

World Journal of *Clinical Cases*

World J Clin Cases 2023 October 16; 11(29): 6974-7260



MINIREVIEWS

- 6974** Applications of time series analysis in epidemiology: Literature review and our experience during COVID-19 pandemic

Tomov L, Chervenkov L, Miteva DG, Batselova H, Velikova T

ORIGINAL ARTICLE**Retrospective Cohort Study**

- 6984** Acute cholangitis: Does malignant biliary obstruction *vs* choledocholithiasis etiology change the clinical presentation and outcomes?

Tsou YK, Su YT, Lin CH, Liu NJ

Retrospective Study

- 6995** Usefulness of analyzing endoscopic features in identifying the colorectal serrated sessile lesions with and without dysplasia

Wang RG, Ren YT, Jiang X, Wei L, Zhang XF, Liu H, Jiang B

- 7004** Roles of biochemistry data, lifestyle, and inflammation in identifying abnormal renal function in old Chinese

Chen CH, Wang CK, Wang CY, Chang CF, Chu TW

- 7017** Clinical efficacy and safety of Guipi decoction combined with escitalopram oxalate tablets in patients with depression

Yu J, Xu FQ

- 7026** Artificial intelligence technology and ultrasound-guided nerve block for analgesia in total knee arthroplasty

Tong SX, Li RS, Wang D, Xie XM, Ruan Y, Huang L

- 7034** Axenfeld-Reiger syndrome: A search for the missing links

Morya AK, Ramesh PV, Sinha S, Nishant P, Nain N, Ramavath RN, Gone C, Prasad R

Observational Study

- 7043** Self-management of osteoarthritis while waiting for total knee arthroplasty during the COVID-19 pandemic among older Malaysians

Mahdzir ANK, Mat S, Seow SR, Abdul Rani R, Che Hasan MK, Mohamad Yahaya NH

- 7053** "In situ bone flap" combined with vascular pedicled mucous flap to reconstruction of skull base defect

Qian M, Chen X, Zhang LY, Wang ZF, Zhang Y, Wang XJ

- 7061** Reference values of gait parameters in healthy Chinese university students: A cross-sectional observational study

Yu JS, Zhuang C, Guo WX, Chen JJ, Wu XK, Xie W, Zhou X, Su H, Chen YX, Wang LK, Li WK, Tian K, Zhuang RJ

- 7075** Effect of T-regulatory cells and interleukin-35, interleukin-10, and transforming growth factor-beta on diffuse large B-cell lymphoma

Wu H, Sun HC, Ouyang GF

META-ANALYSIS

- 7082** Meta-analysis on the effectiveness of parent education for children with disabilities

Jang J, Kim G, Jeong H, Lee N, Oh S

- 7091** Meta-analysis of the efficacy and safety of daratumumab in the treatment of multiple myeloma

Wang P, Jin SY

CASE REPORT

- 7101** Varicella-zoster virus meningitis with hypoglycorrhachia: A case report

Cao LJ, Zheng YM, Li F, Hao HJ, Gao F

- 7107** Unusual presentation of penile giant condyloma acuminatum with spontaneous prepuce perforation: A case report

Hsu FC, Yu DS, Pu TW, Wu MJ, Meng E

- 7113** Primary renal lymphoma presenting as renal failure: A case report and review of literature from 1989

Lee SB, Yoon YM, Hong R

- 7127** Intravascular ultrasonography assisted carotid artery stenting for treatment of carotid stenosis: Two case reports

Fu PC, Wang JY, Su Y, Liao YQ, Li SL, Xu GL, Huang YJ, Hu MH, Cao LM

- 7136** Mucoepidermoid carcinoma of the lung with hemoptysis as initial symptom: A case report

Xie WX, Liu R, Li Z, Zhou PL, Duan LN, Fu DD

- 7144** Co-infection of *Chlamydia psittaci* and *Tropheryma whippelii*: A case report

Du ZM, Chen P

- 7150** Surgical treatment of severe anterior capsular organized hard core cataract: A case report

Wang LW, Fang SF

- 7156** First platelet transfusion refractoriness in a patient with acute myelocytic leukemia: A case report

Tu SK, Fan HJ, Shi ZW, Li XL, Li M, Song K

- 7162** Rare finding of primary aortoduodenal fistula on single-photon emission computed tomography/computed tomography of gastrointestinal bleeding: A case report

Kuo CL, Chen CF, Su WK, Yang RH, Chang YH

- 7170** Rituximab combined with Bruton tyrosine kinase inhibitor to treat elderly diffuse large B-cell lymphoma patients: Two case reports

Zhang CJ, Zhao ML

- 7179** Use of Ilizarov technique for bilateral knees flexion contracture in Juvenile-onset ankylosing spondylitis: A case report
Xia LW, Xu C, Huang JH
- 7187** Case of takotsubo cardiomyopathy after surgical treatment of liver hydatid cyst: A case report
Altaş Y, Abdullayeva Ü
- 7193** Laparoscopic choledocholithotomy and transductal T-tube insertion with indocyanine green fluorescence imaging and laparoscopic ultrasound: A case report
Yoo D
- 7200** Hematopoietic stem cell transplantation of aplastic anemia by relative with mutations and normal telomere length: A case report
Yan J, Jin T, Wang L
- 7207** Emphysematous thrombophlebitis caused by a misplaced central venous catheter: A case report
Chen N, Chen HJ, Chen T, Zhang W, Fu XY, Xing ZX
- 7214** Aggressive angiomyxoma of the epididymis: A case report
Liu XJ, Su JH, Fu QZ, Liu Y
- 7221** Gastric and intestinal ectopic pancreas: Two case reports
Zhang H, Zhao HY, Zhang FH, Liang W
- 7227** Congenital leukemia: A case report and review of literature
Yang CX, Yang Y, Zhang FL, Wang DH, Bian QH, Zhou M, Zhou MX, Yang XY
- 7234** Imaging misdiagnosis and clinical analysis of significant hepatic atrophy after bilioenteric anastomosis: A case report
Liang SY, Lu JG, Wang ZD
- 7242** Surgical treatment of mixed cervical spondylosis with spontaneous cerebrospinal fluid leakage: A case report
Yu Z, Zhang HFZ, Wang YJ
- 7248** Simultaneous thyroglossal duct cyst with parathyroid cyst: A case report
Chen GY, Li T
- 7253** Submandibular solid-cystic mass as the first and sole manifestation of occult thyroid papillary carcinoma: A case report
Chen GY, Li T

LETTER TO THE EDITOR

- 7258** Artificial intelligence and machine learning in motor recovery: A rehabilitation medicine perspective
Swarnakar R, Yadav SL

ABOUT COVER

Editorial Board Member of *World Journal of Clinical Cases*, Zeid J Khitan, FACP, FASN, MBBS, MD, Academic Research, Director, Full Professor, Department of Medicine, Marshall University, Huntington, WV 25701, United States. zkhitan@marshall.edu

AIMS AND SCOPE

The primary aim of *World Journal of Clinical Cases* (WJCC, *World J Clin Cases*) is to provide scholars and readers from various fields of clinical medicine with a platform to publish high-quality clinical research articles and communicate their research findings online.

WJCC mainly publishes articles reporting research results and findings obtained in the field of clinical medicine and covering a wide range of topics, including case control studies, retrospective cohort studies, retrospective studies, clinical trials studies, observational studies, prospective studies, randomized controlled trials, randomized clinical trials, systematic reviews, meta-analysis, and case reports.

