A national audit of antibiotic prophylaxis in elective laparoscopic cholecystectomy

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ABSTRACT

INTRODUCTION Laparoscopic surgeons in Great Britain and Ireland were surveyed to assess their use of antibiotic prophylaxis in elective laparoscopic cholecystectomy. This followed a Cochrane review that found no evidence to support the use of antibiotic prophylaxis in routine cases.

METHODS Data were collected on routine use of antibiotics in elective laparoscopic cholecystectomy, and how that was influenced by factors such as bile spillage, patient co-morbidities and surgeons' experience. An online questionnaire was sent to 450 laparoscopic surgeons in December 2011.

RESULTS Data were received from 111 surgeons (87 consultants) representing over 7,000 cases per year. In routine cases without bile spillage, 64% of respondents gave no antibiotics and 36% gave a single dose. In cases with bile spillage, 11% gave no antibiotics. However, 80% gave one dose and 7% gave three doses. Co-amoxiclav was used by 75% of surgeons. Surgeons are more likely to give antibiotics when patients have risk factors for infective endocarditis.

CONCLUSIONS This study suggests over 20,000 doses of antibiotics and over £100,000 could be saved annually if surgeons modified their practice to follow current guidelines.

KEYWORDS

Cholecystectomy – Laparoscopic – Antibiotic prophylaxis – Risk factors

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There are 60,000 elective laparoscopic cholecystectomies per year in England and Wales.¹ Estimates suggest 10% of adults will develop gallstones, with 1–4% per year becoming symptomatic.² Risk factors include female sex, fair skin, increasing age, obesity, rapid weight loss, parenteral nutrition, diabetes, pregnancy and family history.²

Open removal of the gallbladder (cholecystectomy) and the stones (calculi) it contains has been the traditional treatment for symptomatic cholecystolithiasis. Open cholecystectomy wounds were thought to be prone to be infection and, traditionally, it was routine to give antibiotics to prevent postoperative wound infection. Since laparoscopic cholecystectomy was first performed in 1987, it has been shown to reduce recovery times and morbidity compared with traditional open techniques.³ This has led to patients being treated increasingly in day care settings. A number of groups have considered whether antibiotics are still required with modern multiple port laparoscopic cholecystectomy.

There are currently no specific national guidelines on the use of prophylactic antibiotics in England, Wales or Ireland for elective laparoscopic cholecystectomy. The Scottish Intercollegiate Guideline Network (SIGN) produced evidence-based guidelines on prophylactic antibiotics for use in most surgical settings in 2008.⁴ The aim of

this study was to assess current practice on the use of prophylactic antibiotics for laparoscopic cholecystectomy among clinicians across the UK and Ireland with emphasis on which factors influence their decision making as this has not been reported previously.

Methods

The Association of Laparoscopic Surgeons of Great Britain and Ireland (ALSGBI) agreed to distribute an online survey to their membership in December 2011. Invitations to complete the cross-sectional survey were sent to 450 members via email with no subsequent reminders. Early access to the outcomes was the only incentive offered to participants.

Data collection

Questions were based on the SIGN and Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) recommendations.^{4,5} They sought to assess when clinicians would choose to use prophylactic antibiotics in high and low risk elective laparoscopic cholecystectomy procedures.

The online cross-sectional survey comprised six structured closed-ended and partial closed-ended questions

with ordered and unordered choices (Fig 1). A weblink to the survey was sent via email to the audit population.

Each question required a complete answer before the clinician could move to the next question. When incomplete information was submitted, a 'pop-up' box was displayed, explaining that an answer was required for each row in the matrices. In order to facilitate navigation, an easy-to-use online tool (<http://www.surveymonkey.com/>) was used to collect the anonymised responses.

Analysis

Descriptive analysis of the survey data was carried out using frequencies and percentages with 95% confidence intervals. The chi-squared test was used to draw comparison of discrete data following the identification of different groups in the subject population. An online interactive chi-squared tool was accessed to perform these statistical calculations.⁶ Where relevant, a *p*-value of <0.05 was used to assess statistical significance.

Results

Replies were received from 111 surgeons, with 103 surgeons completing all the questions. The majority of the respondents were consultants (*n*=87, 78%). There were 16 doctors (14%) at other grades. Eight surgeons (7%) did not supply their grade. The 111 respondents represent between 7,500 and 10,800 laparoscopic cholecystectomies of the 60,000 performed nationally each year.¹

In routine laparoscopic cholecystectomies, 64% of surgeons do not give antibiotic prophylaxis (71/111 surgeons). In the same setting, without bile spillage, 36% of surgeons always prescribe at least one dose of antibiotic (40/111). In routine cases with bile spillage, surgeons generally do use antibiotic prophylaxis; 80% (89/111) give one dose only while 88% (98/111) give one or more prophylactic doses of antibiotic (Table 1, Fig 2).

Co-amoxiclav is the most commonly used antibiotic in all settings. Co-amoxiclav was chosen by 30 of 40 surgeons using antibiotics in the absence of bile spillage.

