Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Early (≤4 Weeks) Versus Delayed (>4 Weeks) Interval Cholecystectomy After Percutaneous Cholecystostomy in High-Risk Acute Cholecystitis: A Real-World Surgical Reassessment Cohort

Ricardo A. González-Jaramillo

r.3397@comunidad.unam.mx

Hospital Central Norte, Petróleos Mexicanos (PEMEX)

Eduardo Jordán García

Hospital Central Norte, Petróleos Mexicanos (PEMEX)

Cristina Peralta Rivera

Hospital Central Norte, Petróleos Mexicanos (PEMEX)

Carlos Javier Mata Quintero

Hospital Central Norte, Petróleos Mexicanos (PEMEX)

Research Article

Keywords: Acute cholecystitis, Percutaneous cholecystostomy, Interval cholecystectomy, High-risk patients, Laparoscopic cholecystectomy

Posted Date: February 24th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-8876749/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License. Read Full License

Additional Declarations: No competing interests reported.

Abstract

Background: Management of high-risk acute cholecystitis increasingly relies on percutaneous cholecystostomy (PC) as a bridging strategy when immediate surgery is not feasible; however, real-world surgical data guiding reassessment and timing of interval cholecystectomy remain limited. Understanding how timing decisions are implemented in routine hepatobiliary practice may provide clinically meaningful insight beyond traditional comparative analyses.

Methods: This pragmatic single-center retrospective cohort included adult patients with acute cholecystitis initially managed with PC who subsequently underwent definitive cholecystectomy between January 2016 and December 2025. Patients were categorized according to surgical timing: early (≤4 weeks) or delayed (>4 weeks). Primary exploratory outcomes included operative duration and estimated blood loss, while secondary descriptive outcomes comprised conversion to open surgery, postoperative complications, and mortality. Analyses were conducted descriptively in accordance with STROBE recommendations.

Results: Twenty-seven patients underwent interval cholecystectomy (15 early vs. 12 delayed). Earlier surgery descriptively coincided with shorter operative duration and lower estimated blood loss. Conversion to open surgery and postoperative complications occurred in both groups. Mortality events occurred exclusively in the delayed group; however, given the descriptive design and baseline clinical heterogeneity, no causal inference regarding surgical timing can be established.

Conclusions: These findings provide practice-informing real-world surgical insight into multidisciplinary reassessment after percutaneous cholecystostomy and support individualized hepatobiliary decision-making rather than fixed temporal thresholds.

Trial registration: Open Science Framework (OSF).
Registration DOI: https://doi.org/10.17605/OSF.IO/GR5DT
Clinical trial number: Not applicable.

Introduction

Acute cholecystitis remains one of the most common indications for emergency surgical admission worldwide. Early laparoscopic cholecystectomy is considered the standard treatment; however, a subset of patients presents with advanced comorbidities or physiological instability that precludes immediate surgery. Percutaneous cholecystostomy provides effective source control in high-risk scenarios and is supported by international guidelines; however, it is not definitive therapy and recurrent biliary events remain possible while the gallbladder remains in situ [1,2].

The optimal timing of interval cholecystectomy after percutaneous cholecystostomy remains uncertain, particularly in frail surgical populations where randomized evidence is limited and real-world operative pathways remain underreported. The four-week threshold was selected pragmatically based on commonly reported clinical reassessment intervals in hepatobiliary practice. Rather than attempting to establish comparative effectiveness, the present study intentionally prioritizes transparent reporting of real-world surgical reassessment patterns in a high-risk population frequently underrepresented in randomized trials. In contemporary hepatobiliary practice, understanding how timing decisions are implemented in real-world surgical pathways may be as clinically relevant as comparative effectiveness analyses.

Accordingly, this exploratory study aimed to describe perioperative trends associated with interval cholecystectomy timing following PC in high-risk patients.

METHODS

Study design and setting

Pragmatic observational retrospective cohort conducted at a tertiary referral center between January 2016 and December 2025. The study adhered to STROBE reporting recommendations for observational research.

Participants

Adult patients with acute cholecystitis initially managed with percutaneous cholecystostomy who subsequently underwent definitive cholecystectomy were included.

Exposure definition

Patients were categorized according to surgical timing:

- Early interval cholecystectomy (≤4 weeks)
- Delayed interval cholecystectomy (>4 weeks)

Surgical timing reflected multidisciplinary reassessment based on clinical recovery, comorbidity burden, anesthetic risk, and operative feasibility rather than predefined institutional protocols.

Data collection

Demographics, disease severity, imaging findings, operative variables, and postoperative outcomes were extracted from electronic records using standardized institutional documentation.

Primary exploratory outcomes included operative duration and estimated blood loss. Secondary descriptive outcomes comprised conversion to open surgery, postoperative complications, and mortality.

