Chapter 23
Commentary: Intraoperative Management of Bile Duct Injuries by Non-biliary Surgeon

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Bile duct injury (BDI) causes lasting morbidity, can be fatal, increases costs, and often results in litigation. It remains the most dreaded complication worldwide of laparoscopic cholecystectomy (LC) with certain types of injury (ductal lacerations, bile leaks, aberrant duct injuries) occurring more commonly than before. Early reports suggested that injury rates reflected the "learning curve effect." Indeed, inexperience will contribute to BDI, but today, there are other explanations. After all, LC is over 25 years old for most and training and experience in laparoscopy has advanced for all. Biliary injuries today continue to occur for surgeons who are well beyond the learning curve. That BDI rates remain static is a very sad reality.

A most recent reminder of this comes from Nicolaj Stilling and colleagues from Denmark [1] in the May 2015 issue of ***HPB***. By mining 5 years of a national database, the authors identified 139 patients who suffered iatrogenic BDI for whom annotated clinical outcomes were available. The results are unsettling, but not at all unfamiliar. The median age of patients was 46 years. Nineteen percent suffered concomitant vascular injury. All were repaired at a specialty HPB center by 3 days (median) and 83 % within 2 weeks. Hospital median LOS was long (11 days), 11 % of patients required initial reoperation, 30-day morbidity was 24 %, and longer term complications would afflict 42 %. Ultimately, 4 % of these patients died because of BDI. As noted by Saxon Connor of New Zealand in his highlight, "the results make sober reading." But Sax's heart rate justifiably increases as he makes a call to action by us all against the catastrophe that is BDI. Don't wait idly for these same results to occur again and again, but rise up and truly work to improve the standards and performance of cholecystectomy.

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In a chapter rich with detail, logical advice, and useful technical options, Dr. Jeff Barkun answers this call on behalf of non-biliary surgeons. Dr. Barkun is Professor of Surgery and Head of General Surgery at McGill University in Montreal, Quebec and certainly a global figure in HPB Surgery. Dr. Barkun establishes for the reader the epidemiology of BDI, and then considers their mechanisms as related to risk factors and errors in technique, and their classification. Next, he coaches on how to recognize if a BDI has indeed occurred and what to do in that miserable acute setting. He stresses the need to recognize one's limitations, emphasizing that drainage, stabilization and referral to a specialty center is the best option. Dr. Barkun explains very clearly the technical elements and overall procedural strategies for avoidance of BDI including recognition of aberrant anatomy, the use of cholangiography, the critical view of safety, and perhaps most importantly, the purpose and honor of a low threshold for conversion to open cholecystectomy. Finally, he provides readers with a list of practical recommendations to consider before embarking on any LC.

It really is a terrific, practical and highly informative chapter. I suggest you read it start to finish once, regroup then immediately read it a second time. I got so much more during my re-read as Barkun has truly created a unifying theme of Prevention. Upon that theme, everything he says makes so much sense, and most importantly, is achievable. My commentary will begin with a fascinating vignette about a historically significant BDI, and then offer my perspectives on several aspects of prevention highlighted by Dr. Barkun. Finally, I'll hope to bring you up to speed on some contemporary paradigms of standardization and training. That's where things seem to be heading.

It was jaundice, recurrent abdominal pain, and gallstones that brought Robert Anthony Eden to the operating theatre of St. Bartholomew's Hospital on April 12, 1953. From a birth into gentry, an Eton education, service in World War I, to the position of youngest Foreign Secretary in UK history, Lord Anthony was presumed the heir apparent to Winston Churchill as Prime Minister (Fig. 23.1). But his luck and that of his surgeon Basil Hume changed that Sunday. It was a challenging cholecystectomy with considerable bleeding, a prolonged anesthetic followed by bile leakage and jaundice post-operatively. Richard Cattell of Boston's Lahey Clinic by serendipity was lecturing in London and asked to consult. He insisted reoperation was necessary for the BDI, but in Boston. Churchill resisted, mandating London. Cattell explained the enormity of the injury and re-operation required and Churchill relented. Eden would survive and recover but with complications and reoperations. History suggests his compromised health severely impacted his handling of the Suez Canal Crisis as Prime Minister in the 1950s. And so, a political luminary suffers a BDI which has geopolitical consequences felt for decades.