INDEXING/ABSTRACTING

The WJCC is now abstracted and indexed in Science Citation Index Expanded (SCIE, also known as SciSearch®), Journal Citation Reports/Science Edition, Current Contents®/Clinical Medicine, PubMed, PubMed Central, Reference Citation Analysis, China National Knowledge Infrastructure, China Science and Technology Journal Database, and Superstar Journals Database. The 2023 Edition of Journal Citation Reports® cites the 2022 impact factor (IF) for WJCC as 1.1; IF without journal self cites: 1.1; 5-year IF: 1.3; Journal Citation Indicator: 0.26; Ranking: 133 among 167 journals in medicine, general and internal; and Quartile category: Q4.

RESPONSIBLE EDITORS FOR THIS ISSUE

Production Editor: Hua-Ge Yin; Production Department Director: Xiang Li; Editorial Office Director: Jin-Lei Wang.

NAME OF JOURNAL

World Journal of Clinical Cases

ISSN

ISSN 2307-8960 (online)

LAUNCH DATE

April 16, 2013

FREQUENCY

Thrice Monthly

EDITORS-IN-CHIEF

Bao-Gan Peng, Jerzy Tadeusz Chudek, George Kontogeorgos, Maurizio Serati, Ja Hyeon Ku

EDITORIAL BOARD MEMBERS

<https://www.wjgnet.com/2307-8960/editorialboard.htm>

PUBLICATION DATE

October 16, 2023

COPYRIGHT

© 2023 Baishideng Publishing Group Inc

INSTRUCTIONS TO AUTHORS

<https://www.wjgnet.com/bpg/gerinfo/204>

GUIDELINES FOR ETHICS DOCUMENTS

<https://www.wjgnet.com/bpg/GerInfo/287>

GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH

<https://www.wjgnet.com/bpg/gerinfo/240>

PUBLICATION ETHICS

<https://www.wjgnet.com/bpg/GerInfo/288>

PUBLICATION MISCONDUCT

<https://www.wjgnet.com/bpg/gerinfo/208>

ARTICLE PROCESSING CHARGE

<https://www.wjgnet.com/bpg/gerinfo/242>

STEPS FOR SUBMITTING MANUSCRIPTS

<https://www.wjgnet.com/bpg/GerInfo/239>

ONLINE SUBMISSION

<https://www.f6publishing.com>



Retrospective Cohort Study

Acute cholangitis: Does malignant biliary obstruction vs choledocholithiasis etiology change the clinical presentation and outcomes?

Yung-Kuan Tsou, Yi-Tse Su, Cheng-Hui Lin, Nai-Jen Liu

Specialty type: Gastroenterology and hepatology

Provenance and peer review: Unsolicited article; Externally peer reviewed.

Peer-review model: Single blind

Peer-review report's scientific quality classification

Grade A (Excellent): A
Grade B (Very good): 0
Grade C (Good): C
Grade D (Fair): 0
Grade E (Poor): 0

P-Reviewer: Donato G, Italy;
Malatino L, Italy

Received: August 13, 2023

Peer-review started: August 13, 2023

First decision: August 24, 2023

Revised: September 2, 2023

Accepted: September 26, 2023

Article in press: September 26, 2023

Published online: October 16, 2023



Yung-Kuan Tsou, Yi-Tse Su, Cheng-Hui Lin, Nai-Jen Liu, Department of Gastroenterology and Hepatology, Chang Gung Memorial Hospital, Taoyuan 333, Taiwan

Corresponding author: Nai-Jen Liu, MD, Assistant Professor, Doctor, Department of Gastroenterology and Hepatology, Chang Gung Memorial Hospital, No. 5 Fu-Shin Street, Kweishan, Taoyuan 333, Taiwan. milk1372@cloud.cgmh.org.tw

Abstract

BACKGROUND

Whether clinical outcomes of acute cholangitis (AC) vary by etiology is unclear.

AIM

To compare outcomes in AC caused by malignant biliary obstruction (MBO) and common bile duct stones (CBDS).

METHODS

This retrospective study included 516 patients undergoing endoscopic retrograde cholangiopancreatography (ERCP) due to AC caused by MBO (MBO group, $n = 56$) and CBDS (CBDS group, $n = 460$). Clinical and laboratory parameters were compared between the groups. Propensity score matching (PSM) created 55 matched pairs. Confounders used in the PSM analysis were age, sex, time to ERCP, and technical success of ERCP. The primary outcome comparison was 30-d mortality. The secondary outcome comparisons were intensive care unit (ICU) admission rate, length of hospital stay (LOHS), and 30-d readmission rate.

RESULTS

Compared with the CBDS group, the MBO group had significantly lower body temperature, percentage of abnormal white blood cell counts, and serum levels of aspartate aminotransferase, alanine aminotransferase, and creatinine. Body temperature, percent abnormal white blood cell count, and serum aspartate aminotransferase levels remained significantly lower in the MBO group in the PSM analysis. Platelet count, prothrombin time/international normalized ratio, and serum levels of alkaline phosphatase and total bilirubin were significantly higher in the MBO group. The MBO group had a significantly higher percentage of severe AC (33.9% vs 22.0%, $P = 0.045$) and received ERCP later (median, 92.5 h vs 47.4 h, $P < 0.001$). However, the two differences were not found in the PSM

analysis. The 30-d mortality (5.4% *vs* 0.7%, $P = 0.019$), ICU admission rates (12.5% *vs* 4.8%, $P = 0.028$), 30-d readmission rates (23.2% *vs* 8.0%, $P < 0.001$), and LOHS (median, 16.5 d *vs* 7.0 d, $P < 0.001$) were significantly higher or longer in the MBO group. However, only LOHS remained significant in the PSM analysis. Multivariate analysis revealed that time to ERCP and multiple organ dysfunction were independent factors associated with 30-d mortality.

CONCLUSION

MBO patients underwent ERCP later and thus had a worse prognosis than CBDS patients. Therefore, clinicians should remain vigilant in MBO patients with clinically suspected AC, and perform ERCP for biliary drainage as soon as possible.

Key Words: Malignant biliary obstruction; Common bile duct stones; Endoscopic retrograde cholangiopancreatography; Acute cholangitis; Mortality; Etiology

©The Author(s) 2023. Published by Baishideng Publishing Group Inc. All rights reserved.

Core Tip: Our aim was to compare the outcomes of acute cholangitis (AC) with those of two common causes, malignant biliary obstruction (MBO) and common bile duct stones. We found that clinical manifestations such as body temperature, percentage of abnormal white blood cell count, and serum aspartate aminotransferase levels were significantly lower in the MBO group. The MBO group also had a significantly higher proportion of severe AC and a longer time to endoscopic retrograde cholangiopancreatography (ERCP). The 30-d mortality rate was significantly higher in the MBO group. Therefore, early recognition and early acceptance of ERCP are critical for MBO patients with AC.

