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ORIGINAL ARTICLE

Specialist-led urgent cholecystectomy for acute gallstone disease

Michael A. Glaysher[1] · Peter May-Miller[1] · Nicholas C. Carter[1] · Gijs van Boxel[1] · Philip H. Pucher[1,2] · Benjamin C. Knight[1] · Stuart J. Mercer[1]

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Abstract

Background Despite overwhelming evidence of the clinical and financial benefit of urgent cholecystectomy, there is variable enthusiasm and uptake across the UK. In 2014, following the First National Emergency Laparotomy Audit Organisational Report, we implemented a specialist-led urgent surgery service, whereby all patients with gallstone-related pathologies were admitted under the direct care of specialist upper gastrointestinal surgeons. We have analysed 5 years of data to investigate the results of this service model.

Methods Computerised operating theatre records were interrogated to identify all patients within a 5-year period undergoing cholecystectomy. Patient demographics, admission details, length of stay, duration of surgery, and complications were analysed.

Results Between 01/01/2016 and 31/12/2020, a total of 4870 cholecystectomies were performed; 1793 (36.8%) were urgent cases and 3077 (63.2%) were elective cases. All cases were started laparoscopically; 25 (0.5%) were converted to open surgery—14 of 1793 (0.78%) urgent cases and 11 of 3077 (0.36%) elective cases.

Urgent cholecystectomy took 20 min longer than elective surgery (median 74 versus 52 min). No relevant difference in conversion rate was observed when urgent cholecystectomy was performed within 2 days, between 2 and 4 days, or greater than 4 days from admission ($P = 0.197$). Median total hospital stay was 4 days.

Conclusion Urgent laparoscopic cholecystectomy is safe and feasible in most patients with acute gall bladder disease. Surgery under the direct care of upper gastrointestinal specialist surgeons is associated with a low conversion rate, low complication rate, and short hospital stay. Timing of surgery has no effect on conversion rate or complication rate.

Keywords Gallstone Disease · Cholecystectomy · Laparoscopy · Emergency Surgery · Patient Outcomes

Laparoscopic cholecystectomy is one of the most commonly performed operations in the United Kingdom (UK), with around 70,000 performed each year [1]. Acute biliary symptoms account for about a third of emergency general surgical admissions [2].

Over the past 20 years, urgent cholecystectomy has become the treatment of choice for patients presenting to hospital with symptomatic gallstone disease. Surgery removes the pathology, patients recover and return to work quicker, and there is a far lower risk of future gallstone-related hospital admissions. Multiple studies and meta-analyses have demonstrated its safety, efficacy, and cost-effectiveness, and most national associations and guidelines recommend that urgent cholecystectomy should be considered best practice [3–7].

Uptake of urgent cholecystectomy across the UK is variable; recent data suggest that only 16% of patients presenting as an emergency with acute biliary disease undergo urgent cholecystectomy [2, 8]. Attempts have been made to encourage hospitals to embrace urgent cholecystectomy, but with limited immediate or long-term success. Reasons for this include concerns over increased operative complications or conversions, reluctance to engage in 'process change', and resource limitations [9]. Implementation of a 'hot gall bladder' service requires a change in mindset and a collaborative approach amongst a variety of specialists—radiologists,

✉ Michael A. Glaysher
michaelglaysher@me.com

[1] Department of Surgery, Queen Alexandra Hospital, Portsmouth Hospitals University NHS Trust, Southwick Hill Road, Cosham, Portsmouth PO6 3LY, UK

[2] School of Pharmacy and Biomedical Sciences, University of Portsmouth, Portsmouth, UK

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surgeons, anaesthetists—but the clinical and financial benefits make it worthwhile, and urgent cholecystectomy rates are considered by some to be a marker of the quality of an Emergency Surgery Service [10].

