Application and Nursing Care of Endoscopic Retrograde Cholangiopancreatography Combined with Intraductal Ultrasonography in the Differential Diagnosis of Benign and Malignant Biliary Strictures (Postprint)

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Abstract

This study investigates the application and nursing cooperation of endoscopic retrograde cholangiopancreatography (ERCP) combined with intraductal ultrasound (IDUS) in the differential diagnosis of benign and malignant bile duct strictures. A retrospective analysis was conducted on the clinical data of 208 patients with unexplained bile duct strictures who underwent ERCP combined with IDUS treatment in our hospital from January 2016 to December 2021. All 208 procedures were completed successfully. Diagnosis was confirmed through biopsy pathology, surgical findings, and follow-up. Malignant strictures accounted for 87 cases, including 50 cases of cholangiocarcinoma (21 in the lower segment, 19 in the middle segment, 10 in the upper segment/hilar region), 15 cases of pancreatic cancer, 12 cases of ampullary carcinoma, and 10 cases of invasion by other metastatic tumors; benign strictures accounted for 121 cases. Postoperative complications included hyperamylasemia in 92 cases, fever in 20 cases, delayed bleeding in 1 case, with no cases of postoperative perforation. All patients improved and were discharged after treatment with fasting, anti-inflammatory therapy, hemostasis, enzyme suppression, and fluid replacement. Preoperative psychological guidance and thorough preparation, intraoperative coordinated cooperation, prevention and monitoring of complications, and postoperative meticulous nursing care are crucial for ensuring the successful completion of the procedure.

Full Text

Application of Endoscopic Retrograde Cholangiopancreatography Combined with Intraductal Ultrasonography in the Differential Diagnosis of Benign and Malignant Biliary Strictures and Nursing Care

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Abstract

Objective: To explore the application and nursing cooperation of endoscopic retrograde cholangiopancreatography (ERCP) combined with intraductal ultrasonography (IDUS) in the differential diagnosis of benign and malignant biliary strictures. **Methods:** A retrospective analysis was conducted on clinical data from patients with unexplained biliary strictures who underwent ERCP combined with IDUS treatment at our hospital from [month/year] to [month/year]. All patients successfully completed the procedure, with diagnoses confirmed through biopsy pathology, surgery, and follow-up. **Results:** Among the cases, malignant strictures were identified in [number] patients, including [number] cases of cholangiocarcinoma ([number] in the lower segment, [number] in the middle segment, and [number] in the upper/hilar region), [number] cases of pancreatic cancer, [number] cases of ampullary carcinoma, and [number] cases of other metastatic tumor invasions. Benign strictures were found in [number] patients. Postoperative complications included hyperamylasemia in [number] cases and delayed bleeding in [number] cases; no perforations occurred. All patients improved and were discharged after receiving fasting, anti-inflammatory, hemostatic, enzyme inhibition, and fluid replacement therapies. **Conclusion:** Comprehensive preoperative psychological guidance and preparation, seamless intraoperative cooperation, diligent prevention and monitoring of complications, and meticulous postoperative nursing care are critical components for ensuring successful completion of ERCP combined with IDUS examinations.

Keywords: endoscopic retrograde cholangiopancreatography; intraductal ultrasonography; biliary stricture; perioperative nursing

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Introduction

Biliary stricture refers to the narrowing or obstruction of the bile duct lumen caused by various factors, resulting in impaired bile drainage and accumulation, which leads to liver dysfunction and obstructive jaundice, subsequently causing biliary tract infection. Biliary strictures are classified into benign and malignant types. Benign strictures primarily include inflammatory strictures caused by liver transplantation, cholecystectomy, and bile duct stones, as well

as strictures resulting from bile duct polyps, primary sclerosing cholangitis, extrinsic compression (Mirizzi syndrome, chronic pancreatic fibrosis), and various injuries [1]. Malignant biliary strictures mainly refer to narrowings caused by invasion or compression of the bile duct by cholangiocarcinoma, hepatocellular carcinoma, gallbladder cancer, pancreatic cancer, ampullary carcinoma, and other metastatic tumors [2].

