IATROGENIC BILE DUCT INJURIES

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IATROGENIC BILE DUCT INJURIES (Abstract). Bile duct injuries may occur both in hepatopancreaticobiliary surgery and in gastrointestinal surgery, but, most commonly, during cholecystectomy (80-90%). Laparoscopic approach has increased the occurrence of these significant intraoperative accidents, although it is one of the commonly seen interventions in a surgical department. The general incidence of bile duct injuries is usually 0.4-0.8%; in classical cholecystectomy, the incidence is 0.1-0.2%, and in laparoscopic surgery, it is 0.2-0.8%. Material and methods: We carried out a retrospective study on a batch of 23 patients who underwent surgery, from 1997 to 2015, which shows the approach of these accidents and the proper therapeutic conduct as well. Results: The evolution of each case depends on how quickly the diagnostic of bile duct injury is established. Two types of injuries have been identified: 52% wounds and 48% stenosis. Keywords: LAPAROSCOPIC CHOLECYSTECTOMY, BILE DUCTS, IATROGENIC INJURIES

Common bile duct (CBD) injuries during classical cholecystectomy, but especially during laparoscopic cholecystectomy, are a rare case, but consistently present in worldwide surgical practice CBD injuries cause major complications with locoregional and systemic effects which, without being immediately recognised and treated, may involve vital prognosis and long-term serious sequelae.

Involving the direct responsibility of the surgeon entails psychological pressure and tendency towards precipitation, which requires co-opting an experienced colleague or referring the case to a specialised centre.

Surgical treatment should restore the CBD from a morpho-functional point of view, with immediate and especially long-term good result. The more common association of iatrogenesis in laparoscopic surgery (0.2-0.8%) indicates the involvement of side effects of technology related to visual guiding in a limited field. Approximately 77-89% of CBI causes the postoperative appearance of abdominal pain, choleperitonitis, jaundice or angiocholitis (1).

MATERIAL AND METHODS
The study represents a retrospective analysis of CBI, from 1995 to 2015, caused or treated within the clinic, following classical or laparoscopic cholecystectomy. We took 23 patients for the study, of which 19 were women (83%) and 4 were men (17%), aged between 21 and 77 years (fig. 1).
The parameters used in the statistical analysis were represented by: initial diagnosis, intra or postoperative diagnosis of the injury, final diagnosis, surgical technique, paraclinical imaging examinations—endoscopic retrograde cholangio-pancreatography (ERCP), echography, intraoperative cholangiography, cholangio-NMR, average admission time – re-intervention, and average hospitalisation time.

The main causes of these accidents were pediculitis from the bile ducts caused by inflammation, the fact that all patients were initially diagnosed with acute cholecystitis, and biliary-vascular anatomical variations.

The identified injuries were represented by wounds of the common bile duct and stenoses of the common bile duct. The diagnosis of iatrogenic bile duct injury was established intraoperatively in 3 cases and postoperatively in 20 cases: - early (24-72 hours), in 3 cases, 2 and 3 days, respectively, after the operation; - late (>72 hours), in 17 cases, 6 cases approximately 7 days after the operation, 4 cases approximately 30 days after the operation, and the latest diagnosis of iatrogenic injury was established after 2 years.

**RESULTS**

Of the 23 cases, 7 cases had history of classical cholecystectomy and 16 cases had history of laparoscopic cholecystectomy, 16 cases coming from other centres. The female sex (83%) dominates the casuistry, being known the fact that biliary pathology is predominantly female. The average age of patients is 64 years.

Two types of injuries have been identified (fig. 2):

- **wounds** most commonly located at the level of the common hepatic duct, occurred as a result of a difficult dissection, due to the significant local inflammatory processes, which determined a partial or total section of the common hepatic duct; in the study, 12 wounds have been identified, of which:- 1 case with wound of the aberrant duct; - 1 case with lateral wound below the convergence + downstream stenosis; - 3 cases with lateral wound of the common hepatic duct; - 2 cases with complete section of the common hepatic duct; - 4 cases with lateral wound of the common hepatic duct (cautery) (fig. 3).