Citation: Tsou YK, Su YT, Lin CH, Liu NJ. Acute cholangitis: Does malignant biliary obstruction *vs* choledocholithiasis etiology change the clinical presentation and outcomes? *World J Clin Cases* 2023; 11(29): 6984-6994

URL: <https://www.wjgnet.com/2307-8960/full/v11/i29/6984.htm>

DOI: <https://dx.doi.org/10.12998/wjcc.v11.i29.6984>

INTRODUCTION

Acute cholangitis (AC) occurs clinically when bile duct obstruction results in a cholangiovenous or cholangiolymphatic reflux of pathogenic microorganisms or endotoxins[1,2]. The etiology of AC is diverse and includes common bile duct stones (CBDS), malignant biliary obstruction (MBO), benign biliary strictures, stent occlusion, *etc.* A Japan-Taiwan collaborative study that included 6063 patients showed that the most common etiology was CBDS (60.3%), followed by MBO (15.6%) and stent obstruction (11.0%)[3]. Because of the variety of treatment options for malignancies in the current era, the number of MBO cases will inevitably increase even more[1,4].

MBO usually presents with painless jaundice, pruritus, and infrequently fever and leukocytosis[5]. In contrast, although sometimes asymptomatic, patients with CBDS often present to the emergency department (ED) due to sudden or severe abdominal pain[6]. However, there is no gold standard for the diagnosis of AC. The Tokyo Guidelines (TG) were to define AC for performing evidence-based clinical research[2,7,8]. The diagnostic criteria of TG include systemic inflammation, cholestasis, and imaging findings. Since the TG18 guidelines adopt the TG13 criteria, it is called the TG18/TG13 diagnostic criteria[8]. From TG07 to TG18/TG13, the severity of AC is further stratified and clarified in more detail [2,7,8]. Endoscopic retrograde cholangiopancreatography (ERCP) is currently the recommended first-line treatment for AC because it is less invasive and has a lower risk of adverse events[8-10]. However, for patients with AC, different etiologies may have different clinical manifestations, and patients may receive different drainage methods and thus may respond differently to ERCP[11,12]. Therefore, it is necessary to consider differences in disease state according to etiology. However, to our knowledge, such studies are limited in the literature[3]. Most studies based their findings and conclusions on populations with heterogeneous etiologies of AC[13-15]. Therefore, based on the TG18/TG13 diagnostic criteria, we conducted this study to elucidate the differences between AC caused by the two main etiologies, MBO and CBDS.

MATERIALS AND METHODS

Study design and patients

The current study was a retrospective study from Chang Gung Memorial Hospital Linkou Center. The diagnostic criteria for a definite diagnosis of AC and the severity of AC were according to the TG18/TG13 diagnostic criteria[8]. **Figure 1** shows the study flow chart. Between January 2016 and December 2017, 683 patients who presented to our ED, met the diagnostic criteria for definite AC, and received ERCP were collected retrospectively from the computer database of the

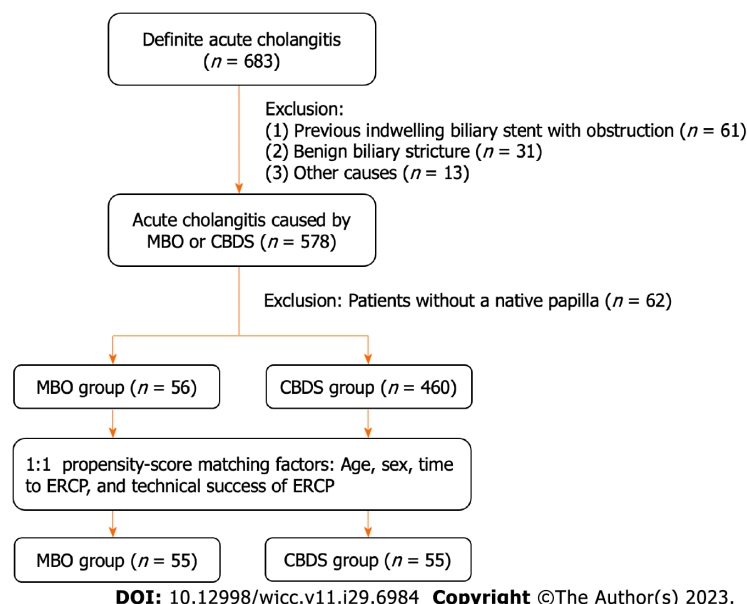


Figure 1 Study flow chart. MBO: Malignant biliary obstruction; CBDS: Common bile duct stones; ERCP: Endoscopic retrograde cholangiopancreatography.

Therapeutic Endoscopy Center in our center. The exclusion criteria were: (1) Causes of AC other than MBO or CBDS [previous indwelling biliary stent obstruction ($n = 61$), benign biliary stricture ($n = 31$), or other causes ($n = 13$)]; and (2) patients without a native papilla ($n = 62$). Patients with AC caused by malignant tumors were categorized into the MBO group; patients with AC caused by CBDS were categorized into the CBDS group. This study was reviewed and approved by the Ethics Committee of the Chang Gung Memorial Hospital (IRB No. 202201601B0). Since this was a retrospective study using routine clinical treatment or diagnostic medical records, the Chang Gung Medical Foundation Institutional Review Board approved the waiver of the participant's consent. All methods were carried out under relevant guidelines and regulations.

We reviewed the medical records of the two groups of patients and obtained the following data for comparison. Demographic data included age and sex. Vital signs included body temperature, blood pressure, heart rate, oxygen saturation, and respiratory rate. Laboratory values included white blood cell (WBC) count, platelet count, prothrombin time-international normalized ratio (PT-INR), serum levels of creatinine, total bilirubin, alkaline phosphatase (ALK-P), aspartate aminotransferase (AST), and alanine aminotransferase (ALT). Serum albumin level data were available for only 82 patients (15.9%) and were excluded from the analysis. Data were collected on patient symptoms, vital signs, and laboratory test results while the patient was in the ED. In the MBO group, the cancer type, stage, and location of biliary obstruction (distal extrahepatic bile duct or perihilar) were recorded for each patient.

Definitions

The definition of organ dysfunction was according to the TG18 criteria, and patients with organ dysfunction were identified on this basis[8]. Cardiovascular dysfunction was hypotension requiring dopamine ≥ 5 $\mu\text{g}/\text{kg}$ per min or any dose of norepinephrine. Neurological dysfunction was the presence of conscious disturbance. Respiratory dysfunction was a $\text{PaO}_2/\text{FiO}_2$ ratio < 300 . Renal dysfunction was serum creatinine > 2.0 mg/dL . Hepatic dysfunction was PT-INR > 1.5 . Hematological dysfunction was a platelet count $< 100 \times 10^3/\mu\text{L}$. Multiple organ dysfunction was the dysfunction of at least two organs. An abnormal WBC count was a WBC $< 4000/\mu\text{L}$ or $> 12000/\mu\text{L}$. Time to ERCP was the time from the ED visit to the commencement of ERCP. Technical success of ERCP was the success of deep bile duct cannulation and subsequent treatments such as stone retrieval and stent insertion.

Outcome assessments

The primary outcome comparison was 30-d mortality. Secondary outcome comparisons included intensive care unit (ICU) admission rate, length of hospital stay (LOHS), and 30-d readmission rate.

Propensity score matching

Because this was a retrospective study without randomization, there was a potential confounding bias between the two groups, which could have affected the study results. Therefore, we performed propensity score matching (PSM) to compensate for the bias caused by the lack of randomization in the two groups of cases. We calculated propensity scores using a logistic regression model. Based on clinical judgment and previous reports[16], four potential confounders of outcome were used in the model: Age, sex, time to ERCP, and technical success of ERCP. We performed 1:1 nearest neighbor matching using a caliper set at 0.05.

