



# Optimal surgical technique, use of intra-operative cholangiography (IOC), and management of acute gallbladder disease: the results of a nation-wide survey in the UK and Ireland

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## ABSTRACT

**INTRODUCTION** There is debate on optimal techniques that reduce bile duct injury during laparoscopic cholecystectomy (LC). A national survey of Association of Upper Gastrointestinal Surgeons of Great Britain and Ireland (AUGIS) members was carried out to determine current surgical practice for gallstones, including the use of intra-operative cholangiography (IOC) or critical view of safety to reduce the risk of bile duct injury.

**SUBJECTS AND METHODS** An anonymous postal survey was sent to all 417 AUGIS members. Data on grade of surgeon, place of work (district general hospital, teaching), subspecialty, number LC per year, use of IOC, critical view of safety, and management of stones detected during surgery were collated.

**RESULTS** There was a 36% (152/417) response – 134 (88%) from consultant surgeons (36, HPB; 106, OG; 64, DGH; 88, teaching hospital). Of these, 38% performed > 100 LC per year, 36% 50–100 LC per year, and 22% 25–50 LC per year. IOC was routine for 24%; and selective for 72%. Critical view of Calot's triangle was advocated by 82%. Overall, 55% first clip and divide the cystic artery, whereas 41% first clip and divide the cystic duct. Some 39% recommend IOC and 23% pre-operative MRCP if dilated common bile duct (CBD) is noted on pre-operative ultrasound. When bile duct stones are identified on IOC, 61% perform laparoscopic CBD exploration (LCBDE), 25% advise postoperative ERCP, and 13% perform either LCBDE or ERCP. Overall, 88% ( $n = 134$ ) recommend index cholecystectomy for acute pathology, and this is more likely in a teaching hospital setting ( $P = 0.003$ ). Laparoscopic CBD exploration was more likely to be performed in university hospitals ( $P < 0.05$ ).

**CONCLUSIONS** A wide dissection of Calot's triangle to provide a critical view of safety is the technique most commonly recommended by AUGIS surgeons (83%) to minimise risk of bile duct injury, in contrast to 24% that recommend routine IOC. The majority (88%) of AUGIS surgeons advise index admission cholecystectomy for acute gallbladder disease.

## KEYWORDS

Gallbladder disease – Intra-operative cholangiography – Calot's triangle – UK audit

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The role of routine intra-operative cholangiography (IOC) during cholecystectomy has been controversial ever since its introduction by Mirizzi in 1931.<sup>1</sup> The recent introduction of laparoscopic cholecystectomy and the reported associated increase in bile duct injury has further fuelled the debate on the optimal role of IOC.<sup>2</sup> Protagonists of routine IOC cite the reduced risk of common bile duct (CBD) injury<sup>3</sup> and the detection of asymptomatic CBD stones<sup>4</sup> as reasonable justification for this policy. In contrast, the opponents of routine IOC state this to be unnecessary biliary instrumentation with inherent morbidity and mortality.<sup>5,6</sup>

A wide dissection of Calot's triangle to provide a 'critical view of safety' is generally accepted as a safe alternative to

IOC as this provides an anatomical overview of the critical structures before clipping and transection of the cystic duct.<sup>7</sup> However, recent data from The Netherlands have suggested that there is no uniformity concerning laparoscopic cholecystectomy especially with regards to the use of IOC, routine or selective, or the use of careful anatomical dissection to provide a 'critical view of safety'.<sup>8</sup> There are no guidelines in the UK on the routine management of gallstones, use of IOC, or dissection to provide a critical view of safety. This study carried out a survey of the members of the Association of Upper Gastrointestinal Surgeons of Great Britain and Ireland (AUGIS) to determine current surgical practice with regard to management of gallstones, use of

**Table 1** Summary of current practice for gallstones

	Positive response ( <i>n</i> = 152)	
		%
Critical view of safety (Calot's triangle)	124	82
Laparoscopic IOUS	9	6
Routine IOC	36	24
Selective IOC	106	69
Clip and divide cystic artery first	79	52
Clip and divide cystic duct first	63	41
Index LC for acute cholecystitis	134	88
IOC in acute cholecystitis	77	51

IOUS, intra-operative ultrasound; LC, laparoscopic cholecystectomy; IOC, intra-operative cholangiogram.

intra-operative cholangiography (IOC), and critical view of safety during laparoscopic cholecystectomy.

