Original Articles

Non-biliary mishaps during laparoscopic cholecystectomy

Rajdeep Singh, Robin Kaushik, Rajeev Sharma, Ashok K Attri

Department of Surgery, Government Medical College and Hospital, Sector 32, Chandigarh 160 030

Background: The most important complications of laparoscopic cholecystectomy (LC) are biliary tract injuries. Non-biliary complications can be equally devastating, but have received less attention in literature. Methods: The case files of 1748 patients who underwent LC over a period of seven years (1997-2003) in our department were retrospectively reviewed to identify non-biliary complications and their management. Results: Nine patients (0.5%) sustained significant non-biliary injury while undergoing LC. The commonest was duodenal perforation during dissection of the Calot's triangle (3 cases). Other complications included diaphragmatic injury (2 cases), and small bowel injury while inserting the umbilical port, right external iliac artery injury during insertion of Veress needle, portal vein injury during dissection, and liver laceration while using a delivery system to extract the gall bladder (1 each). All these complications were detected and managed intra-operatively. During the same period, 10 patients sustained biliary injury. Conclusion: Intra-operative non-biliary injuries during LC occur as frequently as biliary injuries, and can be life-threatening and difficult to manage. [Indian J Gastroenterol 2004;23:47-49]

Key words: Bile duct injury, duodenal injury, laparoscopy, non-biliary injury, pneumoperitoneum, pneumothorax, vascular injury

The two-dimensional view of the operative field and loss of sense of "touch" during laparoscopic surgery make good hand-eye co-ordination necessary in the surgeon. The increased incidence of bile duct injury during laparoscopic cholecystectomy (LC) is well known. However, non-biliary complications can be equally morbid and life threatening.

We summarize our experience with non-biliary complications of LC, and emphasize the need to be aware of and prevent such mishaps that can be a cause of significant morbidity and mortality.

Methods

The case files of 1748 consecutive patients who underwent elective LC for symptomatic gallstone disease at our institute over a period of seven years (1997-2003) were retrospectively reviewed for significant non-biliary complications that occurred during surgery, and their management. As part of our protocol, patients with common bile duct (CBD) calculi were cleared endoscopically prior to LC, or were taken up for open surgery in case clearance could not be achieved. Ours is a teaching hospital, and the procedure was performed by different surgeons and, at times, by the residents under supervision.

We arbitrarily defined significant non-biliary complications as operative complications related to the performance of LC that (i) required conversion to open surgery for their management, but did not involve either the gall bladder or biliary tract or related vasculature; bleeding from the gall bladder fossa was not considered in this category; (ii) delayed discharge from hospital beyond the 1st postoperative day; or, (iii) required investigations such as ultrasonography or chest X-ray in the postoperative period to document the efficacy of surgical treatment performed. Injuries such as minor colonic, duodenal, gastric or omental hematomas; cautery burn; minor lacerations of the liver; split gallstones; wound infections and port site hernia were not considered significant intra-operative injuries.

Nine patients were identified as having sustained significant non-biliary complications intra-operatively. The files of these patients were reviewed.

Results

The overall rate of conversion to open surgery was 8.1% (142 conversions). Of these, nine patients had sustained significant non-biliary complications (Table), giving an incidence of 0.5% of all LC attempted. The commonest non-biliary complication was duodenal perforation during dissection of a difficult Calot's triangle (i.e., where the dissection was difficult either due to adhesions or due to distorted anatomy; 3 cases). Other complications included diaphragmatic injury (2 cases), and small bowel injury while inserting the umbilical port, right external iliac artery injury during insertion of Veress needle, portal vein injury during dissection, and liver laceration while using a delivery system to extract the gall bladder (1 each).