Statistical analysis

In the text and tables, data for continuous variables are expressed as medians and interquartile ranges (IQRs); categorical variables are expressed as numbers and percentages. For comparisons, the Mann-Whitney *U* test was used for continuous variable data, and Pearson's chi-square test or Fisher's exact test was used for suitable categorical variables. Logistic regression analysis was performed to identify factors associated with 30-d mortality. Only variables with a *P* value < 0.05 in the univariate analysis were included in the multivariate analysis. The results of the univariate and multivariate analyses were expressed as odds ratios (OR) and 95% confidence intervals (CI). Two-tailed *P* values < 0.05 were considered statistically significant. Statistical analysis was performed using SPSS software (version 22.0; SPSS, Inc., Chicago, IL, United States).

RESULTS

A total of 516 patients were included in this study, including 56 (10.9%) in the MBO group and 460 (89.1%) in the CBDS group. PSM created 55 matched pairs (shown in Figure 1).

Characteristics of MBO

Table 1 Lists the etiology of MBO, tumor stage, and location of obstruction in the MBO group. All MBO patients were pathologically confirmed to be malignant. Pancreatic cancer was the most common etiology (42.9%), followed by ampullary tumor (23.2%), CBD cancer (10.7%), metastasis (10.7%), perihilar cholangiocarcinoma (5.4%), gallbladder cancer (3.6%), and hepatocellular carcinoma (3.6%). AC mostly occurred in advanced pancreatic cancer, perihilar cholangiocarcinoma, and gallbladder cancer, while it could occur in early ampullary tumors (including 2 adenomas) and CBD cancer. Regarding the location of the obstruction, most occurred in the distal EHD (82.1%), followed by the perihilar area (17.9%). Of the perihilar obstructions, 40% were Bismuth-Corlette type I, and 60% were Bismuth-Corlette type II.

Patient characteristics, laboratory values, and clinical outcomes

Table 2 summarizes the clinical and laboratory findings of the patients.

Demographic data

In the overall population, the median ages of the patients in the MBO and CBDS groups were 69 and 66 years, respectively. The proportions of men in both groups were 62.5% and 57.2%. There were no significant differences in age or sex between the two groups. Differences in demographic data were also not significant in the PSM analysis.

Laboratory values

In the overall population, body temperature (median, 36.9 °C *vs* 37.4 °C, *P* = 0.001), percent abnormal WBC counts (41.1% *vs* 60.9%, *P* = 0.004), and serum levels of AST (median, 109 U/L *vs* 167 U/L, *P* = 0.014), ALT (median, 103 U/L *vs* 189 U/L, *P* = 0.001), and creatinine (median, 0.8 mg/dL *vs* 1.0 mg/dL, *P* = 0.004) were significantly lower in the MBO group. However, platelet count (median, 237/μL *vs* 197.5/μL, *P* = 0.011), prothrombin time (international normalized ratio, median, 1.2 *vs* 1.1, *P* = 0.028), and serum levels of ALK-P (median, 357 mg/dL *vs* 181.5 mg/dL, *P* < 0.001) and total bilirubin (median, 8.2 mg/dL *vs* 3.7 mg/dL, *P* < 0.001) were significantly higher in the MBO group. In the PSM analysis, body temperature, percent abnormal white blood cell count, and serum AST levels remained significantly lower in the MBO group, while platelet counts and serum ALK-P and total bilirubin levels remained significantly higher in the MBO group.

Organ dysfunction and severity of AC

The percentages of organ dysfunction in the MBO and CBDS groups were as follows: 0% and 4.3% for cardiovascular dysfunction (*P* = 0.15), 10.7% and 5.2% for neurological dysfunction (*P* = 0.122), 7.1% and 7.0% for respiratory dysfunction (*P* = 1), 7.1% and 8.0% for renal dysfunction (*P* = 1), 7.1% and 2.2% for hepatic dysfunction (*P* = 0.063), and 8.9% and 5.9% for hematological dysfunction (*P* = 0.372), respectively. The differences in the percent of patients with dysfunction by organ were also not significant in the PSM analysis.

In the MBO and CBDS groups, regarding AC severity, 37.5% and 50.2% were mild AC (*P* = 0.072), 28.6% and 27.8% were moderate AC (*P* = 0.907), and 33.9% and 22.0% were severe AC (*P* = 0.045), respectively. However, in the PSM analysis, no significant differences were found regarding the severity of AC.

Timing and success rate of ERCP

The median time to ERCP was significantly longer in the MBO group than in the CBDS group (92.5 h *vs* 47.4 h, *P* < 0.001). When looking at the time to ERCP according to AC severity, patients with mild AC (median, 89.9 h *vs* 47.3 h, *P* = 0.026) and moderate AC (median, 113.1 h *vs* 44.5 h, *P* < 0.001) had a significantly longer time to ERCP in the MBO group than in the CBDS group. However, the time to ERCP was not significantly different between the two groups of patients with severe AC (median, 68.8 h *vs* 65.9 h, *P* = 0.133). However, in the PSM analysis, the time to ERCP did not differ significantly either in the overall population or according to AC severity.

The technical success rate of ERCP in the MBO group was significantly lower than that in the CBDS group (94.6% *vs* 99.1%, *P* = 0.031). The rate of stent insertion during initial ERCP was significantly higher in the MBO group than in the CBDS group (51/56 or 91.1% *vs* 42/460 or 9.1%, *P* < 0.001). The type of stent insertion in the MBO group was as follows:

Table 1 Cancer type, stage, and location of obstruction in malignant biliary obstruction

	MBO group (n = 56)
Etiology of MBO	
Pancreatic cancer	24 (42.9%)
Stage I/II/III/IV	1/6/3/14
Ampulla of Vater cancer	13 (23.2%)
Adenoma	2
Cancer, stage I/II/III/IV	4/3/3/1
CBD cancer	6 (10.7%)
Stage I/II/III/IV	1/4/0/1
Klatskin tumor	3 (5.4%)
Stage I/II/III/IV	0/0/0/3
Metastatic tumor	6 (10.7%)
Hepatocellular carcinoma	2 (3.6%)
Gallbladder cancer	2 (3.6%)
Stage I/II/III/IV	0/0/0/2
Location of obstruction	
Distal EHD	46 (82.1%)
Perihilar obstruction	10 (17.9%)
Bismuth-Corlette type I	4
Bismuth-Corlette type II	6

MBO: Malignant biliary obstruction; CBD: Common bile duct; EHD: Extrahepatic bile duct.

68.6% had plastic stents, and 31.4% had metal stents. In the PSM analysis, the technical success rate of ERCP was not significantly different between the two groups.

Primary and secondary outcomes

Table 3 shows the primary and secondary outcomes of the study. In the overall population, 30-d mortality was higher in the MBO group than in the CBDS group (5.4% *vs* 0.7%, $P = 0.019$). The ICU admission rate (12.5% *vs* 4.8%, $P = 0.028$) and the 30-d readmission rate (23.2% *vs* 8.0%, $P = 0.028$) were significantly higher in the MBO group. The LOHS was also significantly longer in the MBO group (median, 16.5 d *vs* 7 d, $P < 0.001$).

In the PSM analysis, there were no statistically significant differences in 30-d mortality, ICU admission, or 30-d readmission. The LOHS was still significantly longer in the MBO group than in the CBDS group (median, 16 d *vs* 8 d, $P < 0.001$).