Determining the benign or malignant nature of biliary strictures presents a significant challenge in current diagnosis and treatment. Imaging modalities such as CT, magnetic resonance cholangiopancreatography (MRCP), and endoscopic ultrasonography (EUS) can reveal the morphology, location, size of biliary strictures, and lymph node metastasis. However, when the mass is small and the lesion is confined within the bile duct lumen, these methods are often insufficient for accurate diagnosis [3]. While ERCP combined with bile duct brush cytology can obtain cytological samples from stricture sites, the sensitivity of bile duct brushing is relatively low (30-40%) [4]. In recent years, intraductal ultrasonography (IDUS) has gained increasing attention in evaluating biliary strictures. IDUS can display the microstructure of the bile duct wall and surrounding tissues approximately 2 cm from the lesion, and ERCP combined with IDUS better demonstrates the relationship between peribiliary tissues and the stricture lesion. Studies have shown that IDUS combined with ERCP achieves sensitivity, specificity, and accuracy rates of 88%, 79%, and 87%, respectively, in diagnosing malignant biliary strictures [5]. This combination significantly improves the differential diagnosis of biliary strictures, and IDUS-guided targeted biopsy under fluoroscopic guidance also enhances biopsy positivity rates [6].

Successful completion of bile duct cannulation, acquisition of clear and complete ultrasound images, and prevention of complications represent key focuses and challenges in nursing care. Our hospital employed ERCP combined with IDUS from [month/year] to [month/year] to differentially diagnose [number] patients with unexplained biliary strictures, achieving satisfactory results. This report summarizes our application experience and nursing protocols.

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1. Clinical Data

A retrospective analysis was conducted on clinical data from patients with unexplained biliary strictures who underwent ERCP combined with IDUS treatment at our hospital from [month/year] to [month/year]. The cohort included [number] male and [number] female patients, aged [age range] years, with an average age of [mean] years. All patients presented with varying degrees of bilirubin elevation, accompanied by abdominal pain in [number] cases, jaundice in [number] cases, skin pruritus in [number] cases, and weight loss and fatigue in [number] cases. Carcinoembryonic antigen was elevated in [number] patients, and alpha-fetoprotein was elevated in [number] patients. All cases underwent preliminary evaluation with B-ultrasound and/or CT/MRCP imaging.

All patients successfully completed ERCP combined with IDUS procedures. Diagnoses were confirmed through biopsy pathology, surgical findings, and follow-up results. Malignant strictures were identified in [number] patients, comprising [number] cases of cholangiocarcinoma ([number] in the lower segment, [number] in the middle segment, and [number] in the upper/hilar region), [number] cases of pancreatic cancer, [number] cases of ampullary carcinoma, and [number] cases of other metastatic tumor invasions. Benign strictures were diagnosed in [number] patients. Postoperative complications included hyperamylasemia in [number] cases, which resolved with extended enzyme inhibition and PPI therapy; fever in [number] cases, which normalized after combination antibiotic therapy (cefoperazone-sulbactam + levofloxacin + ornidazole); and delayed bleeding in [number] cases, which was successfully managed with endoscopic metal clip placement. No postoperative perforations occurred. All patients improved and were discharged after receiving fasting, anti-inflammatory, hemostatic, enzyme inhibition, and fluid replacement therapies.

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2. Nursing

2.1 Preoperative Preparation

Patients often experience tension, anxiety, and fear due to uncertain diagnoses and lack of understanding about ERCP procedures. These psychological states affect the relaxation of the duodenal papillary sphincter and directly influence ERCP cannulation success rates [7]. Nurses should provide health education tailored to patients' age, educational level, and psychological resilience, explaining the purpose, procedure, safety, and cooperation requirements of ERCP combined with IDUS to alleviate negative emotions and obtain informed consent from patients and their families.

Preoperative preparation includes completing blood routine tests, coagulation profiles, liver and kidney function tests, electrocardiography, chest radiography, and CT/MRCP imaging. Patients fast for 12 hours and receive an intravenous catheter in the right arm. All metal objects and removable dentures are removed, and patients change into loose, front-opening gowns. Thirty minutes before the procedure, patients receive oral defoaming agents and intramuscular sedatives, analgesics, and antispasmodics to reduce intraoperative discomfort and prevent gastrointestinal spasms.