Of these, seven required conversion, whereas two were managed laparoscopically. One patient with diaphragmatic injury was managed by laparoscopic suturing of the rent using non-absorbable suture; the other case, who sustained liver laceration, was managed by applying pressure over the bleeding site using a gauze piece and grasper instrument. In the majority of cases (5 of 9), the injuries occurred during dissection of the Calot's...
<table>
<thead>
<tr>
<th>Case No.</th>
<th>Age (y)</th>
<th>Sex</th>
<th>Injury sustained</th>
<th>Procedure</th>
<th>Follow up</th>
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<tr>
<td>1</td>
<td>30</td>
<td>F</td>
<td>Right iliac artery injury with Veress needle</td>
<td>Primary vascular anastomosis</td>
<td>Re-operation and graft interposition, Well after 6 y</td>
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<tr>
<td>2</td>
<td>35</td>
<td>F</td>
<td>Duodenal perforation</td>
<td>Primary closure</td>
<td>Well</td>
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<tr>
<td>3</td>
<td>57</td>
<td>F</td>
<td>Portal vein injury</td>
<td>Primary closure</td>
<td>Died</td>
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<tr>
<td>4</td>
<td>43</td>
<td>M</td>
<td>Small bowel perforation while inserting umbilical port</td>
<td>Primary closure</td>
<td>Well</td>
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<td>5</td>
<td>45</td>
<td>F</td>
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<td>Well</td>
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<td>6</td>
<td>23</td>
<td>F</td>
<td>Duodenal perforation</td>
<td>Primary closure</td>
<td>Well</td>
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<tr>
<td>7</td>
<td>37</td>
<td>F</td>
<td>Caustery burn to diaphragm</td>
<td>Repair of rent and chest tube insertion</td>
<td>Well</td>
</tr>
<tr>
<td>8</td>
<td>22</td>
<td>M</td>
<td>Injury to liver while inserting delivery system</td>
<td>Controlled with pressure</td>
<td>Well</td>
</tr>
<tr>
<td>9</td>
<td>70</td>
<td>F</td>
<td>Injury to diaphragm by assistant retracting fundus of gall bladder</td>
<td>Laparoscopic suturing of rent and chest tube insertion</td>
<td>Well</td>
</tr>
</tbody>
</table>

triangle and the gall bladder (Cases 2, 3, 5, 6, 7).

In 673 cases, pneumoperitoneum was created using a Veress needle, and in 1075, by an open technique of trocar insertion. Of the two injuries related to creation of pneumoperitoneum (Cases 1 and 4), one each sustained it while using the Veress needle (Case 1) and the open technique of pneumoperitoneum (Case 4). Although we have shifted over to the open technique exclusively in the last four years, the data revealed no significant difference in the complication rates using either technique.

The postoperative hospitalization in these 9 patients averaged 6.6 days (range 3-19), compared to less than 1.5 days in successful LC (range 1-7). The patient who developed right iliac artery injury while inserting Veress needle required re-operation and insertion of a vascular graft, but is well nearly 6 years later. There was one death – the patient with intra-operative portal vein injury. Initial attempts at laparoscopic control (the extent and nature of injury was not immediately apparent) delayed conversion and the patient exsanguinated before the bleed could be controlled.

During the same period, there were 10 cases of CBD injury detected intra-operatively during LC, giving an overall incidence of 0.6%. Of these, there were 9 cases of lateral injury to the CBD that required repair (1 case primarily, 8 cases over T-tube) and one of CBD transaction that required Roux-en-Y hepaticojejunostomy. One other patient presented 2 weeks after LC with bilary peritonitis that required laparotomy. She had bile leak from the supracystic part of the CBD and was managed by T-tube placement and suturing. She underwent Roux-en-Y hepaticojejunostomy for a type III biliary stricture after one year.

None of the patients in this series had combined biliary and non-biliary complications.

Discussion

At our hospital, the incidence of biliary injuries (0.6%) is similar to that of non-biliary injuries (0.5%).

Of non-biliary complications, trocar injuries to the intestine or major vessels are the most common. The insertion of the first trocar is often considered the most dangerous step in laparoscopic surgery, with a complication rate as high as 1.1%.1,2 Bowel injury occurs during insertion of the first trocar in approximately 0.1% of patients, and is more common in the presence of adhesions in patients with previous intra-abdominal surgery.1 Such injury to the intestine may range from insufflation injuries that may not require further intervention, to those that may require exteriorization of the injured segment of bowel through the umbilical port for closure, or conversion to a formal laparotomy. Trocar-related complications may be minimized by the use of an open technique to create pneumoperitoneum, insertion of the secondary ports under vision, positioning the patient in a Trendelenburg position, elevation of the abdominal wall prior to trocar insertion, and direction of the Veress needle towards the pelvis.3,4 In our experience, the open method of trocar insertion is safe as it provides access to the abdomen under direct vision.