Factors associated with 30-d mortality

The results of the univariate and multivariate analyses are listed in Table 4. The univariate analysis revealed that MBO (*vs* CBDS, OR: 8.623, 95%CI: 1.697-43.806, $P = 0.009$), time to ERCP (every 1-d delay, OR: 1.931, 95%CI: 1.210-3.081, $P = 0.006$), failure of ERCP (OR: 16.88, 95%CI: 1.696-166.389, $P = 0.016$), hepatic dysfunction (OR: 17.917, 95%CI: 2.986-107.492, $P = 0.00$), respiratory dysfunction (OR: 14.455, 95%CI: 2.807-74.421, $P = 0.001$), neurological dysfunction (OR: 17.889, 95%CI: 3.447-92.828, $P = 0.001$), cardiovascular dysfunction (OR: 29.600, 95%CI: 5.450-154.322, $P < 0.001$), multiple organ dysfunction (OR: 33.172, 95%CI: 5.833-188.666, $P < 0.001$), severe AC (*vs* moderate AC + mild AC, OR: 17.174, 95%CI: 1.986-148.479, $P = 0.010$), and ICU admission (OR: 8.944, 95%CI: 1.568-51.014, $P = 0.014$) were associated with 30-d mortality. Not every single organ dysfunction variable associated with 30-d mortality was included in the multivariate analysis due to the use of multiple organ dysfunction in the multivariate analysis. The multivariate analysis revealed that time to ERCP (OR: 1.977, 95%CI: 1.027-3.807, $P = 0.041$) and multiple organ dysfunction (OR: 49.008, 95%CI: 1.692-1419.861, $P = 0.023$) were the two independent factors associated with 30-d mortality.

Table 2 Patient characteristics, laboratory values, and clinical outcomes

Variables ¹	Overall cases (n = 512)			Propensity-score matched cases (n = 110)		
	MBO group (n = 56)	CBDS group (n = 460)	P value	MBO group (n = 55)	CBDS group (n = 55)	P value
Age (yr)	69 (56.8-77.8)	66 (54-78)	0.626	69 (57-80)	69 (59-83)	0.429
Male gender, n (%)	35 (62.5)	263 (57.2)	0.446	35 (63.6)	29 (52.7)	0.246
Body temperature (°C)	36.9 (36.6-37.7)	37.4 (36.9-38.4)	0.001	36.9 (36.6-37.8)	37.5 (37.0-38.1)	0.003
Abnormal WBC count ² , n (%)	23 (41.1)	280 (60.9)	0.004	23 (41.8)	35 (63.6)	0.022
Platelet count (/μL)	237 (169-307.5)	197.5 (150-249.3)	0.011	238.5 (169.5-312.3)	181.5 (142.8-238.3)	0.002
PT/INR	1.2 (1.1-1.3)	1.1 (1.1-1.2)	0.028	1.2 (1.1-1.3)	1.2 (1.1-1.2)	0.23
AST (U/L)	109 (71-209)	167 (91-331)	0.014	109 (71-221.8)	197 (85-453)	0.037
ALT (U/L)	103 (61-198)	189 (102-330)	0.001	104 (58.5-214.5)	140.5 (68-378.8)	0.18
ALK-P (U/L)	357 (224-548)	181.5 (125.3-282)	< 0.001	357 (220-550)	163 (121-252.8)	< 0.001
Total bilirubin (mg/dL)	8.2 (4-12.8)	3.7 (2.4-5.9)	< 0.001	7.5 (3.6-12.7)	3.4 (2.2-5.1)	< 0.001
Creatinine (mg/dL)	0.8 (0.7-1.0)	1.0 (0.7-1.3)	0.004	0.8 (0.7-1.0)	0.9 (0.7-1.4)	0.052
Organ dysfunction, n (%)						
Cardiovascular	0 (0)	20 (4.3)	0.15	0	2 (3.6)	0.495
Neurological	6 (10.7)	24 (5.2)	0.122	5 (9.1)	5 (9.1)	1
Respiratory	4 (7.1)	32 (7.0)	1	4 (7.3)	8 (14.5)	0.221
Renal	4 (7.1)	37 (8.0)	1	4 (7.3)	2 (3.6)	0.679
Hepatic	4 (7.1)	10 (2.2)	0.063	4 (7.3)	0	0.118
Hematological	5 (8.9)	27 (5.9)	0.372	5 (9.1)	7 (12.7)	0.54
Severity of AC, n (%)						0.803
Mild	21 (37.5)	231 (50.2)	0.072	21 (38.2)	22 (40.0)	0.845
Moderate	16 (28.6)	128 (27.8)	0.907	16 (29.1)	13 (23.6)	0.516
Severe	19 (33.9)	101 (22.0)	0.045	18 (32.7)	20 (36.4)	0.688
Time to ERCP (h)						
Overall cases	92.5 (43.9-137.0)	47.4 (26.0-82.3)	< 0.001	89.9 (41.6-137.0)	71.5 (41.8-109.5)	0.418
Mild AC	89.9 (40.9-116.3)	47.3 (28.2-84.0)	0.026	89.9 (38.9-116.4)	74.6 (39.3-114.8)	0.923
Moderate AC	113.1 (65-162.3)	44.5 (24.2-70.4)	< 0.001	113.1 (51.8-163.2)	55.1 (38.1-119.2)	0.11
Severe AC	68.8 (37.0-139.6)	65.9 (25.2-90.7)	0.133	67.4 (29.1-139.4)	77.6 (49.5-120.7)	0.74
ERCP success rate, n (%)	53 (94.6)	456 (99.1)	0.031	53 (96.4)	51 (92.7)	0.679

¹Data are presented as medians (interquartile ranges) for continuous variables and as n (%) for categorical variables.

²Abnormal white blood cell count (WBC) was defined as WBC < 4000/μL or > 12000/μL.

MBO: Malignant biliary obstruction; CBDS: Common bile duct stones; WBC: White blood cell count; PT/INR: Prothrombin time/international normalized ratio; AST: Aspartate aminotransferase; ALT: Alanine aminotransferase; ALK-P: Alkaline phosphatase; AC: Acute cholangitis; ERCP: Endoscopic retrograde cholangiopancreatography.

DISCUSSION

In the literature, few studies reported only MBO-associated AC[17], some gave an account of only CBDS-associated AC [11,18], and most reported mixed results for AC of different etiologies[3,13-15]. Although the etiology of AC varies, studies explicitly comparing the clinical presentations and outcomes of AC of distinct etiologies are rare. In the present study, we found that the clinical manifestations of AC in MBO patients were less conspicuous than those in CBDS patients, manifested by having lower body temperature, being less likely to have abnormal WBC counts, and by having lower serum levels of AST. These results remained verified in the PSM analysis. AC patients with poor systemic inflammation are difficult to diagnose according to the TG18/TG13 criteria[3]. Therefore, AC diagnosis might be delayed in our

Table 3 Primary and secondary outcomes

Variables ¹	Overall cases (n = 512)			Propensity-score matched cases (n = 110)		
	MBO group (n = 56)	CBDS group (n = 460)	P value	MBO group (n = 55)	CBDS group (n = 55)	P value
30-d mortality, n (%)	3 (5.4)	3 (0.7)	0.019	2 (3.6)	0	0.495
ICU admission, n (%)	7 (12.5)	22 (4.8)	0.028	7 (12.7)	3 (5.5)	0.185
LOHS (d) ¹	16.5 (9.8-34.8)	7 (5-9)	< 0.001	16 (9-37)	8 (6-11)	< 0.001
30-d readmission, n (%)	13 (23.2)	37 (8.0)	< 0.001	13 (23.6)	6 (10.9)	0.077

¹Data are presented as medians (interquartile ranges) for continuous variables and as n (%) for categorical variables.

