

Safety Measures During Cholecystectomy: Results of a Nationwide Survey

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Abstract

Background This study aimed to identify safety measures practiced by Dutch surgeons during laparoscopic cholecystectomy.

Method An electronic questionnaire was sent to all members of the Dutch Society of Surgery with a registered e-mail address.

Results The response rate was 40.4% and 453 responses were analyzed. The distribution of the respondents with regard to type of hospital was similar to that in the general population of Dutch surgeons. The critical view of safety (CVS) technique is used by 97.6% of the surgeons. It is documented by 92.6%, mostly in the operation report (80.0%), but often augmented by photography (42.7%) or video (30.2%). If the CVS is not obtained, 50.9% of surgeons convert to the open approach, 39.1% continue laparoscopically, and 10.0% perform additional imaging studies. Of Dutch surgeons, 53.2% never perform intraoperative cholangiography (IOC), 41.3% perform it incidentally, and only 2.6% perform it routinely. A total of 105 bile duct injuries (BDIs) were reported in 14,387 cholecystectomies (0.73%). The self-reported major BDI rate (involving the common bile duct) was 0.13%, but these figures need to be confirmed in other studies.

Conclusion The CVS approach in laparoscopic cholecystectomy is embraced by virtually all Dutch surgeons. The course of action when CVS is not obtained varies. IOC seems to be an endangered skill as over half the Dutch

surgeons never perform it and the rest perform it only incidentally.

Abbreviations

BDI Bile duct injury
CVS Critical view of safety
IOC Intraoperative cholangiography
CBD Common bile duct

Introduction

After laparoscopic cholecystectomy was introduced in the early 1990s, an increase in the number of bile duct injuries (BDIs) was noted [1]. A BDI has serious medical, financial, and medicolegal consequences for patients and health-care professionals [2–4]. Subsequently, additional patient safety interventions were implemented.

A major step toward safe cholecystectomy was the description of the “critical view of safety” (CVS) technique by Strasberg in 1995 [5]. The CVS technique is advocated by virtually all recent guidelines and expert commentaries [6–9]. The Dutch Society of Surgery issued a best-practice guideline in 2005 endorsing the CVS technique [10]. According to the guideline, CVS is achieved once one third of the gallbladder is dissected off the liver, and the presumed cystic duct and artery are the only structures running from the gallbladder to the hepatoduodenal ligament. The guidelines were promoted through publication and presentation at national conferences; all Dutch surgeons are expected to follow them.

Another safety intervention is intraoperative cholangiography (IOC). Population-based analyses have shown a reduction in major BDI by 25–39% when IOC is performed

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[11–13]. The guidelines of the Dutch Society of Surgery currently do not recommend routine IOC.

It has been suggested that the incidence of BDIs in the Netherlands is higher than in other countries [2]. Numerous papers have been published on preventive measures to take during cholecystectomy, but it remains unclear which safety measures are actually being employed by Dutch surgeons. This study aimed to identify practice of and opinions on the CVS technique and IOC.

Methods

An electronic questionnaire was composed by a panel of five abdominal surgeons and a medical psychologist (Appendix). The survey was completely anonymous. E-mail addresses were obtained of all members of the Dutch Society of Surgery, including surgical trainees, and the electronic questionnaire was sent to all addresses. Two weeks after the first e-mail, one reminder was sent. The study closed for recruitment 2 weeks later.

Hospitals in the Netherlands may be classified as “university teaching” (tertiary referral, specialist training, and medical research), “nonuniversity teaching” (general hospitals licensed to train surgical trainees), or “nonteaching” (general hospitals that do not train surgical trainees). Once deemed sufficiently qualified, surgical trainees may perform cholecystectomies without supervision of a consultant present in operating theater.

