

Review Article

Current management and controversies in acute cholecystitis: a narrative review of surgical and nonsurgical strategies, with emphasis on suspicion or incidental detection of gallbladder carcinoma

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ABSTRACT

Acute cholecystitis (AC) is a frequent surgical emergency. Laparoscopic cholecystectomy (LC) remains the standard treatment, though debate continues over surgical timing, the role of percutaneous cholecystostomy (PC), and the management of incidental gallbladder carcinoma (GBC). This review analyzed data from randomized trials, meta-analyses, and large observational studies (1966–2023) on these key issues. Evidence supports early LC (within 24–72 hours) as the optimal approach, consistently reducing hospital stay by about 3–4 days (weighted mean difference: –3.07 to –4.1 days, $p < 0.00001$) without increasing mortality or bile duct injury. Operative time is slightly longer (+9.29 minutes, NS). In high-risk patients (APACHE II ≥ 7), the CHOCOLATE trial demonstrated LC superiority over PC, with lower complication rates (12% versus 65%, $p < 0.001$), fewer reinterventions, and shorter length of stay (5 vs. 9 days, $p < 0.001$). A meta-analysis of 32 studies found PC followed by delayed LC reduced overall complications (RR 0.28, 95% CI 0.14–0.56) but increased biliary leakage when drainage was delayed. Large databases confirm PC alone yields higher mortality and longer hospitalization than LC. Incidentally detected GBC occurs in 0.25–0.89% of cholecystectomies. Registry data show re-resection significantly improves survival for pT2 (44.1 versus 12.4 months) and pT3 (23.0 versus 9.7 months) disease. Early LC is therefore preferred for most AC patients, while PC serves only as a bridge in unstable cases. For incidental GBC, timely re-resection remains essential for curative outcomes, though standardized timing and patient selection criteria require refinement.

Keywords: Acute cholecystitis, Laparoscopic cholecystectomy, Percutaneous cholecystostomy, Incidental gallbladder carcinoma, Re-resection, Oncological survival

INTRODUCTION

Acute cholecystitis (AC) is a surgical emergency defined by inflammation of the gallbladder, most commonly from

cystic duct obstruction caused by gallstones.¹ It accounts for roughly 20% of admissions for biliary colic and usually presents with right upper quadrant pain, fever, nausea and vomiting.² Acalculous cholecystitis arises in critically ill

or debilitated patients and is associated with worse outcomes.³ If obstruction is not relieved, progressive distension leads to ischemia and necrosis and may culminate in gangrene or perforation.⁴

Diagnosis relies chiefly on abdominal ultrasound, which identifies wall thickening, pericholecystic fluid and a sonographic Murphy sign, with sensitivity near 81%.⁵ When ultrasound is nondiagnostic, cholescintigraphy achieves higher sensitivity, reported at about 96%.⁶ The Tokyo guidelines provide a practical severity grading from mild to severe with organ dysfunction and recommend management linked to grade.⁷ In practice, grade 1 disease often responds to conservative treatment with intravenous antibiotics and fluids.⁸ Grade 2 typically prompts urgent laparoscopic cholecystectomy, while unstable grade 3 patients may need percutaneous drainage as a temporising measure.⁹

Laparoscopic cholecystectomy remains the definitive treatment and is associated with lower morbidity than open surgery, although conversion is required when severe inflammation obscures Calot's triangle.¹⁰ Persistent controversies include precise timing of surgery, selection criteria for percutaneous cholecystostomy and the optimal pathway when incidental gallbladder carcinoma is suspected. Clinicians must balance the risks of early operation against comorbidity and diagnostic uncertainty, tailoring decisions to local resources and patient preference. This review examines those debates and synthesises contemporary evidence to guide practice and shared decision making.

METHODS

Study design

This review was conducted as a structured narrative synthesis of the literature on acute AC, with particular focus on surgical timing, percutaneous drainage, and the detection and management of incidental gallbladder carcinoma (GBC). The approach combined elements of systematic review methodology with narrative integration, though no formal protocol was prospectively registered. This absence limits reproducibility and increases the risk of selection bias.

PICO framework

The population included adults aged 18 years and above with acute calculous or acalculous cholecystitis, encompassing both low-risk and high-risk groups, commonly defined by ASA class, APACHE II score, or Charlson comorbidity index. Patients with incidental GBC discovered during or after cholecystectomy were also included.

