IATROGENIC BILE DUCT INJURIES – CLINICAL PROBLEMS

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Laparoscopic cholecystectomy is one of the most frequently performed surgical procedures in surgical wards. Iatrogenic bile duct injuries (IBDI) incurred during the procedures are among postoperative complications that are most difficult to treat. The risk of bile duct injury is 0.2–0.4%, and their consequences are unpleasant both for the surgeon and for the patient.

The aim of the study was analysis of iatrogenic bile duct injuries and methods of their repair, taking into consideration the circumstances, under which the injuries occur.

Material and methods. The study group consisted of 16 patients who had suffered IBDI during surgery. The analysed parameters included sex, age, indications for surgery, the setting of the surgical procedure and the type of bile duct injury. Additionally, the time of injury diagnosis, type of repair and treatment outcome were assessed. The IBDI analysis used the EAES classification of injuries. The time of IBDI repair was defined as immediate, early or late, depending on the time that had passed from the injury. The analysis included complications seen after bile duct repair.

Results. The study group consisted of 10 women and 6 men, aged 29–84. Patients underwent 6 classic cholecystectomies, 8 laparoscopic cholecystectomies, one gastrotomy to remove oesophageal prosthesis and one laparotomy due to peptic ulcer. IBDI was diagnosed intraoperatively in 4 patients. In 12 patients IBDI was diagnosed within 1–7 days. The diagnosis was based on endoscopic retrograde cholangiopancreatography and the results of biochemistry tests. According to the EAES classification, the injuries were of type 1 (4 patients), type 2 (8 patients), type 5 (3 patients) and type 6 (1 patient). Reconstruction procedures were performed during the same anaesthesia session in 3 patients, and in the early period in 13 patients. The main procedure was Roux-en-Y anastomosis (12 patients), with the remaining including bile-duct suturing over a T-tube (3 patients) and underpinning of an accessory bile duct in the pocket left after gallbladder removal (1 patient). The most common reconstruction complications included bile leak (3 patients), recurrent cholangitis (3 patients) and bile duct stricture (2 patients). Mortality in the study group was 12.5%.

Conclusions. The procedures of laparoscopic and classic cholecystectomy are associated with a risk of IBDI, especially in the presence of inflammatory state of the gall-bladder. IBDI is a complex complication: its treatment poses a challenge for the operating surgeon, and even the most careful treatment adversely affects the patient’s life due to complications.

Key words: laparoscopic surgery, cholecystectomy, iatrogenic bile duct injury

Classic and laparoscopic cholecystectomy procedures are associated with a risk of iatrogenic bile duct injuries (IBDI). Iatrogenic bile duct injuries incurred during laparoscopic cholecystectomy, which has become a standard method of treating symptomatic cholelithiasis, are a problem encountered by surgeons around the world. The current risk of bile duct injury during laparoscopic cholecystectomy in Poland is estimated to be 0.21–0.4% (1, 2, 3).

Risk factors for iatrogenic bile duct injuries depend upon: 1) the conditions of surgery (whether the procedure was performed due to emergency indications with the presence of
acute inflammatory state); 2) the operating surgeon’s experience; 3) good visibility within the surgical field; 4) adhesions existing near the operated area; 5) insufficient knowledge of anatomical relationships in the surgical field; 6) haste; 7) failure to consider the possibility of atypical routes of vessels and bile ducts; 8) existing changes in the anatomical conditions due to ongoing disease processes (1, 2, 3).

Currently it is believed that the main causes of IBDI are: incorrect interpretation of atypical anatomy and, less frequently, lack of the surgeon’s care. The incorrect interpretation accounts for 66-97% of injury causes; the risk is higher in a thin person with a narrow main bile duct, which can be erroneously recognised as the cystic duct. In 70-80% cases of IBDI the operating surgeon is unaware of having incurred the injury (3).

Only a leak of biliary content from a drain, postoperative hyperbilirubinaemia, local or diffuse peritonitis or septic symptoms in a patient indicate the possibility of biliary tract injury. This is associated with the necessity of repair surgery. Depending on when the injury is diagnosed, this can be done immediately during the same anaesthetia session, in the early period, i.e. 1 to 45 days after the injury, or in the late period, i.e. after 45 days of the injury. The time of performing repair surgery is still an object of discussion, although in a paper by Iannelli it was demonstrated that late repair is associated with the lowest number of complications (4).

The site requiring repair is also important. Iannelli claims that the success of repair surgery is also associated with the possibility of being performed by a surgeon experienced in biliary tract surgeries. Where this is not possible, it is indicated to thoroughly drain the area of injury.

