LW. Bile duct injuries during laparoscopic cholecystectomy: factors that influence the results of treatment. Arch Surg. 1995;130(10):1123-8.
4. Adamsen S, Hansen OH, Funch-Jensen P, Schulze S, Stage JG, Wara P. Bile duct injury during laparoscopic cholecystectomy: a prospective nationwide series. J Am Coll Surg. 1997;184(6):571-8.
5. Harris BC. Retrospective comparison of outcome of 100 consecutive open cholecystectomy and 100 consecutive laparoscopic cholecystectomies. South Med J. 1993;86:993-6.
6. Van Sonnenberg E, D’Agostino HB, Easter DW, Sanchez RB, Christensen RA, Kerlan Jr RK, et al. Complications of laparoscopic cholecystectomy: coordinated radiologic and surgical management in 21 patients. Radiology. 1993;188(2):399-404.
7. Brooks DC, Becker JM, Connors PJ, Locke DL. Management of bile leaks following laparoscopic cholecystectomy. Surg Endosc. 1993;7:292-5.
8. Vitale GC, Stephens G, Wieman TJ, Larson GM. Use of endoscopic retrograde cholangiopancreatography in the management of biliary complications after laparoscopic cholecystectomy. Surg. 1993;114:806-14.
9. Fletcher DR, Biliary injury of laparoscopic cholecystectomy: recognition and presentation. Aust NZJ Surg. 1993;63:673-7.
10. Blumgart LH. Hilar and intrahepatic biliary-enteric anastomosis. In: Surgery of the liver and biliary tract. Blumgart. Edinburgh:Churchill Livingstone Inc. 1988:899-913.
11. Asbun HJ, Rossi RL, Lowell JA, Munson JL. Bile duct injury during laparoscopic cholecystectomy mechanisms of injury, prevention and management. World J Surg. 1993;17:547-52.
12. Cats JA, Tempkins RK, Busuttil RW. Biliary complications of laparoscopic cholecystectomy. Am Surg. 1993;59:243-7.
13. Woods MS, Traverso LW, Kozarek RA. Characteristics of biliary tract complications during Laparoscopic cholecystectomy: a multi-institutional study. Am J Surg. 1994;167:27-34.
14. Kozarek R, Gannam R, Baerg R. Bile leak after laparoscopic cholecystectomy. Arch Int Med. 1992;152:1040-3.
15. Davidoff AM, Pappas TN, Murray EA. Mechanisms of major biliary injury during Laparoscopic cholecystectomy. Ann Surg. 1992;215:196-202.
16. Nolan TW. System changes to improve patients safety. Br Med J. 2000;320:771-3.
17. Deziel DJ, Millikan KW, Economou SG, Doolas A, Ko ST, Airan MC. Complications of Laparoscopic cholecystectomy: a national survey of 4292 hospitals and an analysis of 77604 cases. Am J Surg. 1993;165:9-14.
18. Sanabria JR, Gallanger S, Croxford R, Strasber SM. Risk factors in Laparoscopic cholecystectomy for conversion to open cholecystectomy. J Am Coll Surg. 1994;179:696-704.
19. Russell JC, Walsh SJ, Mattie AS, Lynch JT. Bile duct injuries, 1989-1993: a statewide experience. Arch Surg. 1996;131(4):382-8.
20. Davids PH, Rauws EA, Tytgat GN, Huibregtse K. Postoperative bile leakage: endoscopic management. Gut. 1992;33(8):1118-22.
21. Silver Stein JC, Wavik E, Millikan KW. A prospective experience with selective cholangiography. Am Surg. 1998;64:654-8.
22. Soper N, Strasberg S. An analysis of the problem of biliary injury during laparoscopic cholecystectomy. Collective review. J Am Coll Surg. 1995;180:101-25.
23. Bismuth H. post operative stricture of the bile duct. In: T biliary tract V. Edited by blumgart LH. edinburgh churchill livingstone Inc; 1982:209-218.
24. Bachellier P, Nakeno H, Weber JC, Lamarque, P, Quissoultzoglo E, Candauc et al. Surgical repair after bile duct and vascular injuries during Laparoscopic cholecystectomy: when and how? World J Surg. 2001;25:1335-45.
25. Waheeb R, Al-Kubati. Bile duct injuries following laparoscopic cholecystectomies. A clinical study. Saudi Gastroenterol. 2010;6(2):100-4.

Cite this article as: Srivastava VP, Agarwal S, Agarwal A, Sharan J. Managing bile duct injuries sustained during cholecystectomies. Int Surg J 2018;5:148-52.