This historical vignette illustrates critical features of BDI discussed by Dr. Barkun which I should highlight further. Disease severity and anatomy are very important risk factors. BDI are more likely to occur during difficult LCs, no different than with open operations. When LC is performed for acute cholecystitis, BDI occur three times more often than during elective laparoscopic cases, and twice as often compared to open cholecystectomy for acute cholecystitis. Aberrant anatomy is common and indeed contributes to BDI. For example, aberrant right hepatic duct

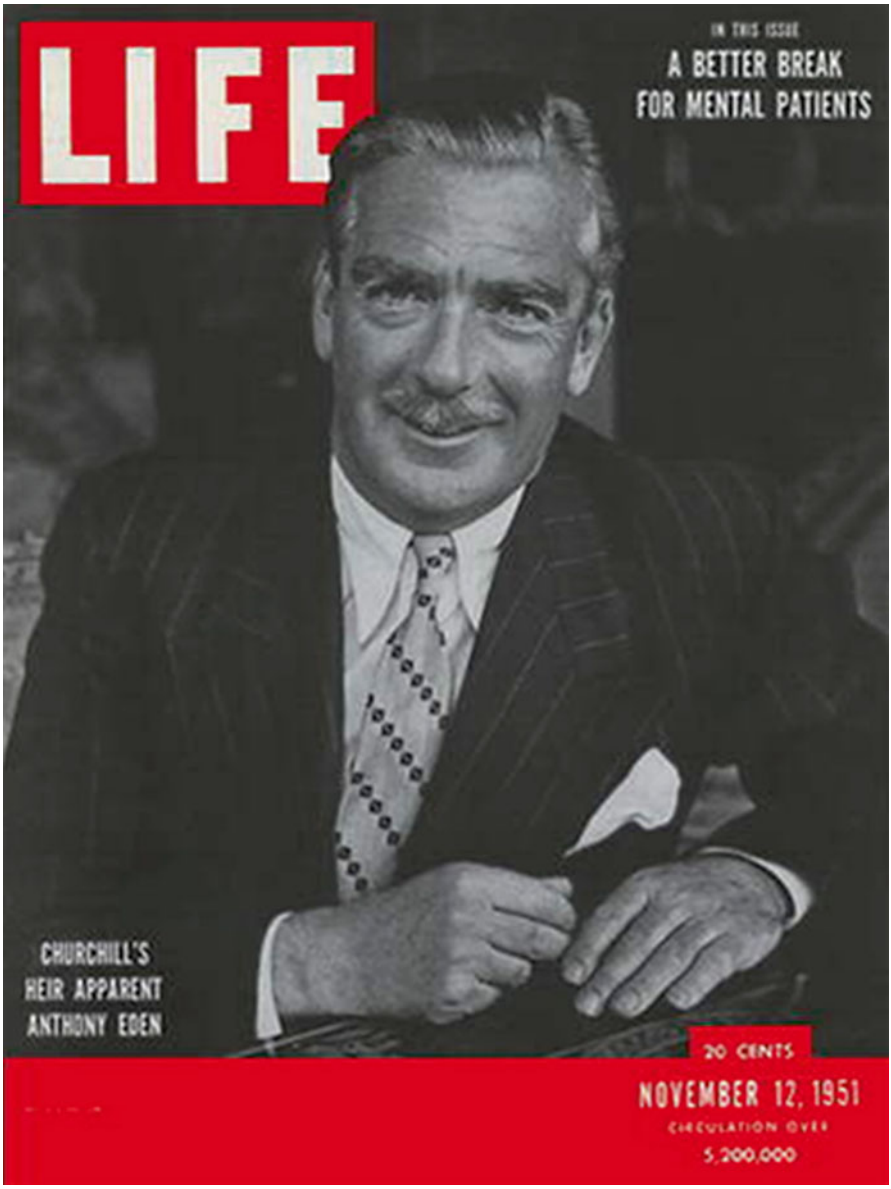

Fig. 23.1 Lord Anthony Eden before BDI catastrophe

anomalies are commonly highlighted in injury reports. Routine intraoperative cholangiography (IOC) is a valuable adjunct to dissection, and as noted (Flum) is actually associated with lower BDI rates. It can reduce the incidence of biliary injuries, or at least their severity. Nothing though replaces a meticulous dissection of anatomy to the Critical View of Safety. The infindibular technique should be avoided as noted by Dr. Barkun.

At times, the best approach is prompt conversion to open surgery. In your operative note, you can emphasize your decision in terms of judgment, prevention and safety. If you're like me, you'll depend on the "20-minute rule." With experience, you will know the progress you should be making. If you are not progressing, convert in a controlled fashion. Be sensitive to the needs of the whole OR team to optimize the open cholecystectomy, and realize what lay ahead will be difficult. Don't delay and get into bleeding, bile and stone spillage, injury to the liver or other viscera, protracted anesthesia, or worse, BDI. It simply makes no sense. Look at imaging carefully in advance, gauge the challenge, and then examine the RUQ once under anesthesia. If you palpate a big hard gallbladder, odds are very much against you for an LC. Be prepared.