In 2014, the First National Emergency Laparotomy Audit (NELA) organisational report called for improvements in the standards of care of emergency general surgical patients [11]. In response to this we changed our Emergency Surgery Service model to make a specialist upper gastrointestinal surgeon available 7 days a week and for all acute presentations of gallstones to come under their care. All patients with a gallstone-related admission, irrespective of the diagnosis, are considered for urgent cholecystectomy. Patients with biliary colic, cholecystitis, and non-severe pancreatitis are operated as soon as theatre space is available; for patients with severe gallstone pancreatitis, the acute inflammatory response is allowed to peak and fall prior to cholecystectomy (preferably whilst still an inpatient). There are two dedicated emergency theatre lists each day, along with a dedicated specialist upper gastrointestinal surgeon. We apply a liberally selective policy of intra-operative cholangiography (IOC), with minimal use of Magnetic Resonance Imaging (MRI). Bile duct stones, identified either pre-operatively or intra-operatively, are managed primarily by laparoscopic bile duct exploration. Post-operative Endoscopic Retrograde Cholangiopancreatography (ERCP) or Magnetic Resonance Cholangiopancreatography (MRCP) are reserved for persistent choledocholithiasis or if there remains uncertainty after surgery. This paper reports on the outcomes of 5 years of this type of service model.

Methods

Data were identified from every cholecystectomy performed in Queen Alexandra Hospital (QAH), Portsmouth Hospitals University NHS Trust (PHT) from January 1st 2016 to December 31st 2020. QAH is a large teaching hospital serving a community of 675,000 patients. Cholecystectomies are performed by eight specialist upper gastrointestinal surgeons and two non-specialist surgeons (transplant).

Patients were identified from a digital theatre database and correlated against electronic patient records. Prospectively collected data include patient demographics, interval from admission to surgery, operative details and duration, post-operative complications requiring intervention, and length of stay. Patients were excluded from analysis if their cholecystectomy was a secondary procedure during other major abdominal surgery.

This study was considered as service evaluation and therefore ethical approval was not required. This cohort study design complies with the STROBE checklist.

Non-parametric data are expressed as medians (interquartile range) and analysed with Mann–Whitney U test. Categorical data were organised into contingency tables and analysed using Fishers exact test. Statistical analyses were performed using SPSS v27.

Results

A total of 4870 cholecystectomies were performed in the 5 year period (1793 as urgent and 3077 electively).

Sixteen further patients were excluded from analysis because their cholecystectomy was a secondary procedure during other major abdominal surgery—4 for the complications of severe acute pancreatitis, 5 as part of colonic cancer surgery, 2 during marsupialisation of a liver cyst, 2 during bariatric surgery, 2 during abdominal wall reconstruction for massive incisional hernias, and one at splenectomy for Immune Thrombocytopaenic Purpura.

Overall, the number of elective and emergency cases each year was similar, except in 2020, when fewer elective cases were carried out during the Covid-SARS pandemic (Fig. 1).

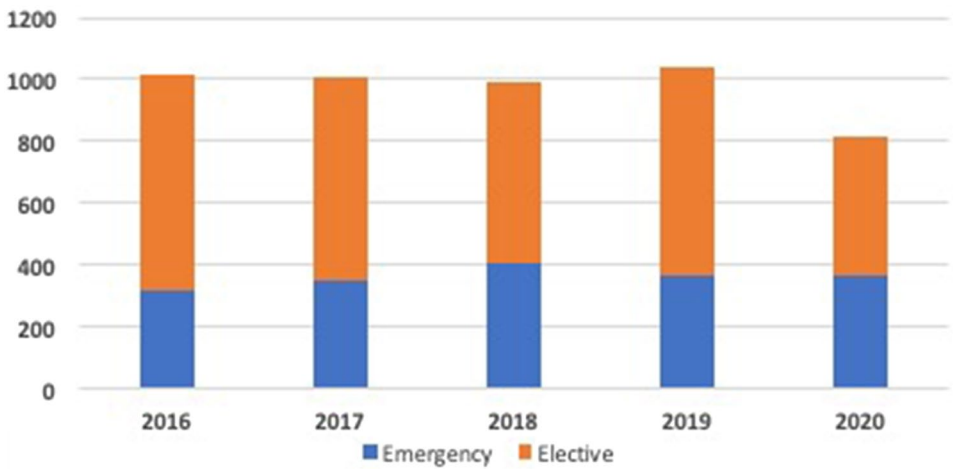

Fig. 1 Elective and Urgent cholecystectomies performed each year

Every case was started laparoscopically (Table 1). Twenty five cases (0.5%) were converted to open surgery; 0.78% ($n=14$) urgent vs. 0.32% ($n=11$) elective ($P=0.046$). Reasons for conversion were adhesions from previous surgery ($n=13$), perforated or fistulating cholecystitis ($n=6$), common bile duct (CBD) stone retrieval ($n=4$), bleeding ($n=1$), and to manage a CBD injury ($n=1$).