- **stenoses** occurred because of ligature or total or partial clipping of the common hepatic duct (2, 6); the 11 identified stenoses were systematized according to the Bismuth classification:

  - 7 cases of Bismuth I injuries: - com-
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- Complete choledochal ligature - 5 cases;
- Ligation of the common hepatic duct - 1 case;
- Lateral ligature of the cystic duct + common bile duct - 1 case.

![Fig. 3. Types of wounds]

- 3 cases of Bismuth II injuries: common bile duct ligatured and sectioned < 2 cm under the convergence.
- 1 case of Bismuth III injury: ligature at the level of the hilum with preserved convergence (fig. 4).

![Fig. 4. Types of stenosis]

According to the Strasberg classification (12), we had the following types of injuries in the studied batch:
- One type C injury;
- Type D injuries: 8 cases;
- Type E1 injuries: 9 cases;
- Type E2 injuries: 4 cases;
- Type E3 injuries: 1 case (fig. 5).

The main imaging explorations used for the diagnosis of the injuries were:
- Abdominal ultrasound, routine exploration, for all cases;
- Intraoperative cholangiography, which reveals leaks of contrast agent and also helps locate the injury (fig. 6, 7);
- Kehr’s tube cholangiography;
- Cholangio-NMR (fig. 8, 9);
- CT.
Fig. 5. Strasberg classification of iatrogenic biliary injuries

Fig. 6, 7. Intraoperative cholangiography in the patient with Bismuth III stenosis

Fig. 8. Postoperative cholangio-NMR in a patient with bile duct stenosis

Fig. 9. Cholangio-NMR in a patient with Bismuth III bile duct stenosis
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The performed paraclinical explorations (blood count, biochemistry, electrolytes) reveal cholestasis syndrome in patients with iatrogenic stenosis, with high levels of total bilirubin, within the interval of 3.89-19.9 mg/dL, accompanied by phenomena of angiocholitis and sepsis, in 7 cases.

The treatment of these injuries depends on how early the injury has been recognised, and it requires experience and a technique appropriate for the type of injury. The injury was immediately identified intraoperatively in only 13% of the cases (3 patients). The approach was classical (fig. 10) and open in all cases for a better view and highlight of the injuries. The applied techniques in all 23 cases were the following:

- for stenosis:
  - hepaticojejunal anastomosis with a Roux-en-Y loop - 6 cases;
  - hepaticojejunal anastomosis with an Ω loop - 2 cases;
  - T-T suture of the common hepatic duct + Kehr drainage - 1 case;
  - extraction of clip, suture of breach + Kehr drainage - 2 cases.
- for wounds:
  - hepaticojejunal anastomosis with a Roux-en-Y loop - 3 cases;
  - suture of the aberrant bile duct, Kehr drainage - 1 case;
  - T-T suture of the common hepatic duct, transcystic drainage - 3 cases;
  - T-T suture of the common hepatic duct + Kehr drainage - 4 cases;
  - biliary drainage with two Kehr tubes in the right and left hepatic duct, one tube in the right paramedian duct - 1 case.

Fig. 10. Iatrogenic CBD injury - intraoperative (personal collection – C. Burcoveanu)
Morbidity was represented by the occurrence of a hepaticojejunal anastomosis fistula accompanied by choleperitoneum and septic phenomena, which cause the appearance of multiple organ failure and death, as well as the appearance of a hepatic abscess in the VIII hepatic segment, with sepsis, solved by drainage and antibiotic therapy. There were 7 cases of angiocholangitis with sepsis - the association of sepsis in postoperative iatrogenic injuries, discovered late, indicate the choice of the restoration operative moment and negatively influences the results.

The mortality ratio was 4%: one patient died postoperatively due to associated personal pathologies developing septic phenomena and multiple organ failure.

DISCUSSION

Iatrogenic bile duct injuries represent a topical problem, considering the frequency of laparoscopic surgery used nowadays. They are signalled since the performance of the first cholecystectomy, in 1882, by Langenbuch.