## Subjects and Methods

An e-mail questionnaire survey of the 417 full members of the AUGIS was performed in 2008. AUGIS is the principal forum in the UK for surgeons with a declared interest in oesophagogastric (OG) and hepatopancreaticobiliary surgery (HPB). Written permission was obtained from the president of AUGIS in order to circulate questionnaires. A reminder e-mail was sent to non-responders after the initial e-mail. The study was closed for recruitment 3 months after the first round of e-mails.

### Questionnaire design

A three-part, brief, anonymous questionnaire was designed to obtain an overview of pre-operative assessment and intra-operative technique in the management of gall stones, with specific emphasis on the use of intra-operative cholangiogram (Appendix 1). The three parts of the questionnaire are as follows:

- 1. Clinical profile questions.** Grade of surgeon, sub-speciality of interest (OG or HPB), place of practice (university hospital or district general hospital), and case volume of laparoscopic cholecystectomies per year.
- 2. Pre-operative assessment.** Preferred management of a dilated CBD (> 6 mm) noted on pre-operative ultrasonography.
- 3. Intra-operative technique.** Use of IOC (selective or routine), use of intra-operative ultrasonography, critical

view of safety, sequence of clipping of cystic artery and duct, management of CBD stones noted on IOC, practice of early laparoscopic cholecystectomy for acute cholecystitis, and use of IOC in acute cholecystitis.

The responses to the survey were anonymised for collation and analysis. Responses to questionnaires were transcribed onto an electronic database (Microsoft Excel; Microsoft Corporation, Redmond, WA, USA) for further analysis. Statistical analysis was performed using SPSS software (SPSS, Chicago, IL, USA). Categorical variables were compared using chi-squared test and Fisher's exact *t*-test as appropriate. *P* < 0.05 was considered statistically significant.

## Results

There was a 36% (152/417) response to the questionnaire.

### Clinical profile

Of respondents, 134 (88%) were consultant surgeons and 18 (12%) were registrars. The majority of the respondents were from the OG speciality (*n* = 106; 70%) followed by HPB (*n* = 36; 24%) and general surgery specialities (*n* = 10; 6%).

### Pre-operative assessment

Of respondents, 39% (*n* = 59) recommend IOC for a dilated CBD (> 6 mm) noted on pre-operative ultrasound, 23% recommend pre-operative MRCP in the first instance, and a further 19% were unsure and would perform either MRCP pre-operatively or IOC. The consensus view provided by 88 surgeons (58%) was that IOC should be performed at surgery to investigate further a dilated bile duct identified on pre-operative ultrasound.

### Intra-operative technique

A wide dissection of Calot's triangle to provide a 'critical view' was advocated by 124 (82%) of surgeons. Seventy-nine surgeons (52%) prefer to clip and divide the cystic artery prior to clipping the cystic duct, and 36 surgeons (24%) recommend routine cholangiography, whereas 106 surgeons (69%) advocate use of IOC on a selective basis. The operative techniques favoured during laparoscopic cholecystectomy are summarised in Table 1.

### Use of intra-operative cholangiogram

IOC was performed routinely by 24% (*n* = 36) of surgeons in all cases, whereas a further 69% of surgeons (*n* = 106) favoured a more selective approach, with IOC generally performed in fewer than 25% of cases (67%; 71/106). Only 6% (*n* = 10) stated that they did not perform IOC in any case.

There was no significant difference noted in the use of IOC between different specialities, operating surgeon, or university hospital and district general hospital. However, surgeons performing < 50 LC per year (*P* = 0.02) were more

**Table 2** Routine or selective IOC for different grade surgeon, place of work, sub-specialty interest, and case-volume

	Routine IOC (n = 36)	Selective IOC (n = 106)	P-value
Consultant	31	97	0.34
Registrar	5	9	
University hospital	16	67	0.05
District general hospital	20	39	
Hepatopancreaticobiliary	10	22	
Oesophagogastric	24	77	0.48
General	2	7	
Laparoscopic cholecystectomies per year			
< 50	8	8	0.02
50–100	14	37	0.69
> 100	14	61	0.04

likely to perform routine IOC. Surgeons performing higher volumes (> 100 LC per year) of cases were more likely to perform IOC selectively ( $P = 0.04$ ).