The interventions evaluated comprised early laparoscopic cholecystectomy (LC), usually defined as surgery performed within 24 to 72 hours of admission;

percutaneous cholecystostomy (PC) or percutaneous gallbladder drainage (PGBD); and re-resection or extended surgery for incidental GBC.

Comparators included early LC versus delayed LC, with definitions ranging from less than 72 hours to more than six weeks; LC versus PC drainage; PC followed by delayed LC versus LC alone; and re-resection versus no re-resection in cases of incidental GBC.

The primary outcomes were mortality (both 30-day and long-term), overall complication rates, and disease-specific survival in GBC. Secondary outcomes included length of hospital stay, operative time, conversion to open surgery, readmission rates, reintervention, recurrence, costs, and oncological outcomes such as residual disease, staging accuracy, and port-site recurrence. A critical weakness across included studies was the inconsistent definition of "early" versus "delayed" LC, which complicates synthesis and weakens direct comparability.

Search and data sources

Evidence was drawn from PubMed, the Cochrane Library, and major registry datasets. Search terms included combinations of "acute cholecystitis," "laparoscopic cholecystectomy," "percutaneous cholecystostomy," "percutaneous gallbladder drainage," "timing," "early versus delayed," "randomized controlled trial," "systematic review," "meta-analysis," "incidental gallbladder carcinoma," and "re-resection." Unlike systematic reviews, no PRISMA flowchart or exhaustive search documentation was produced. This omission increases the risk of publication bias, particularly for rare events such as incidental GBC.

Inclusion criteria

Included studies comprised randomized controlled trials, systematic reviews, meta-analyses, observational cohort studies, and registry-based analyses involving adults with AC or incidental GBC, and available as English-language full-text publications.

Exclusion criteria

Excluded materials were pediatric studies, non-English publications, case reports with fewer than five patients, editorials, or non-peer-reviewed sources. The exclusion of non-English studies introduces language bias, while omission of gray literature may underestimate negative or neutral findings.

Study ranges

The studies reviewed spanned from 1966 to 2023. Sample sizes ranged from small series of approximately 100 patients, such as those reported by Viste et al to large national registries with more than 10,000 patients, such as those analyzed by Lundgren et al. Follow-up durations

extended from immediate postoperative periods assessing 30-day mortality and length of stay to more than five years in oncological cohorts. Such variability complicates pooled effect estimation, particularly for survival outcomes.

Risk of bias (RoB) assessment

Three frameworks were applied depending on study design. The RoB 2 tool was used for randomized trials,

ROBINS-I for non-randomized comparative studies, and Newcastle–Ottawa scale (NOS) principles for registry or cohort studies.

Judgments were made conservatively where reporting detail was limited. Domain-level assessments were summarized at the study level (Table 1).¹¹⁻²⁰ Study characteristics, primary and secondary findings were presented in Tables 2 and 3.¹¹⁻²⁰

Table 1: RoB assessment of included studies.

Study (ref)	Year	Design	Tool used	Key domains (concise judgment)	Overall RoB
Okamoto et al ¹¹	2018	Guideline/consensus	N/A	Evidence selection unclear; expert-driven; no primary data	High
Loozen et al ¹²	2018	Multicentre RCT	RoB 2	Randomization: some concerns (early stop), deviations: low, missing data: low, reporting: some concerns	Some concerns
Cao et al ¹³	2015	Meta-analysis (RCTs)	RoB 2 (applied to trials)	Component trials heterogeneous; older RCTs variably reported	Some concerns
Yang et al ¹⁴	2018	Systematic review/meta-analysis	RoB 2 (pooled trials)	Between-trial variability; outcome definitions inconsistent	Some concerns
Shikata et al ¹⁵	2005	Meta-analysis (older RCTs)	RoB 2 (older trials)	Allocation concealment unclear; incomplete reporting	High
Cirocchi et al ¹⁶	2023	Mixed meta-analysis (RCTs+non-RCTs)	RoB 2 + ROBINS-I	Serious confounding in non-RCTs; heterogeneity high	High
Hall et al ¹⁷	2018	Retrospective database	ROBINS-I / NOS	Selection bias; confounding by indication; limited covariates	High
Viste et al ¹⁸	2015	Retrospective case series	NOS	No control group; retrospective outcomes; selection bias	High
Søreide et al ¹⁹	2019	Systematic review of series	N/A	Source studies observational, small, heterogeneous	High
Lundgren et al ²⁰	2019	National registry cohort	ROBINS-I/NOS	Large sample, but registry coding bias and residual confounding	Some concerns to high

Table 2: Study characteristics.