There was 1 in-hospital death—a 76 year old man with a mechanical mitral valve who underwent a failed laparoscopic CBD exploration, followed by a successful ERCP procedure; he developed biliary sepsis and multi-organ failure and died 21 days after surgery.

Subtotal fenestrating cholecystectomy was performed in 59 cases—0.9% of elective cases ($n=23$) and 1.8% of urgent cases ($n=36$; $P<0.001$). Temporary bile leakage occurred in 11 of these patients, 10 of them in the urgent-surgery group.

IOC was used in 46.4% of urgent cases ($n=831$) and 29.4% of elective cases ($n=904$; $P<0.001$). IOC added a median of 12 min to each case, irrespective of urgency. Median operation time overall was 59 min (IQR 45–75 min); surgery took some 20 min longer in urgent cases than in elective cases ($P<0.001$).

Laparoscopic CBD exploration was performed in 132 patients—1.4% of elective cases ($n=43$) and 5% of urgent cases ($n=89$; $P<0.001$). Four of the urgent cases required conversion to open surgery to retrieve impacted CBD stones; median post-operative stay following urgent CBD exploration was 2 days.

Post-operative bile leaks occurred in 45 patients—29 elective cases (0.94%) and 16 urgent cases (0.90%) (n.s.). One elective patient underwent radiological drain insertion; the remaining 44 patients underwent re-laparoscopy, washout and drain placement, and repair of the bile leak if possible. Fifteen of these patients also required a post-operative ERCP to remove stones from the CBD or to encourage free drainage of bile.

Seven further patients required further surgery to manage complications. Two underwent laparotomy due to small bowel perforation requiring repair; two patients for laparoscopic management of bleeding; and two for laparoscopy for unexplained post-operative pain; and one patient decompensated during surgery with a dilated cardiomyopathy and was transferred for a successful heart transplant.

Median time to surgery for urgent cholecystectomy was 2 days with a median total length of stay of 4 days.

There was no difference in conversion rate in those patients operated on within 2 days, between 2 and 4 days or over 4 days ($P=0.197$)(Table 2). The rate of subtotal cholecystectomy increased ($P<0.001$) and the bile leak rate decreased ($P<0.001$) with time to urgent surgery; and longer delay to urgent cholecystectomy was associated with a longer operative time ($P<0.001$).

Discussion

Despite a wealth of evidence supporting the benefits of immediate over delayed cholecystectomy, there remains significant variability in the provision of acute gallbladder services within the UK. Some of the anxieties around urgent cholecystectomy relate to perceptions of increased surgical complexity and morbidity, but it has been identified that numerous other patient and hospital variables exist to account for this disparity in UK practices [14]. This paper reports the 5-year experience of urgent cholecystectomy within a high-volume emergency surgery service staffed by a team of specialist upper gastrointestinal surgeons as

Table 1 Demographics and operative details

	Overall		Elective		Urgent		*P* value
	Number	%	Number	%	Number	%	
Number of patients	4870	100%	3077	63.2%	1793	36.8%	
% female	3480	71.5%	2300	74.8%	1180	65.8%	$P<0.001$
Median age	53	39–66	52	39–65	54	40–68	$P<0.001$
Intraoperative cholangiogram	1735	35.6%	904	29.4%	831	46.4%	$P<0.001$
Subtotal cholecystectomy	59	1.2%	23	0.9%	36	1.8%	$P<0.001$
Lap CBD exploration	132	2.7%	43	1.4%	89	5.0%	$P<0.001$
Conversion rate	25	0.5%	11	0.4%	14	0.8%	$P=0.046$
Duration of surgery (median, IQR)	59	45–79	52	40–67	74	57–97	<0.001
CBD injury	1	0.0%	0	0.0%	1	0.1%	n.s
Post-operative bile leak	45	0.9%	29	0.9%	16	0.9%	$P=0.950$
Relaparoscopy/laparotomy	50	1.0%	30	1.0%	20	1.1%	$P=0.635$
Pre-op stay (median, IQR)	0	0–1	0	0–0	2	1–3	$P<0.001$
Post op stay (median, IQR)	0	0–1	0	0–0	1	1–2	$P<0.001$
Total stay (median, IQR)	0	0–3	0	0–0	4	2–6	$P<0.001$