### Management of CBD stones noted on IOC

When bile duct stones are identified on IOC, 61% of AUGIS surgeons perform laparoscopic CBD exploration (LCBDE), 25% advise postoperative ERCP, and 14% perform either an open CBD exploration or postoperative ERCP. Thirty-five of 64 surgeons (55%) in district general hospitals perform LCBD exploration compared to 56/88 surgeons (64%) in university hospitals ( $P = 0.037$ ).

### Policy of index cholecystectomy and use of IOC in acute cholecystitis

Of AUGIS surgeons, 88% (134/152) currently perform index cholecystectomy for patients presenting with acute cholecystitis. Surgeons practicing in a university hospital are more likely to perform index cholecystectomy for acute cholecystitis compared to those in district general hospitals (83 vs 51;  $P = 0.025$ ). However only 77 of 134 surgeons (57%) that perform index cholecystectomy for acute cholecystitis also recommend IOC when operating on patients with acute cholecystitis.

## Discussion

There are no data available on the preferred operative technique to reduce the risk of bile duct injury during laparoscopic cholecystectomy in the UK. The present survey assessed the use of IOC amongst specialist upper gastrointestinal

(AUGIS) surgeons who undertake laparoscopic cholecystectomy on a regular basis. There was no consensus on the use of IOC, or the practice of routine IOC (only 24%) in this group of surgeons. However, most specialist surgeons (82%) widely dissect Calot's triangle to obtain a critical view of safety prior to clipping and dividing the cystic duct and artery. This technique was first described and widely advocated by Professor Steven Strasberg, of St Louis, Missouri, USA<sup>7</sup> and is gaining wide-spread acceptance as a safe alternative to IOC in minimising the intra-operative risk of inadvertent bile duct injury.

The practice of IOC<sup>1</sup> has increased with the introduction of laparoscopic cholecystectomy and the associated increase in CBD injuries that occurred in the early 1990s. However, the routine use of IOC to reduce the risk of CBD injury<sup>3</sup> is at the discretion of the operating surgeon, and several authors rather recommend the selective use of IOC based on pre-operative criteria to detect occult bile duct stones.<sup>9,10</sup>

Several studies have evaluated the use of IOC in preventing CBD injury and have concluded that both routine and selective IOC are acceptable policies for reducing the risk of CBD injury.<sup>11–15</sup>

However, many studies are underpowered and, therefore, offer limited evidence on the efficacy of IOC in reducing the rate of CBD injury. This was addressed in 2002 by a meta-analysis of 40 case-series that included 327,523 laparoscopic cholecystectomies, and calculated that routine use of IOC halved the rate of CBD injury.<sup>14</sup> A more recent comprehensive review on the use of IOC concluded that routine IOC does appear to decrease bile duct injury and that wide-spread use of routine IOC would improve patient safety.<sup>5</sup> The present survey noted that the practice of routine IOC is relatively low amongst OG and HPB surgeons in the UK, with only 24% recommending IOC as a routine practice.

The 'critical view of safety' advocated by Strasberg is generally accepted as a safe method to obtain an overview of the key anatomical structures that should be clearly identified before clipping and transecting the cystic duct.<sup>7</sup> Recent studies have shown this technique to be effective in minimising bile duct injury.<sup>15,16</sup> Interestingly, a recent Dutch survey reported that the concept of a critical view of safety was not wide-spread in The Netherlands, but has now been included in the *Best Practice for Laparoscopic Cholecystectomy* guidance document published by the Dutch Society of Surgery.<sup>8</sup> There are no similar technical guidelines in the UK but, in this study, most surgeons (83%) stated that they routinely dissect Calot's triangle to provide a critical view of safety, to minimise the risk of bile duct injury during cholecystectomy.

The incidence of CBD stones in patients undergoing cholecystectomy is around 10–18%,<sup>17</sup> and non-invasive modalities are increasingly used to investigate suspected cholelithiasis.<sup>18</sup> MRCP is increasingly used to identify patients who require ERCP prior to laparoscopic cholecystectomy. As a consequence, there

is now little role for ERCP as a first-line pre-operative assessment, and this is reflected in this study where only 2% of surgeons recommend ERCP for assessment of a dilated CBD on pre-operative ultrasound.