Statistical approach

Given the exploratory real-world design, limited sample size, and absence of randomized allocation, analyses were intentionally restricted to descriptive reporting without hypothesis testing or causal modeling. This analytical strategy was predefined to avoid overinterpretation of observational trends and to preserve clinical transparency within a real-world framework.

Results

Participant characteristics

Twenty-seven patients underwent interval cholecystectomy (15 early vs. 12 delayed). Baseline differences reflected individualized clinical decision-making rather than protocol-driven allocation. Baseline characteristics are summarized in Table 1, disease severity in Table 2, and patient flow in Figure 1.

Operative outcomes

Earlier interval cholecystectomy descriptively coincided with shorter operative duration and lower estimated blood loss. These operative trends are illustrated in Figure 2A and Figure 2B, while detailed operative metrics are summarized in Table 3.

Postoperative recovery

Complications occurred in both groups without a consistent pattern indicating superiority. Mortality events occurred exclusively in the delayed group; however, given the exploratory descriptive design and baseline clinical heterogeneity, no causal inference regarding surgical timing can be established.

Discussion

Within this exploratory cohort, earlier interval cholecystectomy descriptively coincided with shorter operative duration and reduced estimated blood loss; however, these observations likely reflect individualized patient selection rather than intrinsic advantages of surgical timing. Similar descriptive trends have been suggested in observational hepatobiliary literature, where delayed surgery may be associated with fibrosis and distorted surgical planes, although causal relationships remain uncertain [2–5].

By explicitly avoiding causal claims and focusing on transparent descriptive reporting, this study aligns with current calls for high-quality real-world surgical data that complement randomized evidence in complex hepatobiliary populations. Importantly, the present investigation was not designed to evaluate comparative effectiveness or statistical superiority between timing strategies. Instead, it provides a transparent real-world description of institutional practice patterns and multidisciplinary reassessment pathways in frail hepatobiliary populations.

Future multicenter prospective studies incorporating standardized frailty metrics and perioperative risk stratification are required to clarify whether surgical timing independently influences outcomes after percutaneous cholecystostomy. Within this context, the current findings should be interpreted as hypothesis-generating clinical observations intended to inform future collaborative research rather than definitive comparative conclusions.

LIMITATIONS

Retrospective design, potential selection bias, limited sample size precluding inferential statistical analysis, and residual confounding inherent to non-randomized surgical decision-making cannot be excluded.

CLINICAL IMPLICATIONS

Real-world descriptive cohorts remain valuable for informing individualized hepatobiliary surgical decision-making where randomized trials are difficult to perform.

Conclusion

These findings contribute practice-informing real-world insight into surgical reassessment strategies after percutaneous cholecystostomy and support individualized hepatobiliary decision-making in high-risk populations.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki and was approved by the Institutional Research and Ethics Committee. Due to the retrospective observational design, the requirement for informed consent was waived.

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

The authors received no specific funding for this work.

Authors’ contributions

Ricardo A. González-Jaramillo: Conceptualization, Methodology, Data curation, Formal analysis, Writing – original draft, Writing – review & editing, Project administration.

Eduardo Jordán García: Supervision, Clinical expertise, Critical revision.

Cristina Peralta Rivera: Investigation, Data validation, Writing – review & editing.

Carlos Javier Mata Quintero: Senior supervision, Methodological oversight, Final approval.

Acknowledgements

Not applicable.

Registration: Open Science Framework (OSF). https://doi.org/10.17605/OSF.IO/GR5DT

References

1. Yokoe M, Takada T, Strasberg SM, et al. Tokyo Guidelines 2018: management strategies for acute cholecystitis. J Hepatobiliary Pancreat Sci. 2018;25:87–95.
2. Winbladh A, Gullstrand P, Svanvik J, Sandström P. Systematic review of cholecystostomy as treatment of acute cholecystitis. HPB (Oxford). 2009;11:183–193.
3. Altieri MS, Yang J, Obeid N, et al. Early cholecystectomy after percutaneous cholecystostomy is safe. Surg Endosc. 2019;33:3716–3722.
4. Loftus TJ, Moore FA, VanZant EL, et al. Percutaneous cholecystostomy as a bridge to surgery. Surg Endosc. 2017;31:4907–4914.
5. Loozen CS, Oor JE, van Santvoort HC, et al. Percutaneous drainage versus emergency cholecystectomy in high-risk patients. Surg Endosc. 2017;31:795–802.

