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Early surgical management of acute cholecystitis: A quality improvement initiative

A modest educational intervention at a community hospital resulted in an 85% increase in early laparoscopic cholecystectomy rates and a 47% reduction in time from admission to surgery.

ABSTRACT

Background: **Significant research has shown convincingly that managing acute cholecystitis with early laparoscopic cholecystectomy rather than delayed cholecystectomy is safe and is associated with improved outcomes and lower costs. However, early laparoscopic surgery is not routine, suggesting barriers to uniform adoption of this practice.**

Methods: **An online survey of practising general surgeons in the Fraser Health Authority was followed by a retrospective audit of all patients presenting to health authority sites with acute cholecystitis from April 2012 to June 2013. A modest educational intervention was then implemented at Langley Memorial Hospital to facilitate adoption of early laparoscopic cholecystectomy. Data were compared from before and after implementation of the educational intervention. Some outcomes considered were times from admission to surgery, duration of operations, rates for conversion to open surgery, and length of stay.**

Results: **The retrospective audit found that more than half of health authority patients (54%) did not receive early access to surgery, despite this approach being preferred by most surgeons. The comparison of management approaches before and after the educational intervention at Langley Memorial Hospital showed an 85% increase in early laparoscopic cholecystectomy rates and a 47% reduction in time from admission to surgery.**

Conclusions: **Improving access to timely surgery is possible and requires engagement of key stakeholders. Policies aimed at increasing rates of early laparoscopic cholecystectomy for treatment of acute cholecystitis must focus on improving surgeon access to surgical resources.**

This article has been peer reviewed.

Background

Acute cholecystitis is seen commonly in the emergency room and is a leading cause of gastrointestinal-related hospital admissions.[1] Cholecystectomy is the accepted standard of care to manage cholecystitis; however, the timing of surgery has been the subject of debate. In the past, conservative management with a course of antibiotics was thought to reduce inflammation and facilitate definitive

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surgical management at a later date, usually 6 weeks after the initial presentation. This approach was felt to reduce operative risks and was endorsed as recently as 2013 for grade II (moderate) and grade III (severe) cholecystitis as outlined in the Tokyo guidelines (**Table 1**).[2] However, research has shown convincingly that early laparoscopic cholecystectomy (ELC), defined as occurring 24 to 72 hours from time of admission, is preferred for treatment of acute cholecystitis in the modern laparoscopic era.[3] Surgery within 72 hours has become a benchmark after being associated with lower costs and better outcomes, namely reduced complication and mortality rates.[4,5] When compared with delayed laparoscopic cholecystectomy (DLC), early laparoscopic cholecystectomy has been shown to be safe, to have similar or better rates of conversion to an open procedure, and to reduce duration of hospital stay.[5-11] Looking at data from 77 case-control studies, early laparoscopic cholecystectomy was also found to be associated with statistically significant reductions in mortality, total complication rate, bile duct leaks, bile duct injuries, wound infections, conversion rates, length of hospital stay, and blood loss.[3] In a Canadian model, performing surgery early was also estimated to save approximately $2129 per patient.[12] The most recent consensus statement in the 2018 Tokyo guidelines reflects this by extending adoption of early laparoscopic cholecystectomy for both grade II and grade III severity as the ideal preferred approach.[13]

The benefits of early cholecystectomy may extend to patients with symptoms lasting more than 72 hours: a recent randomized controlled trial demonstrated a reduction in length of stay, duration of antibiotic use, and costs when same-admission laparoscopic cholecystectomy was offered to patients with symptom duration greater than 72 hours.[14] Furthermore, delaying cholecystectomy is associated with a higher risk of complications and costs.[5,9,12] Patients with acute cholecystitis who are discharged without surgery have a 19% risk of a gallstone-related emergency room visit or hospital admission.[15] In addition, among patients with recurrent symptoms, approximately 30% will progress to a more morbid gallstone-related complication such as biliary tract obstruction or pancreatitis.[15] Despite the significant body of literature supporting early access to surgery, there continues to be variation in practice seen even within a single regional health care system, suggesting the presence of institutional barriers impeding uniform adoption of ELC.[16] We sought to investigate further by assessing surgeon attitudes toward early laparoscopic cholecystectomy and current practice patterns, and to determine the impact of an educational intervention at a single site on the rates of early surgery.

Table 1. Severity grading for acute cholecystitis.

