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Prophylactic Effect of Pancreatic Duct Stent and Diclofenac in Patients at High Risk for Post-ERCP Pancreatitis

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Abstract: ***Objective:*** *To investigate the preventive effect of pancreatic duct stent combined with diclofenac on post-endoscopic retrograde cholangiopancreatography (ERCP) pancreatitis in high-risk populations, and to evaluate its impact on clinical indicators.* ***Methods:*** *A total of 95 high-risk patients for post-ERCP pancreatitis treated at the hospital from January 2022 to January 2025 were enrolled and randomly divided into a combination group (pancreatic duct stent+diclofenac suppository) of 43 cases and a diclofenac group of 52 cases. A 4-7 cm short pancreatic duct stent was used, and the diclofenac group received 50 mg diclofenac at 1 h before surgery and after surgery. The incidence of post-ERCP pancreatitis, VAS score, length of hospital stay, serum amylase level, WBC, CRP, and ERCP-related complications were observed and compared between the two groups.* ***Results:*** *The number of patients without pancreatitis in the combination group was greater than that in the diclofenac group, and the length of hospital stay was shorter than that in the diclofenac group (P<0.05). There was no statistically significant difference in VAS scores between the two groups (P>0.05). At 24 h after surgery, serum amylase and CRP increased in both groups, and the serum amylase and CRP in the combination group were lower than those in the diclofenac group (P<0.05). There was no statistically significant difference in WBC within or between the two groups (P>0.05). The complication rate in the combination group was 2.33%, lower than the 15.38% in the diclofenac group (P<0.05).* ***Conclusion:*** *Pancreatic duct stent combined with diclofenac can synergistically reduce the incidence and severity of pancreatitis in high-risk patients, improve inflammatory indicators, and shorten hospital stay, without significantly increasing patient pain, and reduces the incidence of ERCP-related complications. It is recommended as a first-line preventive strategy for post-ERCP pancreatitis.*

Keywords: Endoscopic Retrograde Cholangiopancreatography, High-risk population, Pancreatitis, Diclofenac, Pancreatic Duct Stent.

1. Introduction

Although endoscopic retrograde cholangiopancreatography (ERCP) has been widely used in clinical practice, its postoperative complications remain an important factor affecting patient prognosis and postoperative recovery. How to effectively prevent post-ERCP pancreatitis in high-risk populations has become a focus of clinical research. The incidence of post-ERCP pancreatitis in high-risk populations can rise to 15%–40%, leading to a 2–3-fold increase in medical costs, and the mortality rate in severe cases reaches 20%–30% [1, 2]. The current prevention system faces a dual dilemma: first, although traditional mechanical preventive measures (such as pancreatic duct stents) can reduce the risk of post-ERCP pancreatitis (PEP) (RR = 0.35), their benefit is limited by the stent migration rate (5%) and operator experience variability (success rate 75%–90%); second, among pharmacological preventive regimens, although rectal diclofenac has been incorporated into international guidelines, its preventive efficacy in high-risk populations exhibits a ceiling effect and may induce gastrointestinal bleeding [3, 4].Therefore, it is imperative to seek new and effective preventive strategies. In recent years, the application of pancreatic duct stents has achieved certain progress in preventing PEP; however, relying solely on pancreatic duct stent placement does not always yield ideal results. Studies have shown that diclofenac can reduce the occurrence of post-ERCP pancreatitis by inhibiting cyclooxygenase (COX) activity in the pancreas and decreasing the release of inflammatory mediators [5]. Nevertheless, the use of diclofenac alone has also failed to completely resolve the issue of post-ERCP pancreatitis prevention. This study aims to compare the efficacy of combined pancreatic duct stent and diclofenac therapy versus conventional treatment in high-risk populations undergoing ERCP, so as to provide a more scientific preventive strategy for clinical practice, reduce post-ERCP complications, and promote postoperative recovery.