Tables

Table 1. Baseline characteristics

Characteristic	*Early (n=15)*	*Delayed (n=12)*
Age (years)	72.2 ± 11.1	79.9 ± 10.0
Male sex	11 (73.3%)	7 (58.3%)
BMI (kg/m²)	23.9 ± 3.0	26.9 ± 5.9
ASA ≥ III	8 (53.3%)	3 (25.0%)
Hypertension	14 (93.3%)	14 (93.3%)
CAD	7 (46.7%)	4 (33.3%)
CHF	3 (20.0%)	5 (41.7%)
COPD/Asthma	3 (20.0%)	3 (25.0%)
CKD	1 (6.7%)	3 (25.0%)
Diabetes	9 (60.0%)	5 (41.7%)

Table 2. Disease severity and imaging findings

Characteristic	*Early*	*Delayed*
Tokyo grade III	8 (53.3%)	4 (33.3%)
APACHE II	14.9 ± 5.8	13.8 ± 4.3
Leukocytes	13.3 ± 4.6	14.6 ± 5.0
Empyema	10 (66.7%)	6 (50.0%)
Perforation	3 (20.0%)	1 (8.3%)
Gangrenous	6 (40.0%)	6 (50.0%)

Table 3. Operative outcomes

Characteristic	*Early*	*Delayed*
Operative time (min)	83.5 ± 36.4	120.8 ± 31.9
Estimated blood loss (mL)	185.8 ± 131.3	305.0 ± 143.3
Conversion to open	2 (13.3%)	4 (33.3%)
Any complication	2 (13.3%)	4 (33.3%)
Surgical site infection	0	2 (16.7%)
Biliary leak	0	1 (8.3%)
DVT	0	1 (8.3%)
Mortality	0	6 (50.0%)