Grade	Conditions
III (severe)	Associated with any one of the following: 1. Cardiovascular dysfunction: hypotension requiring vasopressors 2. Neurological dysfunction: decreased level of consciousness 3. Respiratory dysfunction: PaO2/FiO2 ratio < 300 4. Renal dysfunction: oliguria, creatinine > 2.0 mg/dl 5. Hepatic dysfunction: PT-INR > 1.5 6. Hematological dysfunction: platelet count < 100 000/mm^3
II (moderate)	Associated with any one of the following: 1. Elevated white blood cell count (> 18 000/mm^3) 2. Palpable tender mass in the right upper abdominal quadrant 3. Duration of complaints > 72 hours 4. Marked local inflammation (gangrenous cholecystitis, pericholecystic abscess, hepatic abscess, peritonitis, emphysematous cholecystitis)
I (mild)	Does not meet criteria of grade III or grade II acute cholecystitis 1. Healthy patient with no organ dysfunction and mild inflammatory changes

Adapated from Tokyo guidelines.[2]

Methods

In 2014 all practising general surgeons in the Fraser Health Authority were approached to complete an online survey about surgeon attitudes, preferences, and practice patterns regarding management of acute cholecystitis. This was followed by a retrospective database audit of records for all patients presenting with acute cholecystitis in Fraser Health between April 2012 and June 2013 who underwent a surgical intervention from April 2012 to December 2013. Baseline data were collected for the entire health authority as well as for each individual hospital within the authority. Regional analysts collected data as part of an approved quality audit using ICD and Canadian Classification of Health Intervention codes.

Our educational intervention took place at Langley Memorial Hospital, a 166-bed facility serving a population of approximately 130 000 in Langley, British Columbia. The intervention began in May 2015 with the distribution of information by email to emergency room physicians and with educational

rounds for operating room nurses. A practice algorithm for acute cholecystitis was then developed and distributed to staff in the emergency room and operating rooms. The algorithm included a recommendation for early surgical consultation for all confirmed or suspected cases of acute cholecystitis. After the educational intervention, data were collected from electronic and paper charts from July 2015 to June 2016. Outcomes included times from admission to surgery and from booking to surgery, as well as preoperative American Society of Anesthesiologists (ASA) scores and duration of operations, conversion to open surgery rates, length of stay, and readmission rates.

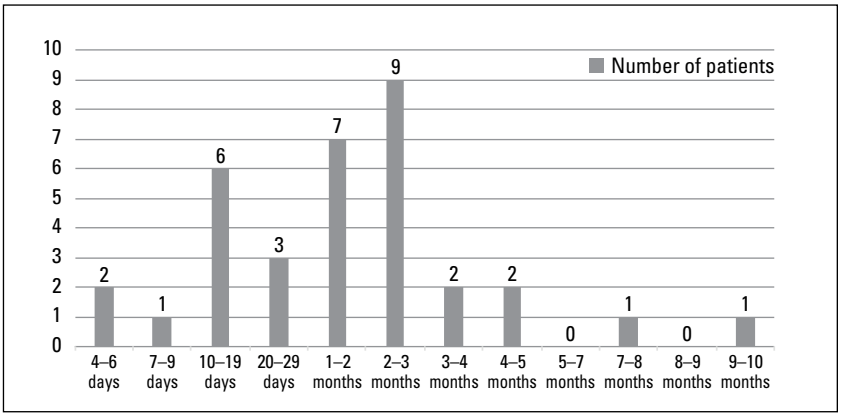

Figure 1. Wait times for 34 patients undergoing delayed cholecystectomy at Langley Memorial Hospital before implementation of educational intervention supporting early cholecystectomy.

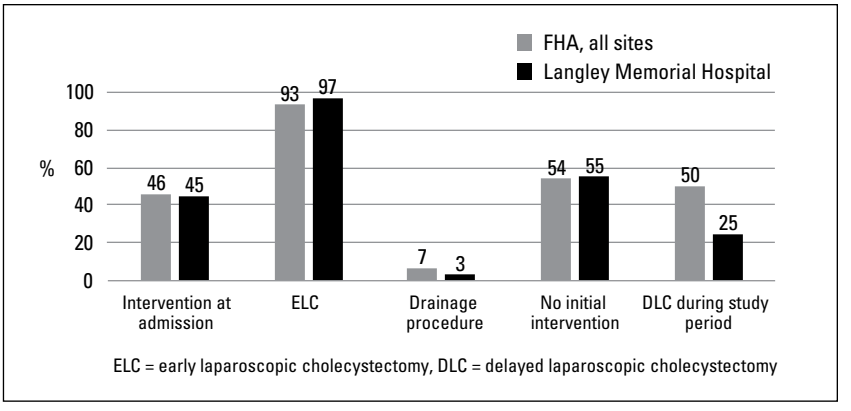

Figure 2. Management of acute cholecystitis at all Fraser Health Authority (FHA) sites and at Langley Memorial Hospital before implementation of educational intervention supporting early cholecystectomy.