2. Materials and Methods

2.1 Baseline Data

A total of 95 patients at high risk for post-ERCP pancreatitis (PEP) who were treated at The Second Affiliated Hospital of Xingtai Medical College from January 2022 to January 2025 were enrolled. Inclusion criteria: 1) classified as high-risk for PEP, meeting at least one of the following risk factors: previous history of acute pancreatitis, gallstones or biliary obstruction, chronic pancreatitis, hyperlipidemia or diabetes, pancreatic tumors, or technically difficult ERCP; 2) scheduled to undergo ERCP with appropriate indications for the procedure; 3) no history of severe drug allergy and able to tolerate rectal administration of diclofenac; 4) able to complete at least 1 month of postoperative follow-up. Exclusion criteria: 1) concurrent severe hepatic or renal dysfunction, cardiac disease, or other underlying conditions precluding tolerance to diclofenac therapy; 2) pre-existing severe digestive system disease before surgery; 3) obvious bleeding tendency before or during surgery. Enrolled patients were divided into a combination group (pancreatic duct stent placement combined with rectal diclofenac suppository) of 43 cases and a diclofenac group (rectal diclofenac suppository alone) of 52 cases. This study protocol was approved by the

Ethics Committee of The Second Affiliated Hospital of Xingtai Medical College, and all enrolled patients signed informed consent forms.

2.2 Treatment Methods

Diclofenac group: fasting for 12 h before surgery, routine examinations, and 50 mg diclofenac sodium injection administered intramuscularly 1 h before surgery. Intramuscular injection of pethidine hydrochloride, diazepam, and anisodamine. ERCP procedure: the patient was placed in the supine position, and the operative area was disinfected and draped. A duodenoscope was inserted orally for pancreatobiliary duct imaging, and the pancreaticobiliary ducts were examined. If necessary, corresponding endoscopic interventions were performed. Postoperatively, 50 mg diclofenac suppository was administered rectally, and the patient was transferred to the recovery room for monitoring of biochemical indicators.

The anesthesia method, ERCP procedure, and diclofenac administration protocol in the combination group were kept completely identical to those in the diclofenac-only group, with prophylactic pancreatic duct stent placement additionally performed on this basis. The specific procedural steps were as follows: a duodenoscope was inserted through the patient's oral cavity, and the pancreaticobiliary system was localized under X-ray fluoroscopy, with clear visualization of the pancreatic duct morphology and patency. Pancreatography was further performed to rule out strictures, obstructions, and other pathological abnormalities in the pancreatic duct. During the procedure, a guidewire was used to precisely guide catheter placement under endoscopic guidance, and a short stent measuring 4–7 cm in length (Cook, Ireland Ltd.) was deployed into the pancreatic duct. Strict positional control was maintained during stent placement to ensure complete coverage of the strictured or obstructed lesion area, while avoiding invasion of the sensitive tissue regions of the pancreatic head and body at both stent ends. The distal end of the stent was left in the duodenal lumen to ensure normal drainage of pancreatic juice into the duodenum. After stent deployment, X-ray fluoroscopy was used to verify stent expansion status, confirming stable positioning without migration or dislodgement, and confirming unobstructed pancreatic duct drainage with no residual obstruction. Stent fixation stability was re-checked to ensure satisfactory placement outcomes. Postoperatively, the timing of stent removal was individualized based on patient recovery: for patients without any postoperative complications, the stent was removed at 3–5 days postoperatively; for patients with postoperative pancreatitis, the stent was removed at 7 days postoperatively after complete resolution of symptoms such as abdominal pain and inflammation; for patients with postoperative hyperamylasemia, the stent was removed 3 days after serum amylase levels returned to normal.

2.3 Observation Indicators and Evaluation Criteria

(1) Incidence of PEP: The occurrence of postoperative ordinary and severe pancreatitis was observed and recorded. Diagnosis was confirmed within 24 h after surgery based on clinical symptoms and laboratory tests. The condition was defined as onset when abdominal pain, nausea, vomiting, and other symptoms were present, and serum amylase or lipase exceeded 3 times the upper limit of normal. (2) Hospital stay: The total number of days from admission to discharge was recorded. (3) Pain score: Pain intensity was assessed using the Visual Analogue Scale (VAS) at 1 h, 6 h, and 24 h after surgery, with patients self-rating on a scale of 0–10, where 0 indicated no pain and 10 indicated severe pain [6]. (4) Laboratory indicators: Venous blood samples were collected before surgery and at 24 h after surgery to measure white blood cell count (WBC), serum amylase, and C-reactive protein (CRP) levels. (5) Surgery-related complications: The occurrence of ERCP-related complications, such as bleeding and infection, within 48 h after surgery was observed and recorded.

