INPLASY

# A systematic review of the influencing factors of post-ERCP pancreatitis after stone removal by ERCP

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## ADMINISTRATIVE INFORMATION

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**Amendments -** This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 10 January 2026 and was last updated on 10 January 2026.

## INTRODUCTION

**Review question / Objective** This study aims to investigate the influencing factors of postoperative pancreatitis following endoscopic retrograde cholangiopancreatography (ERCP) for stone removal by reviewing recent literature. Through a Meta-analysis, we summarize and explore the incidence rate and risk factors of pancreatitis after ERCP stone extraction, providing theoretical guidance for preventing the occurrence of postoperative pancreatitis.

**Rationale** Post-ERCP pancreatitis (PEP) has a high incidence rate. In previous studies, some researchers have explored the risk factors for PEP. However, to date, there remains a lack of recent and effective research on the risk factors for pancreatitis following ERCP stone extraction.

**Condition being studied** Choledocholithiasis, with an incidence rate of approximately 10-20% in China , is a common clinical condition. It primarily results from gallstones or intrahepatic stones falling into and becoming lodged in the common bile duct. Patients may be asymptomatic or only experience upper abdominal discomfort. Without further intervention, secondary cholangitis can occur, leading to symptoms such as abdominal pain, chills, high fever, and jaundice (Charcot's triad). In severe cases, bile duct obstruction may lead to acute obstructive suppurative cholangitis (AOSC), accompanied by hypotension and

neuropsychiatric symptoms (Reynolds' pentad), posing a threat to the patient's life.
In current treatment protocols for choledocholithiasis, endoscopic retrograde cholangiopancreatography (ERCP) is the most common diagnostic and therapeutic approach. ERCP stone extraction involves using a duodenoscope to visualize the bile duct, administer contrast dye to identify stone locations, and then remove the stones directly using specialized instruments. ERCP lithotomy is particularly suitable for elderly patients with multiple comorbidities, offering advantages such as minimal trauma and rapid postoperative recovery. However, it is crucial to remain vigilant about the risk of post-ERCP pancreatitis.

The occurrence of post-ERCP pancreatitis not only increases patient suffering but also prolongs hospital stays and exacerbates the financial burden on patients' families. The objective of this Meta-analysis is to investigate factors associated with the development of pancreatitis following ERCP stone extraction. By synthesizing recent cutting-edge research on ERCP for treating patients with choledocholithiasis, we aim to provide essential theoretical support for preventing post-ERCP pancreatitis (PEP).

## METHODS

**Search strategy** The search was limited to articles published in Chinese or English.
The Chinese search strategy used a combination of subject terms and free-text words:
((“胆总管结石” [Common Bile Duct Stones] AND “胰腺炎” [Pancreatitis] AND “因素” [Factors]) AND “内镜逆行胰胆管造影术” [Endoscopic Retrograde Cholangiopancreatography]) OR “ERCP”.
The English search strategy included:
((“Common bile duct stones” AND “factors” AND “pancreatitis”) AND “endoscopic retrograde cholangiopancreatography”) OR “ERCP”.
Both subject headings and corresponding free-text synonyms were utilized. The literature search was conducted up to June 30, 2025.

**Participant or population** Two reviewers independently conducted the initial screening by reading the abstracts of all retrieved studies to identify those that met the eligibility criteria. The full texts of potentially relevant articles were then carefully reviewed to determine final inclusion. Disagreements between the two reviewers were resolved through discussion, and if consensus could not be reached, a third party was consulted for arbitration.

**Intervention** An initial screening was conducted by reading the abstracts of all retrieved studies that met the eligibility criteria. Two reviewers independently performed the literature selection based on the inclusion and exclusion criteria. The full texts were then carefully reviewed to determine the final included studies. Disagreements between the two reviewers were resolved through discussion, and if consensus could not be reached, a third party was consulted for arbitration.

**Comparator** Study population: Patients with common bile duct stones undergoing ERCP stone extraction.
Outcome: Occurrence of post-ERCP pancreatitis (PEP).

**Study designs to be included** Inclusion criteria for the literature:(1) Study subjects: Patients with common bile duct stones who underwent ERCP treatment;(2) Study design: Consistent with randomized controlled studies or case-control studies;(3) Study outcome: The occurrence of PEP; (4) There are clear diagnostic standards for post-ERCP pancreatitis.

**Eligibility criteria**
Exclusion Criteria
(1) Review articles, conference proceedings, clinical guidelines, and duplicate publications;
(2) Studies that did not analyze risk factors for postoperative pancreatitis or only reported complications;
(3) Studies with incomplete data reporting, obvious errors in data, or those from which complete and accurate raw data could not be extracted.