Careful surgical technique is of key importance for IBDI prevention. Correct spatial visualisation of the Calot’s triangle means careful preparation of the cystic duct and safe gall-bladder removal. Examination of 70 corpses revealed that the cystic artery may be: double – 14%, additional – 10% or duplicated – 13% (37% in total). The groove that runs through the visceral surface of the liver, above the carina, and the initial sections of the hepatic ducts is visible in approx. 80% of patients undergoing surgery. Visualisation of this groove is one of the conditions of safe surgery during cholecystectomy (3). According to Strasberg, another factor contributing to injuries is skipping of intraoperative cholangiography (5). The main aim of the examination is to avoid the risk IBDI or to recognise it immediately, with the secondary purpose being identification of choleductolithiasis. Light cholangiography might be considered (introduction of a duodenoscope to the main bile duct (MBD) and illuminating it from the inside) as well as methylene blue cholangiography (injection of 50% methylene blue solution to the gall-bladder (GB) bottom will cause bluish staining of the bile ducts). With the intent to help avoid IBDI, various training sessions and courses are offered; this includes even simulation training sessions to promote safe surgery. One of the types of IBDI complications, manifesting usually long time after the surgery, is MBD stricture. This condition develops through injury of the MBD axial vessels, leading to chronic ischaemia of its walls (1, 2, 3).

The objective of the study was clinical analysis of a group of patients who had suffered iatrogenic bile duct injuries, with special attention dedicated to the intraoperative circumstances of the injury, diagnosis and reconstruction treatment of the injury as well as the fate of the patients.

**MATERIAL AND METHODS**

The study group consisted of 16 patients who had suffered iatrogenic bile duct injury. Analysis of the group was performed retrospectively. The study group included all patients treated in one facility, supervised by one surgeon (S.G.). Demographic analysis was performed (sex, age), involving the patients in the analysed group, as well as analysis of preoperative diagnoses and concomitant diseases. The analysis additionally included: 1) intraoperative conditions of the procedure, during which the bile duct injury occurred; 2) the type of bile duct injury; 3) the time when the injury was diagnosed (intraoperatively, immediately after surgery in the operating room setting, postoperatively); 4) reconstruction treatment used, time between the IBDI and repair surgery; 5) early reconstruction treatment outcomes; 6) distant outcomes seen in patients.

Bile duct injury was defined as injury of the extrahepatic bile ducts, irrespective of their
anatomy (normal or altered). The injuries were classified according to the Strasberg and EAES classification.

The classification of bile duct injuries (according to Strasberg) in the analysed group (5):

A – an injury of small ducts in the pocket left after gall-bladder removal or originating from the cystic duct, with retained integrity of the main bile duct;

B and C – injuries of atypical variations of the right hepatic duct;

D – partial injury of the main bile duct, with retained integrity of the duct;

E – complete interruption of the main bile duct at the level of the common bile duct, the common hepatic duct or the junction site of the left and right hepatic ducts.

Another system used for classification of bile duct injuries is one prepared by EAES (6).

According to this system, injuries are classified depending upon:

(1) Anatomical localisation within the bile ducts (types 1-6)

Type 1 – injury of the main bile duct occurring 2 cm distally from the junction of the hepatic ducts.

Type 2 – injury of the main bile duct occurring 2 cm proximally from the junction of the bile ducts.

Type 3 – injury of the main bile duct involving the junction of the hepatic ducts, with retention of this junction.

Type 4 – injury of the main bile duct involving the junction of the hepatic ducts, with interruption of the connection between the right and left hepatic ducts.

Type 5 – injury of the left or right hepatic duct without injury of their junction.

Type 6 – injury of accessory bile ducts, e.g. in the gall-bladder pocket, without injury of the main bile duct.

(2) The extent of the injury: complete (C), major (M) (above 25% of the circumference) and partial (P) (below 25% of the circumference).

(3) Accompanying injuries, e.g. vascular injuries.

(4) The size of the defect in the course of bile ducts.

Bile duct repair was performed immediately, in the early period or in the late period: immediate, early (within 45 days of injury) or late repair (after 45 days of injury). The types of repair surgeries performed included: endoscopic intervention and introduction of a prosthesis in the bile ducts (ERCP), simple suturing of the bile ducts and Roux-en-Y anastomosis.

Due to the small size of the study group, descriptive statistics was used in calculations.