2.4 Statistical Methods

SPSS 26.0 software was used for data analysis. Measurement data conforming to a normal distribution were described as ($\bar{x}\pm s$) and analyzed using the t-test; data not conforming to a normal distribution were analyzed using the rank-sum test. Count data were expressed as rates (%) and analyzed using Fisher's exact test or the chi-square test. A $P<0.05$ was considered statistically significant.

3. Results

3.1 Comparison of Baseline Data Between Two Groups

There were 26 males and 17 females in the combination group, and 30 males and 22 females in the diclofenac group. There were no statistically significant differences in baseline data such as age and sex between the two groups ($P>0.05$).

3.2 Comparison of PEP Incidence and Hospital Stay Between the Two Groups

The number of patients without pancreatitis in the combination group was greater than that in the diclofenac group, and the hospital stay was shorter than that in the diclofenac group ($P<0.05$), as shown in Table 1.

3.3 Comparison of VAS Scores Between the Two Groups

At 1, 6, and 12 h postoperatively, there was no statistically significant difference in VAS scores between the two groups ($P>0.05$), as shown in Table 1.

3.4 Comparison of Laboratory Tests Between the Two Groups

At 24 h postoperatively, serum amylase and CRP levels were elevated in both groups, and the serum amylase and CRP levels in the combination group were lower than those in the diclofenac group ($P<0.05$).

There was no statistically significant difference in WBC changes within or between the two groups ($P>0.05$). See Table 1.

3.5 ERCP-related Complications in the Two Groups

The incidence of complications in the combination group was

2.33%, which was lower than the 15.38% in the diclofenac group (P<0.05), as shown in Table 1.

Table 1: Comparative Analysis

Variable	Joint(n=43)	Control(n=52)	Statistic	P
Gender(male/female)	26/17 (60.47%/39.53%)	30/22 (57.69%/42.31%)	χ^2=0.075	0.7845
Age, Mean±SD	62.12+8.21	64.42+8.11	t=-1.371	0.1740
Overall PEP incidence	4/43 (9.30%)	14/52 (26.92%)	OR=0.278	0.0363
PEP severity (mild/moderate/severe)	39/3/1	38/9/5	χ^2=4.871	0.0876
Severe PEP incidence	1/43 (2.33%)	5/52 (9.62%)	OR=0.224	0.2166
ERCP-related adverse events	1/43 (2.33%)	8/52 (15.38%)	OR=0.131	0.0376
Hospital stay, Mean±SD	5.31+1.40	6.06+1.30	t=-2.660	0.0093
VAS 1st hour,Mean±SD	6.42+1.34	6.23+1.35	t=0.657	0.5128
VAS at 6 hours postop, Mean±SD	5.37+1.40	5.36+1.27	t=0.042	0.9665
VAS at 12 hours postop, Mean±SD	4.28+1.29	4.12+1.21	t=0.625	0.5335
Preoperative serum amylase, Mean±SD	83.28+25.46	89.06+23.06	t=-1.148	0.2541
Postoperative serum amylase, Mean±SD	271.25+25.52	299.18+33.83	t=-4.581	0.0000
Preoperative CRP, Mean±SD	6.74+1.43	7.05+1.37	t=-1.041	0.3009
CRP at 24 hours postoperatively, Mean±SD	11.39+3.58	15.71+4.04	t=-5.523	0.0000
Preoperative WBC, Mean±SD	7.44+1.60	7.80+1.52	t=-1.128	0.2623
WBC at 24 hours postoperatively, Mean±SD	6.95±1.30	6.80+1.41	t=0.531	0.5965