MBO: Malignant biliary obstruction; CBDS: Common bile duct stones; ICU: Intensive care unit; LOHS: Length of hospital stay.

MBO patients, especially those with mild AC and moderate AC, which may explain the significantly later ERCP in MBO patients than in CBDS patients.

Consistent with a previous study, we observed a decreased percentage of patients with increased AC severity in the CBDS group but not in the MBO group[3]. Kiriya *et al*[3] reported that 30-d mortality increased significantly with increasing AC severity (5.1%, 2.6%, and 1.2% in severe, moderate, and mild AC, respectively). However, this association was not present in their MBO patients. They suggested that the TG18/TG13 severity grading scale may have limited utility as a predictor of poor prognosis in AC caused by MBO.

In the overall population analysis, we found that MBO-associated AC had significantly higher 30-d mortality than CBDS-associated AC, which is consistent with previous studies[3,4]. Regardless of the etiology, time to ERCP has been reported to be a prognostic factor associated with 30-d mortality in AC patients[13,16,17]. In a study of distal MBO-associated AC, Park *et al*[17] reported that urgent ERCP (within 24 h of ED arrival) improved 30-d mortality in moderate-to-severe AC patients. In our study, in the overall population and in subgroup analyses of patients with mild and moderate AC, MBO patients had a longer time to ERCP than CBDS patients. Therefore, we performed a PSM analysis using a narrow caliper to minimize confounding variables, including time to ERCP[19]. We found no significant differences in AC severity or 30-d mortality between the two propensity-matched cohorts. Furthermore, we found that time to ERCP, but not MBO itself, was an independent factor associated with 30-d mortality in the multivariate analysis. Therefore, time to ERCP was an important factor associated with 30-d mortality in MBO patients[17]. Awareness and early recognition of MBO-associated AC are paramount so that these patients can undergo ERCP earlier to improve outcomes.

The longer LOHS in patients with MBO-associated AC may be related to several factors. First, MBO is frequently associated with anatomical alterations, and this leads to a lower success rate of ERCP, as shown in this study[17]. Patients who fail ERCP require salvage therapy to relieve bile duct obstruction, thereby prolonging LOHS[20]. Second, following ERCP, MBO patients may require additional treatment for the underlying disease. Some studies reported that urgent or early ERCP can shorten LOHS[21,22]. However, in these studies, they did not mention the etiology of AC. Further studies are needed to clarify whether early ERCP can shorten the LOHS in patients with MBO-associated AC.

The 30-d readmission rate is frequently used as a quality measure, but only a few studies have reported readmission risk for AC patients[23,24]. Using the national readmission database, Parikh *et al*[23] reported a 30-d readmission rate of 21.5% for AC patients. They reported that pancreatic neoplasm-associated MBO was one of the factors associated with a high risk of 30-d readmission. However, in their study, the diagnosis, etiology, and severity of AC were unclear, and patients without ERCP were included. Navaneethan *et al*[24] reported a 30-d readmission rate of 22%. In their study, the diagnosis of AC was made according to the clinical manifestations and laboratory tests. Regarding the etiology of AC, 38.7% of the cases were CBDS, and MBO accounted for 16.7% of the cases. They reported that a non-CBDS etiology and a delay in performing ERCP (> 48 h) increased the risk of 30-d readmission. The 30-d readmission rate in our study was 9.7% in the overall population and 23.2% in MBO patients. The 30-d readmission rate was higher in the MBO group than in the CBDS group, a finding presented in the overall population analysis but not in the PSM analysis, likely due to the removal of confounding factors for time to ERCP in the PSM analysis.

This study has several limitations. First, this was a retrospective study with the inherent drawback of selection bias. However, to reduce the effect of selection bias, we performed a PSM analysis between the two groups. Second, we only included AC patients presenting to the ED; AC patients on the ward might have been excluded from this study, especially those with MBO. Third, we only recruited patients with native papillae. As a result, MBO patients with previous indwelling biliary stents were excluded from the study. The above two reasons may explain the low proportion of MBO patients in this study.

CONCLUSION

In conclusion, 30-d mortality, ICU admission, and the 30-d readmission rates were significantly higher in MBO-associated AC patients in the overall population analysis but not in the PSM analysis. Time to ERCP was a paramount factor in this difference. Therefore, clinicians should remain vigilant in the care of MBO patients with clinically suspected AC and have

Table 4 Univariate and multivariate analyses of factors associated with 30-d mortality

Variables		Univariate analysis		Multivariate analysis	
		OR (95%CI)	P value	OR (95%CI)	P value
Age	Every 1-yr increase	1.015 (0.964-1.068)	0.576	-	-
Sex	Male	0.143 (0.017-1.237)	0.077	-	-
	Female	Referent			
Etiology	MBO	8.623 (1.697-43.806)	0.009	5.346 (0.524-54.491)	0.157
	CBDS	Referent			
Fever (BT $\geq 39^{\circ}\text{C}$)	Yes	1.394 (0.160-12.121)	0.764	-	-
	No	Referent			
Abnormal WBC count	Yes	1.411 (0.256-7.776)	0.692	-	-
	No	Referent			
Hyperbilirubinemia ($\geq 5\text{ mg/dL}$)	Yes	0.836 (0.152-4.608)	0.837	-	-
	No	Referent			
Time to ERCP	Every 1-d delay	1.931 (1.210-3.081)	0.006	1.977 (1.027-3.807)	0.041
Failure of ERCP	Yes	16.88 (1.696-166.389)	0.016	27.116 (0.979-751.028)	0.051
	No	Referent			
Hepatic dysfunction (PT-INR > 1.5)	Yes	17.917 (2.986-107.492)	0.002	NI	-
	No	Referent			
Hematological dysfunction (PLT $< 100 \times 10^3/\mu\text{L}$)	Yes	3.058 (0.347-26.987)	0.314	-	-
	No	Referent			
Renal dysfunction (Cr $> 2.0\text{ mg/dL}$)	Yes	2.315 (0.264-20.300)	0.449	-	-
	No	Referent			
Respiratory dysfunction (PaO ₂ /FiO ₂ ratio > 300)	Yes	14.455 (2.807-74.421)	0.001	NI	-
	No	Referent			
Neurological dysfunction (conscious disturbance)	Yes	17.889 (3.447-92.828)	0.001	NI	-
	No	Referent			
Cardiovascular dysfunction ¹	Yes	29.600 (5.450-154.322)	< 0.001	NI	-
	No	Referent			
Multiple organ dysfunction (≥ 2 organ dysfunction)	Yes	33.172 (5.833-188.666)	< 0.001	49.008 (1.692-1419.861)	0.023
	No	Referent			
Severity of AC	Severe	17.174 (1.986-148.479)	0.01	1.496 (0.053-41.837)	0.813
	Moderate + mild	Referent			
ICU admission	Yes	8.944 (1.568-51.014)	0.014	13.667 (0.993-188.394)	0.051
	No	Referent			

¹Defined as hypotension requiring dopamine $\geq 5\text{ }\mu\text{g/kg}$ per min, or any dose of norepinephrine.