Table 2 Emergency cases—variation with timing of surgery

	< 2 days		2–4 days		> 4 days		
	Number	%	Number	%	Number	%	
Number of patients	732	40.8%	687	38.3%	375	20.9%	
% female	493	67.3%	469	68.3%	218	58.1%	$P < 0.001$
Median age (median, IQR)	51	37–62	56	41–69	61	48–74	$P < 0.001$
Intraoperative cholangiogram	282	38.5%	323	47.0%	227	60.5%	$P < 0.001$
Subtotal cholecystectomy	14	1.8%	8	1.2%	14	2.9%	$P < 0.001$
Lap CBD exploration	35	4.8%	32	4.7%	22	5.9%	$P < 0.001$
Conversion rate	5	0.7%	5	0.7%	4	1.1%	$P = 0.197$
Duration of surgery (median, IQR)	70	55–91	75	58–99	79	61–101	< 0.001
CBD injury	0	0.0%	1	0.1%	0	0.0%	n.s
Post-operative bile leak	13	1.8%	1	0.1%	2	0.5%	$P = 0.003$
Relaparoscopy/laparotomy	15	2.0%	2	0.3%	3	0.8%	$P = 0.006$
Post op stay (median, IQR)	1	1–2	1	1–3	1	1–3	$P < 0.001$
Total stay (median, IQR)	2	1–3	4	3–5	7	6–9	$P < 0.001$

a consequence of the 2014 NELA organisational report. It conclusively demonstrates that urgent laparoscopic cholecystectomy delivered within this model is safe and effective, with short hospital stay, low complication rates, and minimal conversion rates.

Our centre reported its initial experience of urgent cholecystectomy in 2004; at this time, the implementation of a specialist upper GI surgery service led to a reduction in laparoscopic conversion rates from 32 to 12% [12]. Other centres have reported reducing conversion rates as experience grows and specialisation increases [7, 13]. In the CholeS study, the overall open surgery rate was 4.3%, although for emergency cholecystectomy it was 7.4%; these figures are typical of published studies [14]. This current report may present the end of the spectrum—a high volume unit (1000 + cases per year), run by invested upper gastrointestinal surgeons, with a conversion rate of less than 0.5%.

Conversion to open surgery is not a failure, and is not the sole benchmark by which units should be judged. However, there is no doubt that it increases the pain and morbidity of surgery, with a higher risk of adhesions and incisional hernias in the future. As surgeons become more accustomed to laparoscopic surgery, and more experienced at dealing with technical difficulties, conversion to open surgery becomes a less necessary 'bail out' option.

An urgent laparoscopic cholecystectomy can be technically challenging; however, any elective cholecystectomy, especially delayed or post-ERCP can be equally challenging. The practice of treating an acute episode of cholecystitis with antibiotics and performing a delayed cholecystectomy therefore is not supported by the literature and does not represent optimal patient care. An acute cholecystectomy service should therefore be delivered by upper gastrointestinal surgeons with interest, time and technical expertise in emergency surgery—technical expertise in advanced laparoscopic skills and expertise in decision-making, such as the decision to perform a subtotal cholecystectomy and drain the sepsis rather than address a badly inflamed Calots triangle, or to leave part of the posterior gall bladder wall attached to the liver if a dissection plane cannot be found [15]. Knowing all the options, and sharing the decisions with colleagues, maintains high surgical standards and improves outcomes without compromising patient safety.

Much has been written about the relative merits of MRCP prior to cholecystectomy *versus* routine or selective IOC [16]. No trial has yet been sufficiently powered to conclusively favour one particular approach, although a study is currently in recruitment of some 30,000 patients to help answer this question [17]. Our approach is pragmatic such that if there is any suspicion of any CBD stones at any time, or of there is any confusion about the biliary anatomy, then IOC is used. This 'liberally selective' policy means that the entire team considers IOC as an integral part of the operation, and this team-familiarity ensures that the average extra surgical time is limited. This study demonstrated an additional surgical time of 12 min when IOC was employed, which matches the 12 min quoted for routine use of IOC in a recent systematic review and much quicker than the 25 min quoted for its selective use [18].