Statistical analysis was performed with SPSS ver. 16.0 for Windows (SPSS Inc., Chicago, IL, USA). Descriptive statistics were used to portray the responses. The accumulated number of cholecystectomies performed by the groups of surgeons was calculated using the median of the self-reported range of cholecystectomies (i.e., 17 for the range of 10–25). In case of >50 cholecystectomies per year, the arbitrarily chosen number of 60 was used. χ^2 tests were used to compare the incidence of BDIs in different groups. A $P < 0.05$ was considered significant.

Results

The electronic survey was successfully delivered to 1206 addresses. There was a 40.4% (487/1206) response rate. Thirty-four surgeons indicated that they no longer performed cholecystectomies. Thus, 453 questionnaires were included for analysis.

Clinical profile

The clinical profile of the respondents is shown in Table 1. Most respondents were abdominal or hepatobiliary surgeons

(31.3%), followed by surgeons of other subspecialties (28.9%) and surgical trainees (23.8%). The majority of respondents worked in nonuniversity teaching hospitals (56.7%), followed by university hospitals (22.7%) and nonteaching hospitals (20.5%). This closely resembles the general distribution in the Netherlands [14]. The total number of estimated cholecystectomies in the last 12 months was 14,387.

Operative technique

The CVS technique was used by 97.6% of the respondents. It was documented by 91.6%, usually in the operation notes. Photographs of the CVS were stored by 42.7% of surgeons and video images by 30.1%. If the CVS cannot be obtained, 50.9% opt for conversion to open surgery, 39.1% continue laparoscopically, and 10.0% perform additional imaging studies.

Intraoperative imaging studies

More than half of the surgeons (53.2%) never perform IOC. The remainder use it incidentally (<5%). Only 2.6% of the surgeons perform IOC routinely (>80% of cholecystectomies). Indications for IOC according to the surgeons were suspected BDI (53.0%), unclear anatomy (46.6%), and suspected common bile duct (CBD) stones (38.0%). Laparoscopic ultrasound was used by 2.1% of the surgeons.

Bile duct injuries

Of the respondents, 20.3% had experienced one or more cases of BDI in the past 12 months. These injuries involved the cystic and Luschkan ducts (type A injuries according to

Table 1 Clinical profile of the respondents

	<i>N</i>
Differentiation	
Surgeon, abdominal or hepatobiliary	142 (31.3%)
Surgeon, other subspecialty	131 (28.9%)
General surgeon/fellow	49 (15.9%)
Surgical trainee	108 (23.8%)
Type of hospital	
University hospital	103 (22.7%)
Teaching hospital	257 (56.7%)
Nonteaching hospital	91 (20.5%)
No. of cholecystectomies in past 12 months	
<10	60 (13.2%)
10–25	117 (25.8%)
26–50	194 (42.8%)
>50	82 (18.1%)

the Amsterdam criteria [15]) in 77.2% of cases and the CBD (nine cases of type B and ten type D) in 18.1% (Table 2). The self-reported BDI rate was 105/14,387 = 0.73%. The self-reported rate of major BDI (i.e., involving the CBD) was 19/14,387 = 0.13%.

The rate of self-reported major BDI was not correlated with the level of training of the surgeon, the course of action if CVS could not be obtained, or the use of IOC (Table 3). There was a nonsignificantly lower rate of major BDI in university hospitals ($P = 0.098$) and a higher rate in the group of surgeons who perform fewer than 10 cholecystectomies per year ($P = 0.082$). These figures are based upon self-reporting and were not corrected for the indication for performing the cholecystectomy, i.e., cholecystitis or biliary colic.

Opinions on IOC

IOC was regarded as cumbersome by 39.0% of the surgeons (Table 4). Most surgeons (77.5%) assume IOC will take 10–30 min. Around one third of the surgeons think IOC reduces the risk of major BDI, one third does not, and one third does not know. A large majority (92.9%) of the surgeons feel that IOC should not be performed routinely.

Trainees

All trainees reported use of the CVS technique versus 96.8% of other surgeons ($P = 0.074$). There were more trainees who never performed IOC than other surgeons (72.2% vs. 47.2%, $P = 0.002$ in linear-by-linear association).