RESULTS

The study group consisted of 16 patients who had suffered bile duct injury. In 15 patients the repair procedures were performed in our Department, by one surgeon. One patient underwent reconstruction surgery directly after the primary surgical procedure, in the facility where the patient was treated. Because of a postoperative problem (major bile leak in the anastomosis), the patient was sent to our Department. In the study group of 16 patients there were 10 women aged 29-84 and 6 men aged 65-84. The patients initially underwent 8 classic procedures involving laparotomy and 8 laparoscopic procedures. The 8 cases of primary classic procedures involving laparotomy included: six classic cholecystectomies, one patient operated due to migration of an oesophageal prosthesis previously implanted due to oesophageal stricture and one patient operated due to peptic ulcer. In the latter two patients, the injury of the common bile duct occurred in especially difficult anatomical conditions during gastrotomy and stomach resection due to peptic ulcer.

In case of classic cholecystectomy, the procedures were performed in acute inflammatory state or after cholecystitis. According to the operating surgeons’ account, the intraoperative conditions were difficult or very difficult in terms of identification of anatomical structures. In 3 cases the bile duct injury was an adverse event that occurred during a seemingly controlled procedure of cholecystectomy. The surgeon was convinced they were dissecting the cystic duct, while in reality the dissected structure was the common bile duct erroneously recognised as cystic duct. As regards laparoscopic cholecystectomies, 4 procedures were performed in the elective setting; in one patient the cystic duct originated from the right hepatic duct, and the surgeon identified the common origin as the cystic duct; in another patient the cystic duct was very short,
and here as well the surgeon erroneously assessed the anatomical situation. In other two young patients, surgeons incorrectly identified narrow common bile ducts as cystic ducts, damaging these structures.

Intraoperative bile duct injury was diagnosed intraoperatively in 4 patients: during laparoscopic cholecystectomy, classic cholecystectomy, gasto-tomy and stomach resection. In 12 patients the diagnosis was established within 1-7 days after surgery, during the hospital stay. In all patients the examination of choice to confirm the injury was endoscopic retrograde cholangiopancreatography (ERCP). Biochemistry tests were used as a supplement (bilirubin concentration, activity levels of asparagine aminotransferase (AspAT) and alanine aminotransferase (AlAT), gamma-glutamyl transpeptidase (GGTP), alkaline phosphatase (ALP), assessment of the coagulation system and renal function as well as imaging examinations, such as ultrasonography, tomography and, after the surgery, cholangio-NMR) (tab. 1, 2).

According to the Strasberg classification, type A injuries were present in one patient, type B or C – in 3 patients, type E in 12 patients (common hepatic duct injuries occurring less than 2 cm from the bifurcation of the left and right hepatic ducts – 7; common bile duct injuries – 5). The most common site of injury was the main bile duct, through the mechanism of complete resection of its fragment after clipping the two ends. The operating surgeons reported that they had identified the bile duct as the cystic duct.

The main type of injury according to the EAES classification was type 2 injury with a defect of integrity of the main bile duct (12 patients); other types were less frequent (type 5 – 3 patients; type 6 – 1 patient).

According to the EAES classification, most frequent were CBD injuries occurring more than 2 cm from the junction of the hepatic ducts (type 1 – 4 patients, type 2 – 8 patients) and injuries of the right or left hepatic duct (type 5 – 3 patients). One patient incurred injury of an accessory bile duct (type 6).

Reconstruction procedures were performed immediately after diagnosis, during the same anaesthesia session, in 3 patients, and in the early period (1–7 days) in 13 patients, after careful preparation and thorough diagnosis of the injury type.

The surgical procedure began with thorough inspection of the surgical field and visualisation of injured bile ducts, which was not easy given the short period from the primary surgery and was usually associated with serious difficulties. After visualisation of the site of injury, intraoperative cholangiography was performed to assess the bile duct anatomy and to make appropriate intraoperative decisions. Most of bile duct reconstruction procedures were performed through anastomosis of the bile ducts, most commonly the main hepatic duct, with creating a loop of the small intestine (Roux-Y loop) (tab. 3).

Mortality in the study group was 12.5% (2/16).

The mean hospitalisation time after the reconstruction procedure was 17 days (10-48 days).

Intraoperative bile duct injuries were diagnosed in 5 patients and (during the same anaesthesia session) a reconstruction procedure was performed, 1 patient was diagnosed with the injury and underwent reconstruction on the day following the procedure, after performing ERCP. In 9 patients ERCP was performed before the reconstruction procedure, a method that plays an important role in establishing the final diagnosis. In the analysed group of patients, cholangio-NMR was used during follow-up visits after the reconstruction procedure (tab. 4, 5).