Multiple databases of varying reliability have been trawled to try to answer the question as to the timeframe within which urgent cholecystectomy should be performed. In our initial study in 2004, we reported that it made no clinically significant difference; this current analysis supports this finding [19]. A recent review of 15 years of HES data reported a statistically significant increase in conversion rate from 3.6 to 4.7% with increasing delay to surgery; however, most would consider a 1.1% increase to lack any clinical relevance whatsoever, particularly as some 35% of cases in this analysis were performed by open surgery [20].

Analysis of the Swedish GallRiks national registry for cholecystectomy suggested a similar distribution, although only 80% of cases were started laparoscopically and a further 20% were converted to open [21]. Our results tend to confirm that a longer delay before urgent cholecystectomy is associated with more technically challenging surgery; the duration of surgery is longer, and there is a statistically significant increase in subtotal cholecystectomy rate. However, this increase is not clinically relevant—in absolute terms, an extra 10 min of operating time or an extra 1:100 chance of a subtotal cholecystectomy is immaterial. We consider that the benefits of surgery at the index admission still outweigh the risks of conservative management and surgery at '6 weeks', which in practice usually stretches out more towards 6 months.

Over the course of 20 years, in our unit, we have incubated a culture of urgent cholecystectomy. This means that a variety of specialists—junior doctors, nurse practitioners, radiologists, surgeons, anaesthetists, theatre staff—share the same mindset. All patients admitted with gallstone-related emergencies are considered for urgent cholecystectomy. The entire team is inculcated with the known evidence that urgent cholecystectomy is better for the patient and better for the hospital. The ultrasonographers and radiologists are attuned to the importance of urgent and accurate ultrasound reports. The emergency nurse practitioners and junior doctors are trained to provide admission or ambulatory care for these patients as appropriate. The anaesthetists and theatre staff have learned to recognise the benefits this service brings to the patients and to the hospital, and the surgical management team have been shown the financial benefits of the service and have resourced the emergency surgery service appropriately. The surgeons have developed expertise in the technical aspects of urgent cholecystectomy, and take pride in imprinting these in the next generation of surgeons. Teamwork is a critical factor in the ongoing success of the programme—the operating surgeon is encouraged to call a colleague for assistance and advice rather than to proceed to open cholecystectomy, and the wisdom to 'call for help' is considered a show of strength rather than a source of shame. Most importantly, emergency surgery and laparoscopic cholecystectomy are considered an important part of the role of our specialist upper gastrointestinal surgeons; for every cancer resection we carry out, we perform approximately 20 cholecystectomies. A full health economics report from NICE concluded that delayed cholecystectomy is more costly and produces more QALYs than early cholecystectomy [22]. An urgent cholecystectomy service is therefore of benefit to patients and healthcare providers, and is a service that should be adequately resourced and delivered to a high standard.

One limitation of this study may be the decision to report the time to surgery from admission rather than from the onset of symptoms. However, the onset of symptoms is often inaccurately recalled by patients, due to variability in an individual's perception of their symptoms, and, equally, is often inaccurately recorded by admitting staff or clinicians. Time to surgery from admission was therefore chosen as it is accurately standardised and is a true reflection of departmental practices in managing a patient after they present. This reporting is in line with NICE guidance, who stipulate that patients should undergo laparoscopic cholecystectomy within 7 days of diagnosis (not onset of symptoms), and is also in line with reporting from other pivotal studies in this field [3, 9].This study is also limited by its observational nature; however, randomised multicentre trials covering many of the aspects discussed have been performed, along with meta-analyses of these trials and in-depth analysis of population-based databases. Most upper gastrointestinal surgeons would agree with what is best practice; the evidence-base is solid, but the pipeline between evidence and practice is leaky. This current analysis does not purport to be a trial of one approach versus another; instead it reports on a team striving to achieve best practice in cholecystectomy, and implementing pathways to achieve this as part of its Emergency Surgery Service. It demonstrates that a model incorporating urgent cholecystectomy under the direct care of specialist surgeons can provide excellent, safe, and effective care, with low conversion rates and complication rates, and short hospital stay. Further research into this is not warranted; instead, teams and hospitals need to implement the evidence that is already available, and should be encouraged to do so by their patients, the professional associations and hospital management.

Declarations

Disclosures Michael A. Glaysher, Peter May-Miller, Nicholas C Carter, Gijs van Boxel, Philip H. Pucher, Benjamin C. Knight and Stuart J. Mercer have no conflicts of interest or financial ties to disclose.

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