Figures

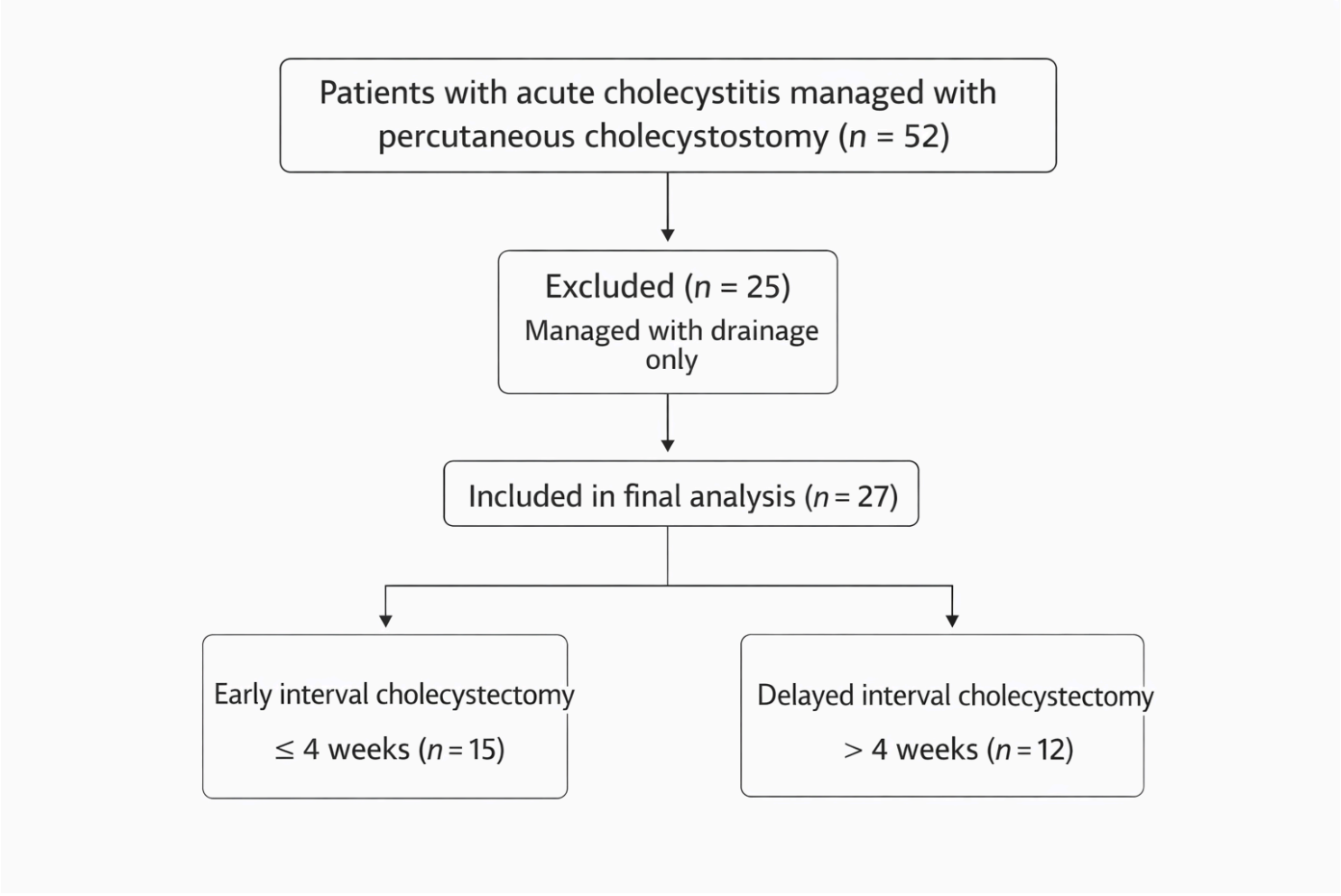


Figure 1

Figure legend not provided with this version

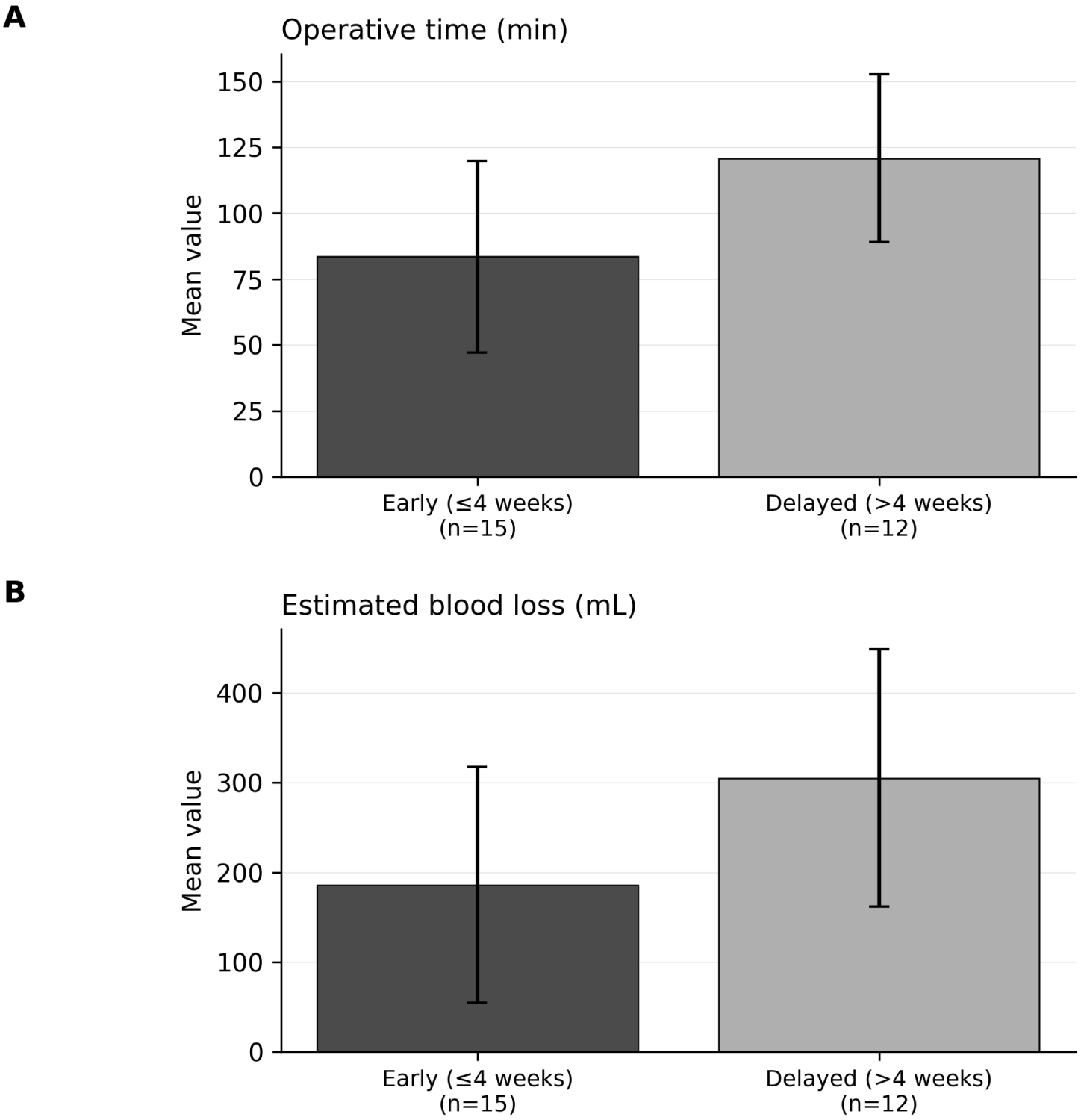


Figure 2

Figure legend not provided with this version