When bile duct stones are identified on IOC, the management may be surgical or endoscopic depending on local expertise. A recent Cochrane review compared open CBD exploration with pre-operative or postoperative ERCP and noted a higher clearance rate, a significantly lower mortality rate, and a trend towards decreased morbidity in patients who underwent a surgical intervention.<sup>17</sup> The Cochrane review of laparoscopic bile duct exploration versus either pre-operative or postoperative ERCP evaluated a relatively small number of patients from four clinical trials and demonstrated less convincing results.<sup>17</sup> A further meta-analysis found no difference in successful duct clearance, morbidity or mortality between endoscopic and surgical management, whether performed by open or laparoscopic technique.<sup>18</sup> From these studies, it can be concluded that, for most patients, a single surgical procedure with bile duct exploration is as effective as pre-operative or postoperative ERCP, and reduces the overall hospital stay. Most surgeons (61%) in this study recommend surgical exploration of the CBD as definitive management of bile duct stones noted on IOC, where the use of an open or laparoscopic approach is dictated by local expertise.<sup>19</sup> Interestingly, the present survey showed that surgeons practicing in university hospitals are more likely to perform a laparoscopic CBD exploration compared to surgeons practicing in district general hospitals, who are more likely to recommend postoperative ERCP.

The practice of early cholecystectomy for acute cholecystitis is quite variable, with 55% of Australian surgeons advising early laparoscopic cholecystectomy on the same admission,<sup>20</sup> and 42% of Japanese surgeons also performing index admission cholecystectomy.<sup>21</sup> In contrast, recent data (2008) from England reported that only 15% of patients undergo laparoscopic cholecystectomy for acute gallbladder disease in the same admission,<sup>22</sup> which is similar to that reported in 2004 when two postal questionnaire surveys in Britain revealed that less than 20% of surgeons carried out a laparoscopic cholecystectomy following an emergency admission.<sup>23,24</sup> In contrast to these previously published UK statistics, it is interesting to note in this survey that 88% of AUGIS surgeons now recommend early laparoscopic cholecystectomy on the same admission for acute gall bladder disease. This may reflect the specialist interest of the AUGIS surgeons in this survey, but may also suggest there is a shift toward early surgery for patients that present with acute gallbladder pathology compared to previous surveys.

## Conclusions

This survey provides an important insight into current standards of practice for symptomatic gallstones in the UK. A significant proportion (24%) of oesophagogastric and

hepatopancreaticobiliary surgeons recommend routine intraoperative cholangiography to reduce the risk of bile duct injury, but the majority (83%) advise careful dissection of Calot's triangle to provide a critical view of safety prior to ligation and division of anatomical structures between the gallbladder and hepatoduodenal ligament. Most surgeons explore the bile duct to remove stones identified on IOC, and 88% of surgeons recommend index admission cholecystectomy for patients that present with acute gallbladder pathology.

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### Appendix 1: E-mail questionnaire, AUGIS 2008

1. Grade of surgeon? Consultant SpR
  2. Sub-speciality? General OG  
Lower GI HPB  
Breast
  3. Type of hospital? DGH Teaching  
Private
  4. Number of laparoscopic cholecystectomies performed per year  
< 25 25–50 50–100 > 100
- Pre-operative assessment**
5. Do you routinely perform before laparoscopic cholecystectomy?  
MRCP Yes No  
ERCP Yes No
  6. If ultrasound reports a dilated bile duct (> 6 mm) pre-operatively, do you perform:  
MRCP Yes No  
ERCP Yes No  
IOC Yes No
- Intra-operative technique**
7. Do you perform IOC? Yes No
  8. If yes, frequency of IOC  
< 25% 25–50% 50–75% 100%
  9. Your policy for IOC?  
Routine Selective
  10. Do you perform intra-operative ultrasound (IOUS) instead of IOC?  
Yes No
  11. Do you perform a wide dissection of Calot's triangle to provide a 'critical view'?  
Yes No
  12. Do you divide the cystic duct first (*i.e.* before division of cystic artery)?  
Yes No
  13. Do you divide cystic artery first (*i.e.* before division of cystic artery)?  
Yes No
  14. If stones are noted on IOC or IOUS during laparoscopic cholecystectomy, do you perform:  
Laparoscopic CBD exploration Yes No  
Open CBD exploration Yes No  
Postoperative ERCP Yes No
  15. Do you think IOC should be performed:  
Routinely Yes No  
Selectively Yes No  
None Yes No
  16. Do you perform early laparoscopic cholecystectomy for acute cholecystitis during the index admission?  
Yes No
  17. Do you perform IOC on these cases with acute cholecystitis?  
Yes No