DISCUSSION

Iatrogenic bile duct injury is a major clinical problem, as well as a professional problem for the surgeon who performed the unfortunate procedure and for surgeons who reconstruct the bile ducts. For the patients, on the other hand, it is a particularly difficult disease, associated with recurring health problems (4, 7, 8).

In the study group, 8 procedures were performed due to cholecystitis, 6 due to symptomatic cholelithiasis without inflammation and 2 due to other indications. According to the literature, inflammatory state in the gall-bladder, involving also the bile ducts, increases the risk of bile duct injury.

One of circumstances, a very controversial one, which can promote IBDI is cholecystectomy performed from the bottom of the gall-
Table 1. Analysis of a group of patients with bile duct injuries

<table>
<thead>
<tr>
<th>No.</th>
<th>Patient</th>
<th>Type of surgical procedure</th>
<th>Site of MBD injury</th>
<th>Injury type according to EAES</th>
<th>Reconstruction procedure</th>
<th>Time from bile duct injury after which the reconstruction procedure was performed (days)</th>
<th>Time of hospitalisation after reconstruction surgery (days)</th>
<th>Patient's fate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AG, age: 29</td>
<td>laparoscopic cholecystectomy</td>
<td>CHD – 2</td>
<td>Roux-en-Y hepaticojejunostomy anastomosis</td>
<td>7</td>
<td>10</td>
<td>1 – the postoperative course was uncomplicated 2 – follow-up after one year – good overall condition</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>CJ, age: 65</td>
<td>laparoscopic cholecystectomy – elective surgery</td>
<td>CBD – 1</td>
<td>Roux-en-Y choledochojejunostomy anastomosis</td>
<td>25</td>
<td>19</td>
<td>patient’s death on the 13th day after the surgery due to massive gastrointestinal haemorrhage</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>IK, age: 57</td>
<td>laparoscopic cholecystectomy</td>
<td>Right bile duct – 5</td>
<td>Roux-en-Y hepaticojejunostomy anastomosis</td>
<td>on the day of surgery, after completing lap. chol.</td>
<td>9</td>
<td>1 – the postoperative course was uncomplicated 2 – follow-up after one year – good overall condition</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>MS, age: 68</td>
<td>laparoscopic cholecystectomy</td>
<td>transection of a bile ductule in the pocket left after gall-bladder removal (duct of Luschka) – 6</td>
<td>ERCP – a small bile leak at one of the clips. Laparotomy – underpinning of an accessory bile ductule (duct of Luschka) in the pocket left after gall-bladder removal.</td>
<td>6</td>
<td>10</td>
<td>1 – the postoperative course was uncomplicated 2 – follow-up after one year – good overall condition</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>LS, age: 61</td>
<td>classic cholecystectomy – acute surgery due to cholecystitis</td>
<td>CHD at the RBD/LBD junction site – 2</td>
<td>Roux-en-Y hepaticojejunostomy anastomosis</td>
<td>43</td>
<td>11</td>
<td>1 – the postoperative period was uncomplicated 2 – several hospitalisations due to recurrent cholangitis</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>EP, age: 84</td>
<td>oesophageal prosthetic replacement due to stricture migration of the prosthesis to the stomach</td>
<td>CBD/PWW – 1</td>
<td>suturing of the main bile duct over a T-tube</td>
<td>on the day of the primary surgery</td>
<td>30</td>
<td>1 – cholangiography through the T-tube, after two weeks – no bile leak was identified 6th day after the procedure – duodenal fistula, parenteral nutrition; healing of the fistula – oral nutrition 2 – patient's death 4 months after the procedure</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>I S-B, age: 34</td>
<td>laparoscopic cholecystectomy – elective</td>
<td>CHD – 2</td>
<td>Roux-en-Y hepaticojejunostomy anastomosis</td>
<td>1</td>
<td>10</td>
<td>1 – follow-up cholangio-NMR: normal duodenal flow to the duodenum. Bile leak. After two weeks the drain was removed 2 – follow-up after one year – good overall condition</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>MS, age: 75</td>
<td>laparoscopic cholecystectomy</td>
<td>CHD – 2</td>
<td>Roux-en-Y hepaticojejunostomy anastomosis</td>
<td>14</td>
<td>10</td>
<td>1 – perioperative bile leak – partial parenteral nutrition Cessation of the leak 2 – follow-up after one year – good overall condition</td>
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<tr>
<td>No.</td>
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| 9   | MS   | 84  | Laparoscopic cholecystectomy – elective or acute surgery | CHD – at the junction (resection of a bile duct fragment) – 2  
Roux-en-Y hepaticojejunostomy anastomosis |
| 10  | EM   | 40  | Classic cholecystectomy; removal of a cyst in the right hepatic duct | Right bile duct – 5  
Roux-en-Y hepaticojejunostomy anastomosis |
| 11  | SS   | 38  | Classic cholecystectomy | Incision of the right hepatic duct – 5  
Suturing of the right hepatic over a little drain.  
on the day of the procedure |
| 12  | WJ   | 49  | Classic cholecystectomy – acute surgery due to cholecystitis | CHD near the RBD/  
LBD junction site – 2  
Roux-en-Y hepaticojejunostomy anastomosis |
| 13  | CA   | 62  | Classic cholecystectomy due to cholecystitis | CBD transection – 1  
CBD sutturing over a T-tube  
procedure performed on the day of the primary surgery |
| 14  | KL   | 60  | Stomach resection due to peptic ulcer | Resection of a fragment of the CBD near the head of pancreas with subsequent resection of a part of the head of pancreas – 1  
the first procedure: intussusception of the CBD with the head of pancreas to the small intestine  
The second procedure: after several months, due to jaundice – choledocolojejunostomy |
| 15  | ST   | 70  | Classic cholecystectomy | CHD transection – 2  
Roux-en-Y hepaticojejunostomy anastomosis |
| 16  | KZ   | 62  | Classic cholecystectomy | CHD transection – 2  
Roux-en-Y hepaticojejunostomy anastomosis |