Discussion

The current study is an inventory of safety measures during cholecystectomy in a broad population of general surgeons and trainees in the Netherlands. The response rate was fair with 40.4%, allowing a comparison with a similar survey in the United States [16] and a survey among British and Irish upper-GI surgeons [17]. The distribution of the respondents with regard to type of hospital resembled the general distribution in the Netherlands. The self-reported number of cholecystectomies performed yearly represents about 60% of the 24,000 performed yearly [18]. The survey therefore provides a reliable representation of the general Dutch practice.

The critical view of safety (CVS) was found to be widely accepted in Dutch practice: 97.6% of the respondents use this technique. Reviewing 13 Dutch cholecystectomy protocols in 2008, Wauben et al. [19] found that only one explicitly incorporated the use of CVS. It seems

Table 2 Operative technique and imaging

	N
CVS technique used	
Yes	442 (97.6%)
No	11 (2.4%)
CVS documented	
Yes	405 (91.6%)
No	37 (8.4%)
N/A	11
CVS documented by ^a	
Operation notes	324 (80.0%)
Photograph	173 (42.7%)
Video	122 (30.1%)
N/A	48
What course when CVS is not obtained	
Usually continue laparoscopically	165 (39.1%)
Usually convert to open	225 (50.9%)
Usually additional imaging studies	44 (10.0%)
N/A	11
IOC performed	
Never	241 (53.2%)
<5%	187 (41.3%)
5–20%	8 (1.8%)
21–80%	5 (1.1%)
>80%	12 (2.6%)
Indications for IOC ^a	
Routine	17 (3.8%)
Suspected CBD stones	172 (38.0%)
Unclear anatomy	211 (46.6%)
Suspected BDI	240 (53.0%)
Other	54 (11.9%)
Laparoscopic ultrasound performed	
Never	443 (97.8%)
<5%	7 (1.5%)
5–20%	2 (0.4%)
21–80%	0
>80%	1 (0.2%)
BDI in the past 12 months	
None	361 (79.7%)
1	79 (17.4%)
2	13 (2.9%)
>2	0
Types of BDI	
Cystic stump leak	53
Luschkan duct leak	28
CBD leak	9
CBD transection	10
Other	5

CVS critical view of safety, IOC intraoperative cholangiography, CBD common bile duct, BDI bile duct injury, N/A not applicable

^a Multiple answers were possible

Table 3 Factors associated with major BDI (i.e., involving the CBD)

	No. of surgeons	Accumulated No. of cholecystectomies ^a	Major BDI ^b	<i>P</i>
Differentiation				0.621
Abdominal/HPB surgeon	142	5267	6 (0.11%)	
Other subspecialty	131	3786	7 (0.18%)	
General surgeon / fellow	49	2580	4 (0.16%)	
Surgical trainee	108	2754	2 (0.07%)	
Type of hospital				0.098
University teaching	103	2005	0	
Nonuniversity teaching	257	8679	11 (0.13%)	
Nonteaching	91	3703	8 (0.22%)	
No. of cholecystectomies in past 12 months				0.082
<10	60	300	2 (0.67%)	
10–25	117	1989	2 (0.10%)	
26–50	194	7178	9 (0.13%)	
>50	82	4920	6 (0.12%)	
What course when CVS is not obtained ^c				0.350
Usually continue laparoscopically	165	5139	8 (0.16%)	
Usually convert to open	225	7291	11 (0.15%)	
Usually additional imaging	44	1369	0	
IOC performed				0.505
Never	241	7495	12 (0.16%)	
<5%	187	6342	6 (0.09%)	
5–20%	8	218	1 (0.46%)	
21–80%	5	136	0	
>80%	12	196	0	

BDI bile duct injury, *IOC* intraoperative cholangiography, *CVS* critical view of safety

^a Calculated by multiplying the number of surgeons by the median of the reported range of cholecystectomies performed yearly, and by 60 for those who reported to perform more than 50 per year

^b These constituted nine type B injuries and ten type D injuries [15]

^c For the surgeons who indicated that they used the CVS technique

that although protocols need to be updated in some hospitals, the CVS is widely accepted in the Netherlands as the gold standard. The implementation of the most important safety measure to prevent bile duct injury (BDI) can thus be considered highly successful and is praiseworthy. In a similar survey by Sanjay et al. [17], 82% of the British and Irish upper-GI surgeons advocated the CVS technique. It is unknown how often this technique is actually practiced by British general surgeons or how well institutionalized the CVS technique is in other countries.