Table 2 shows the influence of co-morbidity on antibiotic prophylaxis. The co-morbidities listed show no statistically significant influence on prescribing practices, except in patients with valvular heart disease or replacement ($\chi^2=24.96$, *df*=1, *p*<0.005).

Of the 11 respondents, 57 surgeons stated that they had a documented policy regarding antibiotic prophylaxis. These surgeons did not differ statistically in their practice from those without a documented policy ($\chi^2=0.092$, *df*=1, *p*=0.762).

Pooled data comparing surgeons' laparoscopic cholecystectomy workload and prescribing practice in routine cases without bile spillage showed no statistically significant change in practice ($\chi^2=0.037$, *df*=2, *p*=0.98). It was noted, however, that the 50 surgeons performing over 75 cases per year were twice as likely to avoid antibiotic use following bile spillage.

Participants had the option to provide additional free text answers to questions 3 and 4. Of the 11 free text

Q1 [Edit Question](#) [Add Question Logic](#) [Move](#) [Copy](#) [Delete](#)

* 1. Approximately how many Laparoscopic Cholecystectomies do you perform per year? (on average over the last 2 years)

☐ <25
☐ 25 to 49
☐ 50 to 74
☐ 75 to 99
☐ 100 to 149
☐ 150 to 199
☐ >200

Q2 [Edit Question](#) [Move](#) [Copy](#) [Delete](#)

* 2. Which answer best matches your Prophylactic Antibiotic use for elective Laparoscopic Cholecystectomy?

	No routine antibiotics	One dose of antibiotic	Three doses of antibiotic	5 days of antibiotic	>5 days of antibiotic
In a routine case without bile spillage	☐	☐	☐	☐	☐
In a routine case with bile spillage	☐	☐	☐	☐	☐
Unexpected Gallbladder empyema	☐	☐	☐	☐	☐

Q3 [Edit Question](#) [Move](#) [Copy](#) [Delete](#)

* 3. Which answer best matches your antibiotic preference for elective Laparoscopic Cholecystectomy?

	None given routinely	Augmentin/Tazocin	Cephalosporin and Metronidazole	Cephalosporin	Erythromycin/Gentamycin	Ciprofloxacin/Meropenem
In a routine case without bile spillage	☐	☐	☐	☐	☐	☐
In a routine case with bile spillage	☐	☐	☐	☐	☐	☐
Unexpected Gallbladder empyema	☐	☐	☐	☐	☐	☐

Other (please specify):

Q4 [Edit Question](#) [Move](#) [Copy](#) [Delete](#)

* 4. In patients with other co-morbidities. Which Co-morbidities affect your prophylactic antibiotic use for Elective Laparoscopic Cholecystectomy?

	No routine antibiotics	One dose of antibiotic	Three doses of antibiotic	5 days of antibiotic	>5 days of antibiotic
Age >60	☐	☐	☐	☐	☐
Diabetes	☐	☐	☐	☐	☐
Chronic Respiratory diseases	☐	☐	☐	☐	☐
Systemic Steroid use	☐	☐	☐	☐	☐
Valvular Heart Disease or replacement	☐	☐	☐	☐	☐
Cardiovascular Disease	☐	☐	☐	☐	☐
ASA grade 2	☐	☐	☐	☐	☐
ASA grade 3	☐	☐	☐	☐	☐
ASA grade 4	☐	☐	☐	☐	☐

Other indications for antibiotic prophylaxis please state choice and duration of treatment:

Q5 [Edit Question](#) [Add Question Logic](#) [Move](#) [Copy](#) [Delete](#)

* 5. Do you have a documented policy regarding prophylactic antibiotic use in Elective Laparoscopic Cholecystectomy?

☐ Yes
☐ No

Q6 [Edit Question](#) [Add Question Logic](#) [Move](#) [Copy](#) [Delete](#)

* 6. What is your current surgical grade?

☐ Consultant (>20 years)
☐ Consultant (>10 years)
☐ Consultant (<10 years including post CCT fellows)
☐ Associate Specialist
☐ Staff grade (or SpR equivalent)
☐ SpR (ST3-8 excluding post CCT fellows)
☐ Trust grade (or SHO equivalent)
☐ CT 1 or 2
☐ Foundation doctor 1 or 2

Figure 1 Survey questions

Table 1 Use of antibiotic prophylaxis in elective laparoscopic cholecystectomy

Antibiotic prophylaxis	Routine cases without bile spillage	Routine cases with bile spillage	Unexpected gallbladder empyema
None	71 (64.0%)	13 (11.7%)	2 (1.8%)
1 dose	40 (36.0%)	89 (80.2%)	45 (40.5%)
3 doses	0 (0%)	8 (7.2%)	37 (33.3%)
5 days	0 (0%)	1 (0.9%)	25 (22.5%)
>5 days	0 (0%)	0 (0%)	2 (1.8%)
Total	111	111	111

responses to question 3 on antibiotic choice, 4 surgeons would use gentamicin, metronidazole and amoxicillin triple therapy, 3 would use gentamicin and metronidazole, and the other responses did not relate to routine laparoscopic cholecystectomy prophylaxis or cases with bile spillage. The free text responses to question 4 on co-morbidities suggested a need for antibiotic prophylaxis in acute cases, cases with cholangitis, and those with jaundice and biliary stenting. Some stated a need to refer to local advice on infective endocarditis prophylaxis.