There are multiple classifications of these injuries, depending on their location and type. The purpose of these classifications is to ease the management and choice of a proper treatment, with a surgical technique appropriate for each type of injury. Classically, the Bismuth classification is used, which is only limited to stenoses:

- I: CBD stenosis more than 2 cm from the hepatic confluence,
- II: CBD stenosis less than 2 cm from the hepatic confluence,
- III: stenosis below the confluence, but with its preservation,
- IV: stenosis at the level of the confluence, which involves both hepatic ducts, losing communication between the right and left hepatic duct,
- V: stenoses of the CBD and of a right aberrant hepatic duct (2, 3, 4).

As the Bismuth classification does not include the entire spectrum of possible injuries in the bile ducts, Strasberg et al. (5) have made a classification which includes that of Bismuth along with other iatrogenic injuries in the extrahepatic bile ducts:

- A: injuries of the cystic duct or the aberrant ducts from the hepatic level,
- B: stenosis of the aberrant segmental duct of the right lobe,
- C: sectioning of an aberrant segmental duct of the right lobe,
- D: lateral injuries of the CBD,
- E: stenoses or complete sections of the CBD, subdivided from E1 to E5, depending on the location of the injury according to the Bismuth classification.

Early intraoperative diagnosis is established in only 11-12% of the cases (1, 6), and, in our study, the intraoperative diagnosis ratio was around these levels, namely: 13%. Most bile duct injuries have been discovered postoperatively, late, after more than 72 hours, at variable intervals of time. For the patients in the study, the diagnosis was established with the help of imaging investigations, and they all benefited from abdominal ultrasound, while 35% of them underwent cholangio-IRM (6).

The choice of therapeutic conduct varies depending on how early the diagnosis is established, the type of injury, and the local and general physio pathological conditions (3).

In our study, most injuries were solved through reconstructive interventions (9 cases). The most used reconstructive tech-
niques to redo the biliary tree were hepaticojejunostomy with a Roux-en-Y loop and hepaticojejunostomy with an Ω loop, laborious techniques which require an experienced team.

Iatrogenic CBD injuries represent an undesired major complication, but possible, both in classical surgery, and especially in laparoscopic surgery.

Prevention of iatrogenesis in CBD surgery requires obsessive interest in adapting the surgical technique to the peculiarities of the case, regardless of the often-deceiving aspect of “simple gallbladder”. There with, a thorough preoperative exploration and the possibility of intraoperative imaging explorations of the CBD are also required.

In our experience, along with data from the literature, the risk factors with a major impact are represented by:

- the local anatomical changes present in acute cholecystitis, but also scleral alterations from the forms of chronic cholecystitis. The choice of the operative moment in acute cholecystitis and intraoperative conversion of the technique are prevention factors of iatrogenic injuries.
- the frequency of anatomical variants at the level of the CBD, commonly accompanied by variants of hepatocystic vascularisation. Prevention of iatrogenic injuries requires preoperative and sometimes intraoperative complete exploration, and it also requires meticulous complete dissection of the anatomical structures, with no early intempestive ligatures. The approach of difficult cases is indicated in relation with the experience and level of perfection of the surgical team in classical and laparoscopic hepatobiliary surgery (7, 8, 9, 10, 11).
- If a CBD injury occurs, not complying with the specialty standard and the lack of intraoperative diagnosis technical means and of necessary materials contraindicates the resolving attempt, and the patient should be referred to a specialised centre (12,13,14).
- the perfect state of the device in laparoscopic surgery and the correct use of electrosurgery prevent possible iatrogenic injuries. The image quality in laparoscopic surgery may determine false anatomical representations, with consequences that are difficult to assess.

CONCLUSIONS

In our experience, iatrogenic bile duct injuries are serious complications that may occur both in laparoscopic and in classical surgery, associated with a high mortality, and early and long-term serious complications.

CBD injuries represent an undesired major complication, but possible. They can be prevented, but they cannot be completely avoided.

Their diagnosis is usually late, in our study, 87% of the cases being diagnosed postoperatively. Recognising the injury intraoperatively is the ideal condition of restoration intervention, with immediate and long-term favourable results. The choice of the operative moment depends on the presence or absence of sepsis and the seriousness of the inflammatory process in the CBD.

Preoperative exploration and the possibility to carry out intraoperative imaging explorations prevent the occurrence of CBD injuries.

Treatment is adapted after carrying out a complete injury report and after understanding the mechanism of how the injury occurred.
REFERENCES