Documentation of the CVS in the operation notes is done by 80.0% of surgeons, and augmented by a majority by video or photographs. The course of action when CVS is not obtained varies. Although the nature of the question does not address some of the nuances in difficult cholecystectomies, a divergent strategic approach of the surgeons is illustrated. Timely conversion in case of uncertain anatomy is seen by many surgeons as an important safety measure. However, as the open approach is increasingly reserved for “difficult cases” and experience with the open technique diminishes, there are increasing reports of BDI occurring *after* conversion [20, 21]. Depending on the experience of the surgeon, other alternatives such as laparoscopic subtotal cholecystectomy may in some cases be

safer than conversion. In a Dutch series of 1509 patients, experienced laparoscopy surgeons were four times less likely to convert than less experienced laparoscopy surgeons (3.6% vs. 15.6%) [22]. The conversion rate in the Netherlands varies; up to 18% has been reported [23]. These papers, like most, do not assess whether CVS was achieved.

Intraoperative cholangiography (IOC) is very seldom performed in the Netherlands; 53.1% of surgeons never use it and 41.3% perform it incidentally (<5% of cholecystectomies). This contrasts with the practice in the US and the UK, where over 25% of surgeons routinely perform IOC and there are few surgeons who never apply it [16, 17]. In Australia, IOC is performed in over 60% of cholecystectomies [12]. Despite the fact that many Dutch surgeons feel that suspected common bile duct (CBD) stones, unclear anatomy, and suspected bile duct injury (BDI) are indications for IOC, in clinical practice they only rarely apply it.

Approximately one third of the responding surgeons believed that IOC reduces the risk of BDI, one third did not, and one third indicated that they did not know. Opinions were divided on whether IOC was a cumbersome procedure and how much time it consumes. The great

Table 4 Opinions on IOC

	<i>N</i>
Performing IOC is cumbersome	
Usually	74 (16.3%)
More often than not	103 (22.7%)
Sometimes	127 (28.0%)
Usually not	114 (25.2%)
Missing	35 (7.7%)
How long does IOC take	
<10 min	30 (6.7%)
10–20 min	179 (39.5%)
20–30 min	170 (37.5%)
30–40 min	50 (11.0%)
>40 min	24 (5.3%)
IOC reduces the risk of major BDI	
Yes	134 (29.6%)
No	153 (33.8%)
Don't know	136 (36.6%)
IOC should be performed routinely	
Not	421 (92.9%)
In all teaching hospitals	21 (4.6%)
In all hospitals	11 (2.4%)

IOC intraoperative cholangiography, BDI bile duct injury, IOC intraoperative cholangiography

majority of surgeons (93%) believe that IOC should not be routinely practiced. This is remarkable as many of these surgeons believed that IOC reduces the risk of BDI. Apparently, the arguments against routine IOC are thought to outweigh the benefits. Additionally, Dutch insurance companies currently do not reimburse the surgeon for performing IOC. The guidelines currently do not advise selective or routine IOC, and this is reflected in the daily practice of Dutch surgeons. Although the discussion on whether to perform IOC routinely or selectively is far from closed, it seems undesirable that surgeons would lose the skill of IOC altogether. We advocate a low threshold for IOC, especially in complicated biliary disease such as cholangitis and pancreatitis, and certainly in cases of unclear anatomy. An attitude change may be necessary in order for Dutch surgeons to apply IOC more frequently as an investment in patient safety.