Results

Survey respondents included 26 general surgeons (48% of active/provisional regional members) representing all Fraser Health sites. When surgeons were asked how they would manage acute uncomplicated cholecystitis in a medically fit patient, 73% chose early laparoscopic cholecystectomy and 27% chose a trial of conservative management with delayed cholecystectomy. Of those who opted for delayed surgery, 75% cited limited access to the operating room as their main reason for choosing this strategy. Among those who opted for early laparoscopic cholecystectomy, 84% would book the case as needing to be done within 24 hours, although only 23% said they felt surgery was "usually" or "always" completed within this time frame. The majority of respondents (88%) supported an institutional policy allowing for early laparoscopic cholecystectomy.

Between April 2012 and December 2013, a total of 1329 patients were admitted to Fraser Health sites with a diagnosis of cholecystitis, and 611 (46%) had an intervention on their initial admission. Of these, 569 (93%) had laparoscopic cholecystectomies and the remaining 48 (7%) had drainage procedures (either operative or radiologic). This left 718 patients (54%) who had no intervention for cholecystitis on their initial admission. Among these patients, 359 (50%) went on to have a delayed cholecystectomy during the study period. Average hospital length of stay in the ELC group receiving early treatment was 5.8 days compared with 6.4 days for the DLC group receiving delayed treatment.

Before the educational intervention, 135 patients presented to Langley Memorial Hospital with acute cholecystitis over 13 months, and 61 (45%) had an intervention on their initial admission. Of these, 59 (97%) underwent cholecystectomies and 2 (3%) had drainage procedures. This left 74 patients (55%) who had no intervention for acute cholecystitis on their initial admission. Among these, 34 patients (25%) went on to have a delayed procedure during the study period (**Figure 1**). Overall, management of acute cholecystitis at Langley Memorial Hospital before the educational intervention was comparable to that seen at other Fraser Health sites

(Figure 2).

After the educational intervention, 129 patients presented to Langley Memorial Hospital with acute cholecystitis over 12 months. Of these, 109 (84%) had an early cholecystectomy and 20 (16%) had nonoperative management for a variety of reasons (Table 2). Of the138 cholecystectomies performed during the entire study period, 29 (21%) were performed for reasons other than acute cholecystitis (Table 3).

The impact of the educational intervention on surgical access was positive (Table 4), with reductions in time from admission to surgery and from booking to surgery (Table 5). The average OR time was 62.32 minutes (OR times for the period prior to the educational intervention are not known). Of the early cholecystectomy patients, 3 were readmitted, with 2 requiring endoscopic retrograde cholangiopancreatography and 1 with abdominal pain requiring no intervention. Conversion to open procedures was required in only 3 (2.9%) of all the cholecystectomies. The preoperative status of most patients who underwent early cholecystectomy was ASA 2 (45%) or ASA 3 (34%) (Figure 3). The ASA status of all patients' pre-educational intervention is not available.

Table 2. Reasons for nonoperative management in 20 cases of acute cholecysitis at Langley Memorial Hospital after educational intervention.

Reason	Number of cases
Medically unfit*	10 (50%)
Biliary colic (symptoms resolved)	4 (20%)
Refused surgery/left against medical advice	3 (15%)
Incidental gallstones	2 (10%)
Initially managed with percutaneous drain	1 (5%)

*Including 2 cases addressed with conservative management alone and 8 cases addressed with percutaneous drain insertion

Table 3. Reasons for laparoscopic cholecystectomy in 29 cases not involving acute cholecystitis at Langley Memorial Hospital after educational intervention.

Reason	Number of cases
Gallstone pancreatitis	15
Common bile duct stone requiring endoscopic retrograde cholangiopancreatography	9
Delayed diagnosis/referral	2
Admitted from same-day surgery	2
Percutaneous cholecystostomy tube inserted	1

Table 4. Impact of educational intervention on surgical access for cases of acute cholecystitis managed with early laparoscopic cholecystectomy.

	Before intervention	After intervention	Percentage change
Number of cases	59	109	85% increase
Total time from admission to surgery (hours)	2808.00	2461.50	12% reduction
Average time from admission to booking for surgery (hours)	43.20	22.92	47% reduction
Average length of stay (days)	4.60	2.57	44% reduction

Table 5. Time from admission to booking and from booking to surgery after educational intervention.

Admission to booking	Booking to surgery start
22.92 hours	7.38 hours

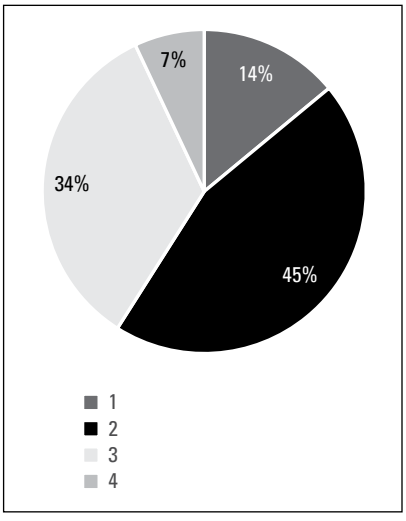

Figure 3. ASA status of early cholecystectomy patients at Langley Memorial Hospital after implementation of educational intervention supporting early cholecystectomy.