LIST OF ABBREVIATIONS USED IN THE TABLE AND PAPER:
- Iatrogenic bile duct injuries – IBDI
- Common hepatic duct – CHD
- Common bile duct – CBD
- Endoscopic retrograde cholangiopancreatography – ERCP
- Main bile duct – MBD
- Left bile duct – LBD
- Right bile duct – RBD
Table 2. Time of bile duct repair surgery

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Iatrogenic bile duct injuries – clinical problems

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</tbody>
</table>

Iatrogenic bile duct injuries – clinical problems

Table 2. Time of bile duct repair surgery

<table>
<thead>
<tr>
<th>Bile duct repair surgery (according to the time criterion)</th>
<th>Number of surgeries performed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate</td>
<td>5</td>
</tr>
<tr>
<td>Early</td>
<td>11</td>
</tr>
</tbody>
</table>

Table 3. The method of the performed bile duct repair procedure

<table>
<thead>
<tr>
<th>Bile duct repair surgery (according to the repair procedure type)</th>
<th>Number of surgeries performed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roux-en-Y anastomosis</td>
<td>12</td>
</tr>
<tr>
<td>Suturing of the main bile duct over a T-tube (2) or other drain (1)</td>
<td>3</td>
</tr>
<tr>
<td>Underpinning of an accessory bile duct in the pocket left after gall-bladder removal</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 4. Post-operative complications

<table>
<thead>
<tr>
<th>Post-operative complications</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biliary fistula</td>
<td>1</td>
</tr>
<tr>
<td>Spontaneously subsiding bile leak</td>
<td>3</td>
</tr>
<tr>
<td>Frequently recurring bile duct infections</td>
<td>3</td>
</tr>
<tr>
<td>Bile duct stricture requiring surgical correction</td>
<td>1</td>
</tr>
<tr>
<td>Bile duct stricture not requiring surgical correction</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 5. Summary classification of injuries according to EAES

<table>
<thead>
<tr>
<th>Summary classification of injuries according to EAES</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td>4</td>
</tr>
<tr>
<td>Type 2</td>
<td>2</td>
</tr>
<tr>
<td>Type 5</td>
<td>3</td>
</tr>
<tr>
<td>Type 6</td>
<td>1</td>
</tr>
</tbody>
</table>
patients (this included bile duct prosthesis placement and 2 procedures of suturing) and early repair was performed in 13 patients (12 procedures of Roux-en-Y anastomosis and 1 procedure of suturing).