The self-reported major BDI rate (i.e., involving the CBD) was 0.13%. This is much lower than the figures mentioned in the literature and similar to the rate observed before the laparoscopic era [11, 24]. Caution is necessary interpreting this figure as a survey such as this is not the optimal tool to assess the occurrence of complications. No evidence could be found in the literature on the validity of self-reported complications by surgeons. Further research is needed to confirm this low complication rate. The most

important limitation of this study is that it relies on self-reporting. It cannot be confirmed that the surgeons use the techniques that they report to use and to what extent. However, the results are certainly of interest as they reflect opinions on and the acceptance of safety measures during cholecystectomy.

In summary, our survey provides insight into safety precautions taken by Dutch surgeons to prevent BDI during cholecystectomy. The CVS approach is embraced by virtually all Dutch surgeons. When CVS is not obtained, different approaches are used, with half of the surgeons choosing to convert. IOC seems to be an endangered skill as over half the Dutch surgeons never perform it and the rest do so only incidentally. Although one may argue as to whether IOC should be performed routinely or selectively, it seems an undesirable development that surgeons would lose the skill of IOC altogether.

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Appendix: Surgeon survey (translated from Dutch)

Part A: Profile

- What is your differentiation?
 - Abdominal or hepatobiliary surgeon
 - Otherwise differentiated surgeon
 - General surgeon
 - Fellow
 - Surgical trainee
- What type of hospital do you work in?
 - University medical centre
 - Teaching hospital
 - Non-teaching hospital
- How many cholecystectomies have you performed or supervised in the past 12 months?
 - <10
 - 10–25
 - 25–50
 - >50

Part B: Operative technique

4. Do you use the “Critical View of Safety” technique?
 - a. Yes
 - b. No
5. Do you document the “Critical View of Safety”?
 - a. Yes
 - b. No
 - c. Not applicable
6. How do you usually register the “Critical View of Safety”? (Multiple answers possible)
 - a. Not
 - b. Operation report
 - c. Photograph
 - d. Video
7. What do you do when you cannot achieve the “Critical View of Safety”?
 - a. Usually continue laparoscopically
 - b. Usually convert
 - c. Usually perform additional imaging studies
8. How often do you perform intraoperative cholangiography during cholecystectomy?
 - a. Never
 - b. 1–5%
 - c. 5–20%
 - d. 20–80%
 - e. >80%
9. What are indications for you to perform intraoperative cholangiography?
 - a. Routinely during every cholecystectomy
 - b. Suspected common bile duct stones
 - c. Unclear anatomy
 - d. Suspected bile duct injury
 - e. Other
10. How often do you perform laparoscopic ultrasound for intraoperative visualization of bile ducts?
 - a. Never
 - b. 1–5%
 - c. 5–20%
 - d. 20–80%
 - e. >80%
11. How often, in the past 12 months, was one of your cholecystectomies complicated by bile duct injury?
 - a. 0
 - b. 1

- c. 2
- d. 3
- e. >3

12. If there was a bile duct injury, what type was it?
 - a. Cystic stump leakage
 - b. Luschkan duct
 - c. Common bile duct leakage
 - d. Common bile duct transection
 - e. Other injuries

Part C: Opinions on intraoperative cholangiography

13. Performing intraoperative cholangiography is a cumbersome procedure
 - a. Usually
 - b. More often than not
 - c. Sometimes
 - d. Usually not
14. By how much time does intraoperative cholangiography prolong the procedure?
 - a. 1–10 minutes
 - b. 10–20 minutes
 - c. 20–30 minutes
 - d. 30–40 minutes
 - e. >40 minutes
15. Intraoperative cholangiography reduces the risk of major bile duct injury.
 - a. Agree
 - b. Disagree
 - c. Don’t know
16. Intraoperative cholangiography should be performed routinely.
 - a. Not
 - b. In all teaching hospitals
 - c. In all hospitals

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