Conclusions

With a modest educational intervention we were able to achieve significant clinical impact: an 85% increase in early cholecystectomy rates and a 47% reduction in time from admission to surgery for patients with acute cholecystitis. In addition to providing better patient care, increasing patient access to early cholecystectomy resulted in a 44% reduction in hospital length of stay. The length of stay for early cholecystectomy patients after the educational intervention was appreciably shorter (2.57 days) than for patients in the Fraser Health early cholecystectomy group (5.1 days). Interestingly, the hospital stay after the educational intervention was also shorter than the 5.1 days seen in pooled data for patients undergoing early cholecystectomy.[3] One possible explanation for this substantial reduction in length of stay is that our intervention focused on education for both emergency room physicians and perioperative staff, which may

have facilitated more streamlined care for patients with acute cholecystitis and expedited their access to surgery. This outcome is significant from both a system and a patient perspective. Reducing hospital length of stay will reduce the costs associated with cholecystitis for an already overburdened system. Less time in hospital also reduces the impact of acute cholecystitis on patients by facilitating a faster return to baseline function and work.

Part of the success of our intervention resulted from surgeon buy-in, although this is not the only factor that determines patient access to timely surgery for cholecystitis. In a large review of patients with acute cholecystitis across Ontario, similar patients at different hospitals did not receive comparable care, likely reflecting local institutional barriers to the provision of early surgery.[16] Providing all patients with access to early laparoscopic cholecystectomy requires more than surgeon buy-in; it also requires administrative support that allocates the appropriate amount of institutional resources to make this delivery of timely care possible.

Management approaches

While our results suggest it would be worthwhile to increase access to early laparoscopic cholecystectomy, some degree of caution must be exercised before instituting a strict policy of ELC with rigid scheduling benchmarks, since such a policy could lead to markedly increased after-hours surgery. Data regarding the safety of nighttime laparoscopic cholecystectomy are somewhat conflicting; a retrospective review at two large urban centres found an increased risk of conversion to an open procedure for patients receiving laparoscopic cholecystectomies between 7 p.m. and 7 a.m.[17] Another slightly larger and more recent retrospective review found no increased risk of complications for patients undergoing laparoscopic cholecystectomies after 5 p.m., and statistically significant reduced length of stay among the nighttime laparoscopic cholecystectomy group.[18] While performing after-hours surgery may be safe, the long-term impacts on the surgeon and operating room staff, which can include burnout, exhaustion, and job dissatisfaction, must be considered. It is important to note that we were able to achieve our increased rates of early cholecystectomy while adhering to a policy of operating after 11 p.m. only if conditions were life- or limb-threatening.

Finally, it is worth emphasizing that not all cases of acute cholecystitis present an equal surgical challenge and risk to the patient, and that other options such as percutaneous drainage may be preferred.[19] However, a recent retrospective review found that a majority (90.7%) of patients with moderate to severe acute cholecystitis who received early laparoscopic cholecystectomy had a subsequent open conversion rate of only 9.2% and an overall mortality rate of 1.5%.[13] Perhaps the most prudent surgical approach would be one that estimates the difficulty of surgery to determine which patients are ineligible for after-hours surgery rather than ineligible for early cholecystectomy altogether. For example, male gender, previous episodes of cholecystitis, serum fibrinogen, neutrophil count, and alkaline phosphatase levels can be used preoperatively to calculate a score of operative difficulty in laparoscopic cholecystectomies.[20] Patients with high scores could then be prioritized for daytime operations. A "working smarter, not harder" approach is likely to be the most sensible way to manage this common disease.

The need for early access to surgery for acute cholecystitis is clear and the benefits of it have been well defined in the literature.

Study limitations

The main limitation of this study is the retrospective design, which exposes it to selection bias. As well, data for the educational intervention were obtained from a single site, which limits generalizability. Despite these limitations, our results are concordant with previous findings that support the safety and feasibility of early laparoscopic cholecystectomy.

Summary

The need for early access to surgery for acute cholecystitis is clear and the benefits of it have been well defined in the literature. Achieving higher rates of early laparoscopic cholecystectomy is possible but requires

the engagement of the entire health care team, from front-line emergency room staff to medical and nursing staff in the operating room. Policies aimed at increasing the rates of early laparoscopic cholecystectomy will provide greater access to surgical resources, and ideally this access will be in the daytime. BCMJ

Competing interests

None declared.

Policies aimed at increasing the rates of early laparoscopic cholecystectomy will provide greater access to surgical resources.

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