t: t-test, χ^2: Chi-square test
SD: standard deviation

4. Discussion

The results of this study show that pancreatic duct stenting combined with diclofenac treatment can reduce the incidence of PEP, shorten hospital stay, and decrease the occurrence of ERCP-related complications. The incidence of pancreatitis and severe pancreatitis in the combination group was significantly lower than that in the diclofenac group, a finding consistent with existing studies, indicating that pancreatic duct stenting has a potential protective effect in preventing post-ERCP pancreatitis [7]. The application of pancreatic duct stents reduces pancreatic inflammatory response by maintaining pancreatic duct patency and preventing pancreatic juice reflux. During ERCP, mechanical injury to the pancreatic duct, pancreatic juice extravasation, and reflux are among the main causes of post-procedural pancreatitis [2]. Elevated postoperative pancreatic duct pressure can impede the normal drainage of pancreatic juice, thereby exacerbating pancreatic inflammation. The placement of a pancreatic duct stent provides physical support to the duct, preventing pancreatic fluid retention and reflux, and thus effectively reducing the incidence of pancreatitis. For high-risk patients, pancreatic duct stenting is particularly effective in preventing localized pancreatic fluid accumulation and inflammatory responses caused by factors such as improper surgical manipulation or pancreatic duct stenosis during the procedure, further enhancing postoperative recovery outcomes. In this study, the improvement in postoperative inflammatory responses observed in the combined group also suggests that the role of the pancreatic duct stent extends beyond merely physically draining the duct; by reducing mechanical injury to the pancreas and pancreatic juice reflux, it alleviates both local and systemic postoperative inflammatory responses, thereby facilitating recovery. This mechanism is consistent with previous research findings, which indicate that pancreatic duct stenting can reduce postoperative local pancreatic injury and systemic inflammatory responses, lowering the incidence of pancreatitis [8]. Compared with diclofenac monotherapy, patients treated with pancreatic duct stenting combined with diclofenac had a significantly shorter hospital stay, suggesting that this combination regimen can promote postoperative recovery. Accelerated postoperative recovery not only alleviates clinical discomfort but also helps reduce healthcare resource utilization. Laboratory results showed that postoperative serum amylase and CRP levels in the combination group were significantly lower than those in the diclofenac group, indicating that the combined intervention has a superior effect on suppressing postoperative inflammatory responses. Although there was no statistically significant difference in postoperative WBC levels between the two groups, the improvements in serum amylase and CRP suggest that combination therapy can reduce local pancreatic injury and exert an inhibitory effect on systemic inflammatory responses. Pain assessment results showed no significant difference in postoperative VAS pain scores between the two groups, indicating that pancreatic duct stenting combined with diclofenac does not aggravate postoperative pain, and this regimen can maintain satisfactory pain control while reducing the risk of postoperative complications. Regarding ERCP-related complications, the overall complication rate in the combination group was significantly lower than that in the diclofenac group, further confirming that pancreatic duct stenting can reduce adverse events after ERCP and has positive implications for reducing the occurrence of complications such as bleeding, infection, and pancreatic pseudocysts. Combination therapy improved patient safety and clinical outcomes by reducing postoperative complications. From a pathophysiological perspective, the synthesis of prostaglandins in pancreatic tissue is closely related to the development of pancreatic inflammation. During ERCP, the pancreas may be injured due to surgical manipulation and contrast agent use, thereby activating the inflammatory response [9]. Diclofenac reduces the occurrence and severity of postoperative pancreatitis to some extent by inhibiting COX enzymes and reducing the release of prostaglandins [10]. Although diclofenac can significantly reduce postoperative inflammatory response, it has not been able to completely prevent the occurrence of pancreatitis when used alone. This suggests that although non-steroidal anti-inflammatory drugs can alleviate local inflammation, they may not be sufficient to completely prevent pancreatitis induced by ERCP in high-risk patients [7]. This is consistent with the efficacy comparison results between the diclofenac group and the combination group in this study, namely that diclofenac alone cannot fully exert the expected preventive effect. Pancreatic duct stents reduce the opportunity for pancreatic injury and pancreatic juice reflux through physical protection, while diclofenac alleviates postoperative pancreatic inflammatory responses through chemical

inhibition. The combined use of the two is mechanistically complementary: the pancreatic duct stent controls local mechanical injury, while diclofenac reduces chemical inflammatory responses, and their synergistic effect effectively decreases the risk of postoperative pancreatitis [11]