Author(s)	Year	Study design	Population	Sample size	Follow-up	Intervention	Methodology
Okamoto et al ¹¹	2018	Guideline-based narrative review with consensus	Adults with acute cholecystitis (grades I–III)	NA	NA	Early LC, biliary drainage, delayed surgery	Literature synthesis, expert consensus
Loozen et al ¹²	2018	Multicentre RCT	High-risk ACC (APACHE II ≥ 7)	142 (66 LC, 68 drainage)	1 year	LC versus PC drainage	Randomized, multicentre
Cao et al ¹³	2015	Meta-analysis of RCTs	Adults with acute cholecystitis	18 RCTs (24 reviewed)	Variable	Early versus delayed LC	Systematic review + meta-analysis
Yang et al ¹⁴	2018	Systematic review and meta-analysis	Adults with acute cholecystitis undergoing LC	15 RCTs	Variable	Early versus delayed LC	Systematic review, RevMan analysis
Shikata et al ¹⁵	2005	Meta-analysis of RCTs	Adults with acute cholecystitis	1,014 (534 early, 480 delayed)	1966–2003 data	Early versus delayed cholecystectomy	Systematic search, pooled risk analysis

Continued.

Author(s)	Year	Study design	Population	Sample size	Follow-up	Intervention	Methodology
Cirocchi et al ¹⁶	2023	Systematic review+ meta-analysis	Adults with high-risk acute calculous cholecystitis	32 studies (9 RCTs, 23 non-RCTs)	To April 2022	PGBD+LC versus LC	PRISMA, PROSPERO, pooled RR
Hall et al ¹⁷	2018	Retrospective database analysis	High-risk emergent ACC	Large UHC database	Not specified	PC versus LC versus OC versus conversion	Database outcomes+cost
Viste et al ¹⁸	2015	Retrospective analysis	Severe/antibiotic-refractory ACC, high comorbidity	104	Median 12 months	PC	Retrospective clinical review
Søreide et al ¹⁹	2019	Systematic review	Incidental GBC post-cholecystectomy	12 reviews/audits/series	To May 2018	Reresection versus cholecystectomy; staging	Systematic review
Lundgren et al ²⁰	2019	National cohort study	Swedish patients with incidental GBC	249	2007–2016	Re-resection with curative intent	Registry-based cohort

Table 3: Primary and secondary findings.

Reference no.	Primary outcomes	Secondary outcomes	Quantitative data	Main findings	Limitations
11	Safe timing/criteria for surgery	Drainage suitability, risk stratification	Charlson ≤ 5 , ASA-PS ≤ 2	Early LC safe in selected grade II–III	Consensus-based, limited RCTs
12	Mortality 1y: 3% versus 9% (p=0.27)	Complications: 12% vs 65% (p<0.001)	RR 0.19 (95% CI 0.10–0.37); LOS 5 versus 9 d (p<0.001)	LC reduced complications, reinterventions, recurrence	Early termination; limited generalizability
13	Complications, mortality, conversion (NS)	LOS, operative time	LOS reduced 4.1 d (95% CI –4.8 to –3.4, p<0.001)	Early LC safer, shorter stay	Heterogeneity in definitions
14	Bile duct injury (NS), bile leakage (borderline)	Wound infection, conversion, complications	LOS –3.07 d (p<0.00001); op time+9.29 min (NS)	ELC as safe as DLC, shorter stay	Timing heterogeneity
15	Mortality/morbidity NS	Conversion, LOS shorter in early	Mortality RD –0.02; shorter LOS early	Early surgery shortens stay, no added risk	Older trials, heterogeneous
16	Complications lower with PGBD+LC (RR 0.28)	Lower abscess, blood loss, conversion	Biliary leak higher in late PGBD (RR 0.18)	PGBD+LC reduces complications	Heterogeneity, mixed designs
17	Mortality, complications: lowest LC, highest PC/OC	Cost, LOS: lowest LC, highest PC/OC	PC ~20% cases; worse mortality, LOS	LC safest, cheapest; PC worse	Retrospective, limited clinical detail
18	Symptom resolution 97.2%	Later cholecystectomy (30 cases)	30 d mortality 3.8%; median drain 6.5 d	PC safe, effective relief	Retrospective, selection bias
19	Survival by stage; T1a up to 100%	Role of reresection, imaging, port site	Incidental 0.25–0.89%; 5 y survival 100% (T1a)	Reresection $\geq$ T1b; controversy extent/timing	No RCTs, heterogeneity
20	DSS improved with reresection	Residual disease worsened survival	Statics: pT2		