Discussion

Despite the 2008 guidance from SIGN advocating avoidance of antibiotic prophylaxis in routine cases,⁴ 36% of surgeons still invariably use prophylactic antibiotics. Surgeons who use antibiotics in routine cases are more likely to give excessive courses of antibiotics in high risk cases.

SAGES reviewed the literature on the subject in 2010.⁵ Evidence-based guidelines from both SIGN and SAGES recommend that prophylactic antibiotics are reserved for high

Table 2 Influence of co-morbidity on antibiotic prophylaxis

Co-morbidity	χ^2	Degrees of freedom	p-value
Age >60 years	0	1	1
Diabetes	2.876	1	0.090
Chronic respiratory disease	0.084	1	0.771
Systemic steroid use	2.426	1	0.119
Valvular heart disease/replacement	24.96	1	5.9 x 10⁻⁷
Cardiovascular disease	0	1	1
ASA grade 2	0	1	1
ASA grade 3	0.332	1	0.564
ASA grade 4	0.516	1	0.473

ASA = American Society of Anesthesiologists

risk patients only.^{4,5} A Cochrane review in 2010 found there was not sufficient evidence to support or refute the use of antibiotics in low risk elective laparoscopic cholecystectomy.⁷

High risk patients as defined by SIGN⁴ and SAGES⁵ were defined as being at increased risk of wound infection within 30 days of surgery and include patients over 60 years old,⁵ diabetics⁵ and those with acute symptoms of biliary colic within 30 days of surgery,^{4,5} jaundice,^{4,5} acute cholecystitis^{4,5} or cholangitis.⁵ Other high risk groups include patients with immunosuppression⁴ and pregnant women.^{4,5} High risk procedures include intraoperative cholangiography, conversion to laparotomy, insertion of prosthetic devices and intraoperative bile spillage.⁴

Consistently across the SIGN, SAGES and National Institute for Health and Care Excellence (NICE) guidelines, all

Figure 2 Summary of responses to survey

groups agree that antibiotic prophylaxis should be limited to a single dose if given.^{4,5,8} This practice is adopted by 80% of respondents following bile spillage.

Bile spillage significantly increases antibiotic usage from 36% (40/111 surgeons) to 88% (89/111 surgeons) (95% confidence interval: 0.82–0.94, $\chi^2=64.424$, $df=1$, $p=0.000$). Greater use of more broad spectrum antibiotics was also noted when bile was spilt. However, this did not reach statistical significance ($\chi^2=1.655$, $p=0.198$). Published in 2013, a randomised controlled trial limiting antibiotic prophylaxis to patients at high risk found no cases of wound infection after bile spillage whether the patient received antibiotic prophylaxis or not.⁹ Following bile spillage in high risk patients or in those at risk of endocarditis, consideration of antibiotic prophylaxis is all that is supported by the relevant SIGN⁴ and NICE guidelines.⁸ Further evidence is needed to clarify best practice in this setting.

Despite NICE guidance from 2008 stating that antibiotic prophylaxis to prevent infective endocarditis following invasive procedures (including upper gastrointestinal surgery and endoscopic retrograde cholangiopancreatography) was not indicated or supported by the literature,⁸ 69% of surgeons (72 of the 104 who responded to this question) continue to give prophylactic antibiotics against infective endocarditis in those with valvular heart disease or valve replacement. The NICE guidelines emphasise repeatedly that the small risk of adverse events from antibiotics significantly outweighs any potential benefit of reduced bacteraemia, even in the groups most vulnerable to infective endocarditis.⁸ While SIGN was listed as a key stakeholder along with many other groups, the surgical colleges were not. It is unclear why these recommendations have failed to modify the practice of those surveyed in this paper more than four years after their publication.

Antibiotic overuse increases procedure costs as well as adverse events including anaphylaxis, methicillin resistant *Staphylococcus aureus* and invasive *Clostridium difficile* infections.^{4,8} Extrapolation of these results would suggest over 20,000 doses of antibiotics, costing over £100,000,¹⁰ could be saved annually across England and Wales alone if surgeons modified their practice to follow the evidence-based guidelines in routine cases without co-morbidities, with further savings available in those groups considered at risk of infective endocarditis.

Study limitations

It is noted that owing to the online nature of the survey, which was not mandatory to complete, there was a large number of non-respondents (339/450, 75%). This may

have led to self-selection bias. Consultants were heavily overrepresented; however, in our experience, most surgical teams use their consultant's routine practice, even when the consultant is not present.

Conclusions

This study suggests over 20,000 doses of antibiotics and over £100,000 could be saved annually if surgeons modified their practice to follow current guidelines. Further work is needed to compare lavage and antibiotics following bile spillage, to communicate the savings and risk reductions available if surgeons adopt evidence-based practices. Understanding why clinicians have failed to adopt the relevant guidelines (or modify their practice where local policies exist) may benefit the surgical community and our patients more widely.

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