MBO: Malignant biliary obstruction; CBDS: Common bile duct stones; NI: Not included; AC: Acute cholangitis; BT: Body temperature; WBC: White blood cell count; ERCP: Endoscopic retrograde cholangiopancreatography; Cr: creatine; PT/INR: Prothrombin time/international normalized ratio; PLT: platelet; ICU: Intensive care unit; OR: Odds ratios; CI: Confidence intervals.

to perform ERCP for biliary drainage as soon as possible.

ARTICLE HIGHLIGHTS

Research background

Whether the clinical outcome of acute cholangitis (AC) differs depending on the cause is unknown.

Research motivation

This study aimed to elucidate whether the clinical manifestations and outcomes of AC caused by malignant biliary obstruction (MBO) and choledocholithiasis differ.

Research objectives

The primary outcome comparison was 30-d mortality. The secondary outcome comparisons were intensive care unit admission rate, length of hospital stay, and 30-d readmission rate.

Research methods

This retrospective study included 516 patients undergoing endoscopic retrograde cholangiopancreatography (ERCP) due to AC caused by MBO (MBO group, $n = 56$) and common bile duct stones (CBDS group, $n = 460$). Clinical and laboratory parameters were compared between the groups. Propensity score matching (PSM) created 55 matched pairs. Confounders used in the PSM analysis were age, sex, time to ERCP, and technical success of ERCP. The primary outcome comparison was 30-d mortality. The secondary outcome comparisons were intensive care unit admission rate, length of hospital stay, and 30-d readmission rate.

Research results

The 30-d mortality, intensive care unit admission rates, 30-d readmission rates, and length of hospital stay were significantly higher or longer in the MBO group. However, only the length of hospital stay remained significant in the propensity score matching analysis. Multivariate analysis revealed that time-to-ERCP and multiple organ dysfunction were independent factors associated with 30-d mortality.

Research conclusions

MBO patients undergo ERCP later, and the prognosis is worse than that of patients with choledocholithiasis. Therefore, newly diagnosed MBO patients with clinically suspected AC should be alerted and ERCP should be performed as soon as possible for biliary drainage.

Research perspectives

The diagnostic criteria used for systemic inflammation may differ between patients with MBO and those with choledocholithiasis, and this may be considered in the development of new guidelines in the future.

FOOTNOTES

Author contributions: Tsou YK contributed to the conceptualization of the study and original manuscript writing; Su YT contributed to data collection, planning, interpretation and formal analysis; Lin CH contributed to manuscript review and editing; Liu NJ worked on the conceptualization of the study and revised the final version of the submitted manuscript.

Institutional review board statement: This study was reviewed and approved by the Ethics Committee of the Chang Gung Memorial Hospital (IRB No. 202201601B0).

Informed consent statement: Since this was a retrospective study using routine clinical treatment or diagnostic medical records, the Chang Gung Medical Foundation Institutional Review Board approved the waiver of the participant's consent.

Conflict-of-interest statement: The authors declare no conflict of interest.

Data sharing statement: Deidentified individual participant data are available and will be provided on reasonable request to the corresponding author.

STROBE statement: The authors have read the STROBE Statement—checklist of items, and the manuscript was prepared and revised according to the STROBE Statement—checklist of items.

Open-Access: This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <https://creativecommons.org/licenses/by-nc/4.0/>

Country/Territory of origin: Taiwan

ORCID number: Yung-Kuan Tsou 0000-0002-7254-7369; Cheng-Hui Lin 0000-0001-8102-0625; Nai-Jen Liu 0000-0002-7992-0234.