Is conversion as easy as it seems? Perhaps for some, but certainly not all. The reality is that open cholecystectomy has been far less frequently performed over these past 15 years. Trainees during that period presumably received valid instruction and proctoring for LC, but rarely for open cases. Established surgeons needed to command the laparoscopic operation to compete, all the while potentially diluting their comfort with the open variant. Finally, there is the pressure and patient expectation for rapid recovery. Two very different operations lead to two scenarios which, though not proven, could subtly account in part for static biliary injury rates. Because of inexperience, the surgeon ignores or resists the sensible default option to convert, does not and incurs injury. In other instances, the surgeon overextends laparoscopic experience when disease severity warrants conversion, and incurs injury. The medico-legal consequences of surgeon experience have recently been analyzed by SAGES past-president Steve Schwaitzberg, et al. [2].

What can help prevent this? First, during informed consent, patients need be fully aware that open cholecystectomy is always a possibility. If faced with acute or chronic cholecystitis at operation, the best surgeon will seek help rather than persist on marginal laparoscopic or open cholecystectomy experience. During training, these dictums for safety will be reinforced during every gallbladder case, and if available, technical elements taught and refined through inanimate videotrainers and simulation modules before actual patient care [3].

Even more will be required, and we can look beyond surgery for guidance. Steven Strasberg, a thought-leader on biliary injury prevention strategy, recommends "changing the culture of cholecystectomy." He invokes a stopping rule mentality, something common in industry. This means that once danger arises, clearly defined rules are applied to stop a process before it enters any zone of great danger. He provides tangible examples from aviation to argue that similar safety measures are possible and warranted during cholecystectomy. He exposes common zones of danger in the difficult cholecystectomy revealing how risks can be controlled using stopping rules. After all, this is usually benign disease.

Training through formal educational programs such as Fundamentals of Laparoscopic Surgery (FLS) as offered by SAGES and the American College of Surgeons should be pursued so surgeons can optimally refine their skills. One could argue that credentialing might even pivot to some degree off such validated curricula. Beyond didactics and skill-set training, the question arises whether these truly

matter at the moment of truth—the actual operation? There is also increasing scrutiny over the value of contemporary simulation-based training models, especially in light of how expensive and resource intensive simulation can be. Dawe et al. [4] provide a comprehensive systematic review which informs this issue. Using strong data, they show that simulation-based training indeed results in skills that are transferable to the operating room for LC and endoscopy. They extend recommendations that simulation is a safe, effective, and ethical manner to get entry surgeons LC trained before that moment of truth. One can but imagine both the implications and opportunities this infers for surgical training going ahead.

SAGES convened its Safe Cholecystectomy Task Force with a charge to improve safety in LC and reduce BDI. They now provide an expert Delphi consensus [5] aimed at identifying future directions for process improvement, training and research towards this goal. They present 39 factors for safe practice in LC agreed upon through a nominal group technique process. They cover technical, nontechnical and perioperative domains and most have been highlighted by Dr. Barkun. It is an excellent paper absolutely worth your time to read.

Today, some argue convincingly for procedural standardization in performing each and every LC. In essence, the surgeon understands, accepts and follows a checklist of technical steps while performing LC. After all, checklists are common across many different industries, and all agree they can enhance complex task completion, strengthen teamwork, and reduce error rates. And we all know they exist in surgery as highlighted by the World Health Organization surgical checklist and its favorable impact on surgical outcomes worldwide across quite varied settings.

Connor et al. [6] propose a succinct, easy to remember checklist for the performance of LC that emphasizes safely and reliably obtaining the critical view. When the checklist cannot be completed, or when the surgeon for whatever reason deviates from it, then alarms should go off. The procedure may well be entering a danger zone, and everyone involved (not just the surgeon) should activate "stop mentality." While some will not agree with all the proposed steps of this particular checklist (avoidance of cautery, IOC), the message can still be embraced. There are other examples of LC procedural standardization available in the literature all with the same motive of reducing BDI and fostering a culture of safe cholecystectomy. Take a look, build a checklist like these perhaps tailored slightly to you and your team, and move ahead.

Although BDI has cast its cloud on LC, millions individually and societies worldwide have benefited from this historic advance against gallbladder disease. In fact, LC sparked the fire that today is minimally invasive surgery. We must preserve these benefits. But still, based on estimates of 800,000+ such operations in the USA next year, we can expect 3000 or so new BDI to occur. All agree that is unacceptable. We must continually assess measure and mandate clinical competency for this operation. As I've highlighted, this will necessitate new paradigms in training and procedure standardization. We will also need meaningful medical error tracking, credentialing and transparent outcome reporting, all designed to optimize patient safety. BDI is a lingering healthcare and financial disaster sorely in need of a lasting solution.

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