RESULTS

Guideline consensus on surgical timing

Okamoto et al presented guideline-driven narrative review where he outlined early laparoscopic cholecystectomy's (LC), drainage and delayed surgery for acute cholecystitis.¹¹ This guideline is not based on trial data and this consensus emphasized that patients with Charlson comorbidity index ≤ 5 and ASA-PS ≤ 2 could safely undergo early LC, even in selected Grade II–III disease. The strength of this work lay in stratifying risk and setting clinical thresholds though the reliance on expert agreement rather than randomized data limited its evidential power.

Early surgery versus drainage in high-risk patients

Loozen et al conducted a multicentre randomized trial of 142 high-risk patients (APACHE II ≥ 7), comparing LC with percutaneous drainage.¹² Mortality at one year did not differ significantly (3% versus 9%, $p=0.27$), but complication rates were markedly lower with LC (12% versus 65%, $p<0.001$). Reinterventions and recurrent biliary disease were also reduced, and hospital stay was shortened (5 versus 9 days, $p<0.001$). These findings strongly favored early LC, although the trial's early termination restricts broad generalization.

Meta-analyses of early versus delayed cholecystectomy

Cao et al synthesized 18 RCTs and found that early LC significantly reduced hospital stay by about four days (95% CI -4.8 to -3.4 , $p<0.001$) without increasing mortality or conversion risk.¹³ Shikata et al analyzing over 1,000 patients from older trials, confirmed no excess mortality or morbidity in early surgery but noted shorter hospitalizations.¹⁵ Similarly, a later review, likely by Yang et al, included 15 RCTs and reported no significant differences in bile duct injury, conversion, or wound infection between early and delayed groups, while hospital stay was reduced by just over three days ($p<0.00001$).¹⁴ Operative time was slightly longer for early cases, particularly if surgery occurred within the first week, but the clinical relevance was modest. Together, these reviews show a consistent trend: early LC is safe and shortens hospitalization, though statistical signals for bile leakage and operative difficulty remain borderline in some analyses.

Combined percutaneous drainage and surgery

Cirocchi et al examined 32 studies, including 9 RCTs, to evaluate percutaneous gallbladder drainage followed by LC. Complications were significantly lower with the combined approach (RR 0.28, 95% CI 0.14–0.56), and conversion, blood loss, and abscess rates improved.¹⁶ However, biliary leakage was higher when drainage was delayed (RR 0.18, 95% CI 0.04–0.80). While this supports drainage as a bridge in high-risk patients, the heterogeneity

of included designs and the moderate strength of evidence temper firm conclusions.

Outcomes of percutaneous cholecystostomy

Hall et al used a large national database to compare PC, LC, open cholecystectomy, and conversion.¹⁷ PC accounted for about 20% of emergent cases but was associated with higher mortality, longer hospitalizations, and increased infections, whereas LC had the best outcomes and lowest cost. Viste et al reported on 104 patients undergoing PC, with symptom relief in 97.2% and a 30-day mortality of 3.8%.¹⁸ Although safe as a temporizing measure in frail patients, long-term mortality remained high, reflecting comorbidity. Both studies highlight PC as effective for symptom control but inferior to surgery in survival and recurrence outcomes.

Suspicion or incidental detection of gallbladder carcinoma

Systematic evidence on incidental gallbladder cancer

Søreide et al reviewed 12 audits and series, finding incidental gallbladder cancer rates of 0.25–0.89% after cholecystectomy.¹⁹ Five-year survival reached 100% in T1a disease, but outcomes worsened with deeper invasion. Re-resection was recommended for stage $\geq T1b$, though the optimal extent and timing remain debated. Evidence relied heavily on observational studies, with no randomized trials available.

Survival impact of re-resection

Lundgren et al analyzed 249 Swedish patients with incidental gallbladder cancer from national registries.²⁰ Disease-specific survival was significantly improved by re-resection, particularly for pT2 (12.4 versus 44.1 months) and pT3 tumors (9.7 versus 23.0 months). Residual disease markedly worsened prognosis (32.2 months vs not reached). Median survival gains were most notable after 2007 ($p=0.030$). These results underscore re-resection as essential in appropriate stages, though registry-based data are limited by missing clinical details and selection bias.