S-Editor: Yan JP

L-Editor: A

P-Editor: Zhang XD

REFERENCES

- Kimura Y, Takada T, Kawarada Y, Nimura Y, Hirata K, Sekimoto M, Yoshida M, Mayumi T, Wada K, Miura F, Yasuda H, Yamashita Y, Nagino M, Hirota M, Tanaka A, Tsuyuguchi T, Strasberg SM, Gadacz TR. Definitions, pathophysiology, and epidemiology of acute cholangitis and cholecystitis: Tokyo Guidelines. *J Hepatobiliary Pancreat Surg* 2007; **14**: 15-26 [PMID: [17252293](#) DOI: [10.1007/s00534-006-1152-y](#)]
- Wada K, Takada T, Kawarada Y, Nimura Y, Miura F, Yoshida M, Mayumi T, Strasberg S, Pitt HA, Gadacz TR, Büchler MW, Belghiti J, de Santibanes E, Gouma DJ, Neuhaus H, Dervenis C, Fan ST, Chen MF, Ker CG, Bornman PC, Hilvano SC, Kim SW, Liau KH, Kim MH. Diagnostic criteria and severity assessment of acute cholangitis: Tokyo Guidelines. *J Hepatobiliary Pancreat Surg* 2007; **14**: 52-58 [PMID: [17252297](#) DOI: [10.1007/s00534-006-1156-7](#)]
- Kiriyama S, Takada T, Hwang TL, Akazawa K, Miura F, Gomi H, Mori R, Endo I, Itoi T, Yokoe M, Chen MF, Jan YY, Ker CG, Wang HP, Wada K, Yamaue H, Miyazaki M, Yamamoto M. Clinical application and verification of the TG13 diagnostic and severity grading criteria for acute cholangitis: an international multicenter observational study. *J Hepatobiliary Pancreat Sci* 2017; **24**: 329-337 [PMID: [28419764](#) DOI: [10.1002/jhbp.458](#)]
- Tan M, Schaffalitzky de Muckadell OB, Laursen SB. Unchanged mortality in patients with acute cholangitis despite an increase in malignant etiologies - a 25-year epidemiological study. *Scand J Gastroenterol* 2019; **54**: 335-341 [PMID: [30946608](#) DOI: [10.1080/00365521.2019.1585568](#)]
- Lorenz JM. Management of Malignant Biliary Obstruction. *Semin Intervent Radiol* 2016; **33**: 259-267 [PMID: [27904244](#) DOI: [10.1055/s-0036-1592330](#)]
- Caddy GR, Tham TC. Gallstone disease: Symptoms, diagnosis and endoscopic management of common bile duct stones. *Best Pract Res Clin Gastroenterol* 2006; **20**: 1085-1101 [PMID: [17127190](#) DOI: [10.1016/j.bpg.2006.03.002](#)]
- Kiriyama S, Takada T, Strasberg SM, Solomkin JS, Mayumi T, Pitt HA, Gouma DJ, Garden OJ, Büchler MW, Yokoe M, Kimura Y, Tsuyuguchi T, Itoi T, Yoshida M, Miura F, Yamashita Y, Okamoto K, Gabata T, Hata J, Higuchi R, Windsor JA, Bornman PC, Fan ST, Singh H, de Santibanes E, Gomi H, Kusachi S, Murata A, Chen XP, Jagannath P, Lee S, Padbury R, Chen MF, Dervenis C, Chan AC, Supe AN, Liau KH, Kim MH, Kim SW; Tokyo Guidelines Revision Committee. TG13 guidelines for diagnosis and severity grading of acute cholangitis (with videos). *J Hepatobiliary Pancreat Sci* 2013; **20**: 24-34 [PMID: [23307001](#) DOI: [10.1007/s00534-012-0561-3](#)]
- Kiriyama S, Kozaka K, Takada T, Strasberg SM, Pitt HA, Gabata T, Hata J, Liau KH, Miura F, Horiguchi A, Liu KH, Su CH, Wada K, Jagannath P, Itoi T, Gouma DJ, Mori Y, Mukai S, Giménez ME, Huang WS, Kim MH, Okamoto K, Belli G, Dervenis C, Chan ACW, Lau WY, Endo I, Gomi H, Yoshida M, Mayumi T, Baron TH, de Santibañes E, Teoh AYB, Hwang TL, Ker CG, Chen MF, Han HS, Yoon YS, Choi IS, Yoon DS, Higuchi R, Kitano S, Inomata M, Deziel DJ, Jonas E, Hirata K, Sumiyama Y, Inui K, Yamamoto M. Tokyo Guidelines 2018: diagnostic criteria and severity grading of acute cholangitis (with videos). *J Hepatobiliary Pancreat Sci* 2018; **25**: 17-30 [PMID: [29032610](#) DOI: [10.1002/jhbp.512](#)]
- Buxbaum JL, Buitrago C, Lee A, Elmunzer BJ, Riaz A, Ceppa EP, Al-Haddad M, Amateau SK, Calderwood AH, Fishman DS, Fujii-Lau LL, Jamil LH, Jue TL, Kwon RS, Law JK, Lee JK, Naveed M, Pawa S, Sawhney MS, Schilperoort H, Storm AC, Thosani NC, Qumseya BJ, Wani S. ASGE guideline on the management of cholangitis. *Gastrointest Endosc* 2021; **94**: 207-221.e14 [PMID: [34023065](#) DOI: [10.1016/j.gie.2020.12.032](#)]
- Tsuchiya T, Sofuni A, Tsuji S, Mukai S, Matsunami Y, Nagakawa Y, Itoi T. Endoscopic management of acute cholangitis according to the TG13. *Dig Endosc* 2017; **29** Suppl 2: 94-99 [PMID: [28425666](#) DOI: [10.1111/den.12799](#)]
- Sato J, Nakahara K, Morita R, Morita N, Suetani K, Michikawa Y, Kobayashi S, Itoh F. Efficacy and Safety of Single-Session Endoscopic Stone Removal for Acute Cholangitis Associated with Choledocholithiasis. *Can J Gastroenterol Hepatol* 2018; **2018**: 3145107 [PMID: [30175087](#) DOI: [10.1155/2018/3145107](#)]
- Boulay BR, Birg A. Malignant biliary obstruction: From palliation to treatment. *World J Gastrointest Oncol* 2016; **8**: 498-508 [PMID: [27326319](#) DOI: [10.4251/wjgo.v8.i6.498](#)]
- Tan M, Schaffalitzky de Muckadell OB, Laursen SB. Association between early ERCP and mortality in patients with acute cholangitis. *Gastrointest Endosc* 2018; **87**: 185-192 [PMID: [28433613](#) DOI: [10.1016/j.gie.2017.04.009](#)]
- Mulki R, Shah R, Qayed E. Early vs late endoscopic retrograde cholangiopancreatography in patients with acute cholangitis: A nationwide analysis. *World J Gastrointest Endosc* 2019; **11**: 41-53 [PMID: [30705731](#) DOI: [10.4253/wjge.v11.i1.41](#)]
- Lu ZQ, Zhang HY, Su CF, Xing YY, Wang GX, Li CS. Optimal timing of biliary drainage based on the severity of acute cholangitis: A single-center retrospective cohort study. *World J Gastroenterol* 2022; **28**: 3934-3945 [PMID: [36157549](#) DOI: [10.3748/wjg.v28.i29.3934](#)]
- Khashab MA, Tariq A, Tariq U, Kim K, Ponor L, Lennon AM, Canto MI, Gurakar A, Yu Q, Dunbar K, Hutfless S, Kalloo AN, Singh VK. Delayed and unsuccessful endoscopic retrograde cholangiopancreatography are associated with worse outcomes in patients with acute cholangitis. *Clin Gastroenterol Hepatol* 2012; **10**: 1157-1161 [PMID: [22507875](#) DOI: [10.1016/j.cgh.2012.03.029](#)]
- Park N, Lee SH, You MS, Kim JS, Huh G, Chun JW, Cho IR, Paik WH, Ryu JK, Kim YT. Optimal timing of endoscopic retrograde cholangiopancreatography for acute cholangitis associated with distal malignant biliary obstruction. *BMC Gastroenterol* 2021; **21**: 175 [PMID: [33865307](#) DOI: [10.1186/s12876-021-01755-z](#)]
- Jang SE, Park SW, Lee BS, Shin CM, Lee SH, Kim JW, Jeong SH, Kim N, Lee DH, Park JK, Hwang JH. Management for CBD stone-related mild to moderate acute cholangitis: urgent versus elective ERCP. *Dig Dis Sci* 2013; **58**: 2082-2087 [PMID: [23456495](#) DOI: [10.1007/s10620-013-2595-z](#)]
- Lunt M. Selecting an appropriate caliper can be essential for achieving good balance with propensity score matching. *Am J Epidemiol* 2014; **179**: 226-235 [PMID: [24114655](#) DOI: [10.1093/aje/kwt212](#)]
- Tsou YK, Pan KT, Lee MH, Lin CH. Endoscopic salvage therapy after failed biliary cannulation using advanced techniques: A concise review. *World J Gastroenterol* 2022; **28**: 3803-3813 [PMID: [36157537](#) DOI: [10.3748/wjg.v28.i29.3803](#)]

- 21 **Park CS**, Jeong HS, Kim KB, Han JH, Chae HB, Youn SJ, Park SM. Urgent ERCP for acute cholangitis reduces mortality and hospital stay in elderly and very elderly patients. *Hepatobiliary Pancreat Dis Int* 2016; **15**: 619-625 [PMID: [27919851](#) DOI: [10.1016/s1499-3872\(16\)60130-3](#)]
- 22 **Du L**, Cen M, Zheng X, Luo L, Siddiqui A, Kim JJ. Timing of Performing Endoscopic Retrograde Cholangiopancreatography and Inpatient Mortality in Acute Cholangitis: A Systematic Review and Meta-Analysis. *Clin Transl Gastroenterol* 2020; **11**: e00158 [PMID: [32352721](#) DOI: [10.14309/ctg.0000000000000158](#)]
- 23 **Parikh MP**, Garg R, Chittajallu V, Gupta N, Sarvepalli S, Lopez R, Thota PN, Siddiki H, Bhatt A, Chahal P, Jang S, Stevens T, Vargo J, McCullough A, Sanaka MR. Trends and risk factors for 30-day readmissions in patients with acute cholangitis: analysis from the national readmission database. *Surg Endosc* 2021; **35**: 223-231 [PMID: [31950275](#) DOI: [10.1007/s00464-020-07384-z](#)]
- 24 **Navaneethan U**, Gutierrez NG, Jegadeesan R, Venkatesh PG, Butt M, Sanaka MR, Vargo JJ, Parsi MA. Delay in performing ERCP and adverse events increase the 30-day readmission risk in patients with acute cholangitis. *Gastrointest Endosc* 2013; **78**: 81-90 [PMID: [23528654](#) DOI: [10.1016/j.gie.2013.02.003](#)]



Published by **Baishideng Publishing Group Inc**
7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA

Telephone: +1-925-3991568

E-mail: bpgoffice@wjgnet.com

Help Desk: <https://www.f6publishing.com/helpdesk>

<https://www.wjgnet.com>