**Information sources** We systematically searched the following databases: PubMed, Embase, Web of Science, ProQuest, CNKI (China National Knowledge Infrastructure), Wanfang Data, and VIP Information.

**Main outcome(s)** This study finally included 14 articles, evaluating 14 potential risk factors. The total number of patients enrolled in the studies was 7,813, among whom 623 developed post-ERCP pancreatitis, resulting in an overall incidence rate of 7.97%. Male gender (RR = 0.649, 95% CI [0.482, 0.875], P = 0.005) was identified as a protective factor against post-ERCP pancreatitis following stone extraction. In contrast, a history of prior pancreatitis (RR = 3.245, 95% CI [1.680, 6.268], P < 0.001), a history of sphincter of Oddi dysfunction (SOD) (RR = 2.931, 95% CI [1.567, 5.485], P = 0.001), difficult cannulation during the procedure (RR = 2.391, 95% CI [1.741, 3.284], P < 0.001), and pancreatic duct opacification during

ERCP (RR = 3.438, 95% CI [2.604, 4.537], P < 0.001) were found to be independent risk factors for the development of post-ERCP pancreatitis after stone removal.

**Additional outcome(s)** Through this study, male gender was identified as a protective factor against post-ERCP pancreatitis (PEP) following stone extraction. Independent risk factors for PEP included a history of prior pancreatitis, sphincter of Oddi dysfunction (SOD), difficult cannulation during the procedure, and pancreatic duct opacification. Factors such as age, history of cholecystectomy, diabetes mellitus, hypertension, periampullary diverticula, common bile duct dilation, endoscopic sphincterotomy (EST), endoscopic papillary balloon dilation (EPBD), and procedure duration showed no significant association with the development of PEP.
Stratified management strategies should be implemented for high-risk populations: preoperatively, individuals with a history of pancreatitis or SOD should be prioritized for screening, and prophylactic pancreatic duct stenting may be considered. Intraoperatively, wire-guided cannulation should be employed to reduce intubation time, and low-pressure contrast injection techniques should be used to minimize ductal pressure. Postoperatively, high-risk patients may benefit from combined pharmacological prophylaxis, including rectal NSAIDs (e.g., indomethacin suppositories) and somatostatin analogues.

**Data management** We searched for previous studies on factors influencing the occurrence of pancreatitis after ERCP stone extraction using relevant keywords. After an initial screening of all retrieved literature abstracts that met the eligibility criteria, two reviewers independently applied the inclusion and exclusion criteria to select articles. The full texts of the selected studies were then carefully reviewed, and baseline characteristics and case data were extracted. Original data related to risk factors for post-ERCP pancreatitis (PEP) were obtained from each included study. Study quality was assessed using the Newcastle-Ottawa Scale (NOS). Data analysis and heterogeneity testing were performed using Stata 18 software to explore and summarize the risk factors associated with the development of PEP following ERCP lithotomy.

**Quality assessment / Risk of bias analysis** All studies included in this analysis were observational. The quality of each study was assessed using the Newcastle-Ottawa Scale (NOS), which evaluates three core domains: selection of the study population, comparability between groups, and assessment of exposure or outcome. The scale consists of eight items with a maximum score of 9. Studies scoring ≥7 points were considered high quality, those scoring 5–6 points were deemed moderate quality, and those scoring ≤4 points were classified as low quality. Only studies with a score of at least 5 were included.

**Strategy of data synthesis** In this study, all data types were converted into binary categorical variables. The original binary data (count data) were analyzed using the relative risk (RR) and its 95% confidence interval (CI). When RR > 1 and the lower limit of the 95% CI was greater than 1, the factor was considered a risk factor (i.e., increasing the risk of post-ERCP pancreatitis [PEP]). All analyses were performed using Stata 18 software.

**Subgroup analysis** When heterogeneity exceeds 50%, subgroup analysis should be further conducted using Stata 18 software to identify the sources of heterogeneity and evaluate the robustness of the results.

**Sensitivity analysis** Conversely, when RR < 1 and the upper limit of the 95% CI was less than 1, the factor was identified as a protective factor (i.e., reducing the risk of PEP). A significance threshold of P < 0.05 was used to determine statistical significance.

**Language restriction** Chinese, English.

**Country(ies) involved** China.

**Keywords** Common bile duct stones; ERCP; Pancreatitis; Risk factors; Meta-analysis.

**Contributions of each author**
Author 1 - Bai yf - Writing the manuscript.
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Author 2 - Liu Z - Provide theoretical guidance on research protocol design and statistical methods.

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