Bile duct injury repair is associated with 4.5 to 26 times higher cost than uncomplicated laparoscopic cholecystectomy (9). An important problem is the technique of cholecystectomy after retrograde cholangiopancreatography (ERCP) performed due to cholelithiasis or other indications. As in our experiences, Siert et al. (10) more frequently converted to classic cholecystectomy after ERCP than in a patient group where cholecystectomy was not preceded by this procedure. Such difficulties can be associated with abnormal function of the sphincter of Oddi, secondary bacterial colonisation of the bile ducts, inflammation and subsequent scarring of the hepatoduodenal ligament, which impedes preparation within the Calot’s triangle. In approx. 60% of patients after ERCP, the bile ducts are colonised by bacteria. A surgical procedure performed after ERCP is more difficult, makes it more difficult to treat the cystic duct and place clips (which are more prone to fall off); what is more, bile leaks from the cystic duct are more frequent. In such cases, a suture should be placed or the cystic duct should be ligated. Our experiences, like those of Siert et al. (10), indicate that such cholecystectomy should be considered more difficult and performed by an experienced surgeon.

A systematic review of 45 studies involving 2,626 patients undergoing single incision laparoscopic cholecystectomy yielded the percentage of 0.72% of bile duct injuries incurred in elective surgeries (6). A review of other registries performed by the same team (Eikermann et al.) demonstrated a dangerously high percentage of bile duct injuries: 0.9% (German Hospital Quality Report – 172,368 pts), 0.25% (Danish Cholecystectomy Database In Denmark – 24,240 pts), 0.9% (Finnish cohort – 8,349 cholecystectomies, 1,616 open and 6,733 laparoscopic cholecystectomies), 0.11% (from Kaiser Permanente Northern California).

Similarly to our observations (2, 11), the cited studies reveal patient-related factors and local factors increasing the risk of IBDI. These include: age, sex, acute cholecystitis, the presence of a calculus in the Hartmann’s pouch, a short or absent cystic duct, anatomical differentiation of the bile duct arrangement, a thick wall of the gall-bladder, a widened common bile duct, extensive scarring of the Calot’s triangle area, numerous adhesions after previous surgeries. An increased risk of injuries was seen in men compared with women. In our group there were more women (10/16), who underwent surgery mostly due to cholecystitis (8/10 procedures).

Eikermann et al. (6) recommend certain rules of intraoperative conduct, which are largely similar to our previous guidelines published in Pol Przegl Chir (2). The team (8) recommends using oblique plane imaging, which allows for better visualisation of the bile ducts. Multidirectional straining of the gallbladder (frontal, lateral, caudal) allows for better visualisation of the anatomical conditions of the main bile duct. It is best to start preparation and incision of the peritoneum from the infundibulum level; one should pay continuous attention to the hepatic parenchyma. Preparation should be continued towards the cystic duct, releasing the Hartmann’s pouch using the so-called flag technique. Monopolar coagulation should be used with caution, in short periods of 1–2 s. Surgeons, depending on their experience, use a hook electrode, scissors, dissector or ultrasonic knife. Only after obtaining of a clear image of the two duct structures, separation of the structures and demonstration that they communicate with the gall-bladder, is it possible to ligate or clip those structures. The marker of the cystic artery is the Cloquet’s node.

In case of intraoperative difficulties, anatomical conditions should be reassessed: first, the gallbladder should be separated from the liver, and then the Calot’s triangle should be re-explored. Such means might be insufficient; intraoperative cholangiography or ultrasonography should be used to allow approximation of the anatomical conditions (12, 13, 14, 15).

In the group in question, routine intraoperative cholangiography was not performed during the primary procedure. This method is considered by some authors to be a way to avoid IBDI. Only a suspicion of bile duct injury was an indication for cholangiography. Possibly, the option of intraoperative cholangiography should be used more extensively during cholecystectomy, if there is no reliable identification of anatomical structures (3, 14, 15).
What is more, in such situations one should consider preparation starting from the bottom and convert when in doubt. It needs to be emphasised that the time factor is of great importance. If the surgeon cannot identify the anatomy within 30–45 minutes, they should convert to the open method. While separating the gallbladder from the bed, it is important to properly treat the ducts of Luschka. Visible duct structures should be ligated; coagulation should be avoided to reduce the risk of bile leaks.

Cholecystectomy performed as part of an elective or acute procedure is associated with a risk of IBDI, especially if signs of cholecystitis are present.

All preventive measures aimed at reducing the risk of bile duct injury are extremely important.

CONCLUSIONS

Iatrogenic bile duct injury is a complex complication, in the case of which – even when it is treated early and in the best possible manner – there is no guarantee that complications will not occur after a longer period of time. Such complications are associated with recurrent cholangitis, stricture of the anastomosis site as well as other factors and they adversely affect the patients’ quality of life.

REFERENCES