Vascular injury can also occur at the time of insertion of Veress needle or the first trocar, with a reported incidence of 0.1% to 2%.3,4,6,7,8 Since the secondary trocars are placed under vision, they have a lower risk of injuring major blood vessels.7,8 During LC, the incidence of major retroperitoneal vessel injury is reportedly 0.05%, with injury to the abdominal aorta, iliac vessels and inferior vena cava being common.9 The surgeon's inexperience, improper positioning of the patient, failure to elevate the abdominal wall, incorrect direction of insertion of the trocar, inadequate pneumoperitoneum, failure to rotate the trocar during insertion, forceful thrust, inability to recognize anatomical landmarks, extreme thinness, skeletal deformity and previous abdominal surgery have all been implicated.7,8 It must be remembered that retroperitoneal bleeding may not present with visible blood, and that the high intra-abdominal pressure...
secondary to the pneumoperitoneum decreases venous return, which in turn may reduce arterial bleeding. Therefore, sudden unexplained hemodynamic instability occurring shortly after needle insertion should alert the operating team to the possibility of a vascular injury even in the absence of any visible bleeding.7

Major vascular injury may also occur during dissection in the Calot’s triangle, where the portal vein or the right hepatic artery are intimately related to the biliary tract, and may be injured or accidentally clipped.4,10 Management of such injuries can be complex and demanding even for the experienced surgeon. Care should be taken to define the Calot’s triangle, with good posterior dissection, and clear visualization of the contained structures before proceeding with clipping / ligating. Occlusion of the right hepatic artery may not produce any symptoms, or it may present with signs of right lobe ischemia, necrosis, liver failure and sepsis that may eventually require liver transplantation.11

Pneumothorax is a well-described complication of pneumoperitoneum, with a reported incidence of 0.015-0.4%.12,13 Although the exact mechanism is unknown, it is postulated that air enters the mediastinum through the aortic and esophageal hiatuses, or through congenital weak points in the diaphragm, secondary to the continuous high pressure of pneumoperitoneum.12 Direct injury to the diaphragm may also cause pneumothorax, as occurred in two of our patients. In one, the hook cautery was activated at the wrong time, probably without adequate visualization, at the time of dissection of the gall bladder off the liver bed; in the other, overenthusiastic retraction of the gall bladder fundus by the assistant lead to direct puncture of the diaphragm during surgery.

Pneumothorax should be suspected when there is increase in airway pressure, decrease in pulmonary compliance, unexplained fall in oxygen saturation, or when there is unexplained hypoxia, hypercarbia, or hemodynamic instability. If recognized early, treatment consists of deflating the abdomen, performing a tube thoracostomy, and then proceeding with surgery provided the patient is stable. If detected towards the end of the procedure in a stable patient, the operation should be completed and nothing further needs to be done, as the carbon dioxide in the pleural cavity gets reabsorbed rapidly after deflating the abdomen.12

The other complications such as injury to the duodenum (3 cases) occurred by persisting with dissection in a difficult Calot’s triangle. Gentle dissection, recognition of the normal anatomy, avoidance of persisting with dissection in a difficult Calot’s triangle, and a low threshold of conversion should go a long way in preventing not only bile duct injuries, but also complications such as these.

To conclude, in our experience, non-biliary injuries occur with an almost equal frequency as their biliary counterparts and are equally difficult to manage. These complications can occur at any stage of surgery— from insertion of the first trocar to extraction of the gall bladder—and are best avoided by adhering to the principles of good laparoscopic surgery.

References

Correspondence to: Dr Singh. E-mail: rajdeep2000@hotmail.com, robinkaushik@yahoo.com