Currently, preventive strategies for high-risk groups of post-ERCP pancreatitis have not yet reached a complete consensus regarding drug selection, dosage, timing of administration, and endoscopic procedural technical parameters. Clinical management protocols still vary across different centers, which to some extent affects the efficacy evaluation and clinical promotion of preventive regimens. Based on the findings of this study, pancreatic duct stent placement combined with diclofenac can serve as an effective intervention for preventing post-ERCP pancreatitis in high-risk patients and holds clinical application value. For high-risk populations, particularly those with comorbid chronic pancreatitis, biliary diseases, and other underlying digestive system conditions, a perioperative preventive regimen combining pancreatic duct stent placement with diclofenac may be considered. In addition to reducing the risk of post-ERCP pancreatitis, this regimen can also decrease ERCP-related complications, shorten hospital stay, and help control medical costs. For cases involving technically difficult procedures and complex operational steps, standardized placement of pancreatic duct stents should be emphasized to fully realize their preventive effect. This study still has certain limitations, including a limited follow-up observation period. Future research with longer follow-up durations, incorporating multidimensional indicators such as genetic and immunological factors, is warranted to further analyze differential responses to this preventive regimen across populations, thereby providing evidence-based support for establishing individualized preventive strategies for post-ERCP pancreatitis.

In conclusion, pancreatic duct stenting combined with diclofenac is more effective than diclofenac alone in the treatment of patients at high risk for post-ERCP pancreatitis. It significantly reduces the incidence of pancreatitis in high-risk populations, improves inflammatory markers, shortens hospital stay, does not significantly increase postoperative pain, and reduces the occurrence of complications. It can serve as an effective preventive strategy for patients at high risk of post-ERCP pancreatitis, offering a feasible therapeutic option for clinical practice.

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References

[1] Akshintala V S, Kanthasamy K, Bhullar F A, et al. Incidence, severity, and mortality of post-ERCP pancreatitis: an updated systematic review and meta-analysis of 145 randomized controlled trials [J]. Gastrointestinal endoscopy, 2023,98(1):1-6.

[2] Kang H, Park C H, Ryu K. Prevention, Detection, and Management of Post-Endoscopic Retrograde Cholangiopancreatography Pancreatitis [J]. Gut and liver, 2025,19(6):795-808.

[3] Mazaki T, Masuda H, Takayama T. Prophylactic pancreatic stent placement and post-ERCP pancreatitis: a systematic review and meta-analysis [J]. Endoscopy, 2010,42(10):842-853.

[4] Arham M, Bhat A, Ali Z, et al. Rectal Diclofenac Versus Indomethacin in Preventing Post-ERCP Pancreatitis: A Systematic Review and Meta-Analysis [J]. Digestive diseases and sciences, 2026,71(6):2383-2393.

[5] Geng C, Li X, Li Y, et al. Nonsteroidal anti-inflammatory drugs alleviate severity of post-endoscopic retrograde cholangiopancreatography pancreatitis by inhibiting inflammation and reducing apoptosis [J]. Journal of gastroenterology and hepatology, 2020,35(5):896-904.

[6] Dourado G B, Volpato G H, de Almeida-Pedrin R R, et al. Likert scale vs visual analog scale for assessing facial pleasantness [J]. American journal of orthodontics and dentofacial orthopedics: official publication of the American Association of Orthodontists, its constituent societies, and the American Board of Orthodontics, 2021,160(6):844-852.

[7] Hanscom M. Benefits of NSAIDs Plus Pancreatic Stenting to Prevent Post-ERCP Pancreatitis [J]. Gastroenterology, 2024,167(4):812.

[8] Cha S, Leung W D, Lehman G A, et al. Does leaving a main pancreatic duct stent in place reduce the incidence of precut biliary sphincterotomy-associated pancreatitis? A randomized, prospective study [J]. Gastrointestinal endoscopy, 2013,77(2):209-216.

[9] Ribeiro I B, Do Monte Junior E S, Miranda Neto A A, et al. Pancreatitis after endoscopic retrograde cholangiopancreatography: A narrative review [J]. World journal of gastroenterology, 2021, 27(20): 2495-2506.

[10] Okuno M, Shiroko J, Taguchi D, et al. The Effectiveness of the Rectal Administration of Low-dose Diclofenac for the Prevention of Post-endoscopic Retrograde Cholangiopancreatography Pancreatitis [J]. Internal medicine (Tokyo, Japan), 2018,57(16):2289-2294.

[11] Elmunzer B J, Foster L D, Serrano J, et al. Indomethacin with or without prophylactic pancreatic stent placement to prevent pancreatitis after ERCP: a randomised non-inferiority trial [J]. The Lancet, 2024, 403(10425): 450-458.