DISCUSSION

The management of acute cholecystitis remains defined by disputes over timing of cholecystectomy, suitability of minimally invasive approaches, and strategies for patients at high surgical risk. Central questions continue to concern the balance between early and delayed surgery and the appropriate response to incidental gallbladder carcinoma.¹

Evidence in favour of early laparoscopic cholecystectomy (ELC) has grown steadily. Lai et al showed that performing ELC within 24 hours of admission shortened hospital stay and did not increase morbidity or conversion rates, thereby challenging the long-standing practice of

interval surgery after conservative care.²¹ Özkardes et al corroborated this, reporting reduced hospitalization, lower cost, and faster return to baseline activity.²² Wu et al in a meta-analysis, quantified this benefit as a mean reduction of three days in hospital stay when surgery was carried out within seven days, with no significant differences in morbidity or mortality.²³ A Cochrane review reinforced these conclusions, although it noted variability in trial quality and residual risk of bias.²⁴ Together, these findings lend strong support to ELC as the default approach where operative expertise and perioperative support are assured.

Safety considerations are not minor. Wakabayashi et al within the surgical arm of the Tokyo guidelines, underscored the need for meticulous technique, including the critical view of safety and readiness to convert when dissection proves unsafe.²⁵ These recommendations temper the enthusiasm for ELC by reminding surgeons of the heightened risks in grade II and III cholecystitis, where inflammatory distortion of anatomy complicates exposure.

For patients considered unfit for immediate surgery, PC remains widely used, though its limitations are now evident. Hsieh et al documented clinical improvement in up to 90% of high-risk patients after PC, but relapse and long-term morbidity were common unless interval cholecystectomy was later performed.²⁹ Wadhwa et al analysing outcomes at a national scale, found higher mortality and readmission rates among PC recipients, many of whom never underwent definitive surgery.²⁸ These findings make clear that while PC can suppress infection in the acute phase, it cannot be regarded as adequate long-term therapy for most patients.

A separate concern is the detection of incidental gallbladder carcinoma (IGBC). Ahn et al reported a 1% incidence, with survival determined primarily by stage at diagnosis; older age, advanced disease, and delay in definitive oncological resection were linked to poorer outcomes.²⁶ Geramizadeh et al further observed that while T1a disease may be cured by simple cholecystectomy, more advanced stages required radical resection to achieve survival benefit.²⁷ These data confirm the necessity of thorough histopathological examination of all cholecystectomy specimens and highlight the importance of prompt referral for oncological evaluation when carcinoma is discovered.

Overall, the evidence converges on several points. Early laparoscopic cholecystectomy is the most effective treatment for the majority of patients, provided operative conditions are favourable. Percutaneous cholecystostomy, while useful in stabilising selected high-risk patients, is associated with poorer long-term outcomes if not followed by surgery. Meanwhile, the small but critical problem of incidental carcinoma requires a systematic strategy, ranging from reassurance after simple cholecystectomy in T1a disease to radical resection in advanced stages. These intersecting themes illustrate that the management of acute cholecystitis cannot be confined to resolving acute

inflammation alone but must also anticipate the oncological implications that may follow routine surgery.

CONCLUSION

Current evidence confirms laparoscopic cholecystectomy as the cornerstone of treatment for acute cholecystitis. Early intervention within 72 hours of admission, can reduce hospital stay by an average of three to four days and does so without increasing operative complications or mortality compared with delayed surgery. For patients who cannot undergo immediate operation, percutaneous cholecystostomy remains a valuable means of stabilisation, yet its long-term outcomes are consistently inferior unless followed by definitive cholecystectomy. It should therefore be regarded as a bridge to surgery rather than a stand-alone treatment. Incidental gallbladder carcinoma, although uncommon with an incidence approaching 1%, represents a critical diagnostic and prognostic concern. Tumours staged T1b and above benefit from timely re-resection, whereas simple cholecystectomy may suffice for T1a lesions. The persistence of uncertainty lies in defining the optimal threshold for “early” surgery and clarifying the role of non-operative measures in frail or high-risk groups. Addressing these gaps requires more precise, risk-stratified protocols that align surgical timing and treatment selection with individual patient profiles.

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