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7.1 Bile Duct Injuries

7.1.1 Introduction

A quarter of century from the first laparoscopic cholecystectomy (LC) and more about 20 years after it was established the gold standard for gallbladder removal, a rate of biliary duct injuries (BDI) is still reported with a range from 0.25 to 0.74 % for major BDI and from 0.28 to 1.7 % for minor BDI [1, 2] (survey) [3–10] (LoE4) [11–14] (LoE3). The accepted incidence for total BDI is nowadays attested in about 0.4 % [1] (survey) [12, 15] (LoE3) and seems to remain constant despite advances in this surgical field.

Nowadays only knowledge of risk factors and efforts to understand causes may help the surgeon to decrease BDI incidence. Patient features, as age or sex, and local factors, as acute or chronic inflammation, anatomic variations, previous abdominal surgery and hemorrhage, are associated in literature with BDI, but because of a small number of cases it is not always possible to provide data for the relevance of these factors.

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7.1.2 Identification of Calot's Triangle Structures

Misidentification of structures within the Calot's triangle is the most frequent cause of BDI [16] (LoE4) so that a correct and conclusive identification of cystic and common bile duct (CBD) may help to prevent injuries. With this goal, routine use of intraoperative cholangiography (IOC) is often advocated, although the efficacy and cost-effectiveness are nowadays discussed. In our systematic review CBD injury risk during LC was similar with or without routine IOC, even if IOC was reported helpful in perioperative CBD stone detection [17] (LoE1). No routine IOC was associated with shorter operative time and fewer perioperative complications. The IOC may be adopted for patients undergoing LC when clinical, biochemical, or radiological features are suggestive of CBD stones [17] (LoE1). In a recent population-based cohort study, early detection of BDI using IOC led up to an improved survival [14] (LoE3). The EAES guideline that routine IOC cannot be recommended even if it allows early identification of BDI, as long as it is correctly interpreted, is still valid. To visualize the junction of cystic duct and CBD with the aim to decrease the incidence of BDI, routine use of intraoperative laparoscopic ultrasound (IOUS) was also proposed. Hashimoto M. et al. referred 94 % of intraoperative valid identifications of biliary structures in 200 enrolled patients during LC before IOC [18] (LoE3). Machi J. et al. reported 96 % of successful IOUS in 200 patients during LC, whereas, in selected cases (3.5 %), IOC was needed with no false-positive detection of the identified 20 bile duct stones [19] (LoE3). Even if this technique may be useful to select patients needing IOC and to detect stones, the effectiveness of routine IOUS as an alternative to usual methods for identification of anatomic structures of Calot is nowadays unclear and not strongly recommended.

7.1.3 Critical View of Safety (CVS)

The effort to standardize an approach to the cystic artery and duct brought Strasberg et al. [20] (LoE2) to outline the "critical view of safety" (Figs. 7.1, 7.2, 7.3, and 7.4). Although there is only limited evidence from clinical studies to back this technique, the EAES guidelines recommended to perform this strategy [21]. A more detailed description of the evidence available on CVS is in Chap. 2.

7.1.4 About Conversion

Despite the advances in training and increased clinical experience, conversion rates reaching 10 % are still reported [22] (LoE4). Needless prompt conversions are mandatory to avoid complications, but few studies have investigated the causes of conversion. Lengyel et al. recently claimed that conversion, in many circumstances, is performed "electively" due to an "anticipated" difficulty, with a longer hospital stay and higher costs [23] (LoE4) [24] (LoE3). Furthermore, to identify the timing and the main reasons for conversion, they concluded that the conversion was elective in