2.2 Equipment Processing

The duodenoscope is a reusable, sophisticated medical instrument with complex structures. The elevator channel and distal tip architecture are particularly prone to inadequate cleaning and disinfection, potentially leading to microbial residue and healthcare-associated infections, especially in ERCP procedures that breach mucosal barriers [8]. Contributing factors include insufficient irrigation

of the duodenoscope elevator channel, inadequate brushing of the distal tip, incomplete cleaning of the distal cap, insufficient disinfection duration, and inadequate drying of the elevator channel. Reports of duodenoscope-related infections are not uncommon, prompting significant attention from experts worldwide regarding cleaning and disinfection protocols. Studies have demonstrated that enhanced processing after high-level disinfection reduces residual pathogenic microorganisms on endoscopes [9].

To minimize iatrogenic infection risk, our department strictly adheres to duodenoscope cleaning and disinfection protocols while performing additional manual brushing and repeated high-level disinfection with ortho-phthalaldehyde before procedures to reduce bacterial counts and prevent infection.

2.3 Intraoperative Nursing Cooperation

2.3.1 Patient Positioning Patients are placed in prone position with the head turned to the right. This position restricts thoracic movement and affects normal respiration, predisposing patients to hypoxemia. Oxygen is administered at 2 L/min, and a slanted pillow under the right shoulder slightly elevates one lung to facilitate breathing. Prolonged prone positioning creates pressure on the chest, abdomen, and knee joints, particularly in emaciated patients or those with drainage tubes. Placing thin blankets on the examination table reduces thoracoabdominal pressure, while soft pillows under joints, bony prominences, or drainage sites increase support area and improve patient comfort and cooperation.

The duodenoscope is a side-viewing instrument, and prone positioning alters gastric axis orientation, potentially causing the endoscope to lose direction in the gastric fundus. In such cases, assisting the patient to bend the right leg, support themselves on the right hand, and elevate the right shoulder slightly to achieve left lateral prone position helps expose the pylorus and facilitates advancement to the duodenal descending segment.

2.3.2 Bile Duct Cannulation and Sphincterotomy The nurse adjusts sphincterotome tension according to papillary morphology and bile duct orientation to modify catheter insertion direction. After successful cannulation, the sphincterotome is advanced over the guidewire into the bile duct, and a small amount of contrast medium is injected for confirmation. The IDUS probe tip has a diameter of 2 mm, making passage through the duodenal papilla difficult even with guidewire assistance and risking probe damage. A small sphincterotomy can facilitate passage. The nurse adjusts endoscope depth and angle, maintaining the cutting wire at the 11-12 o'clock position. Electrosurgical parameters are set using a "fast then slow" approach. The wire should not be tightened or pulled too quickly to avoid "zipper-like" incision. Carbon deposits or eschar on the wire should be cleaned promptly to ensure adequate contact with papillary tissue. The incision should be just large enough to allow smooth passage of the ultrasound probe.

2.3.3 Intraductal Ultrasonography The IDUS probe tip consists of a transparent sheath containing ultrasound transmission fluid, a transducer, a base, and a drive shaft. Before use, the nurse must check for air bubbles around the transducer and ensure adequate transmission fluid. Bubbles degrade ultrasound image quality and must be removed by grasping the insertion tube approximately 10 cm from the tip, pointing the tip downward, and shaking vigorously until bubbles are eliminated, taking care not to impact the tip or connection. If transmission fluid is insufficient, hanging the tip vertically for several hours allows fluid to accumulate.

When passing the IDUS probe over the guidewire, the side-hole end must be held to avoid guidewire friction or axial misalignment that could rupture the insertion port. The probe tip should be inserted vertically into the instrument channel to prevent bending, minimizing endoscope angulation. The elevator should be fully raised before insertion and lowered when the probe contacts it, allowing the tip to exit the channel before raising the elevator again to bring the IDUS probe into view. This sequence prevents elevator damage to the ultrasound transducer.

Within the bile duct lumen, bile serves as the ultrasound medium; if insufficient, contrast medium can be injected. The examination table is adjusted to Trendelenburg position to reduce bile and contrast drainage. Under fluoroscopic guidance, the nurse assists in observing microprobe passage through the stricture, enabling ultrasound scanning from proximal to distal with lesion measurement. The probe's 5 mm tip is not radiopaque, so excessive force should be avoided to prevent bile duct injury. During daily cleaning and disinfection, the probe should be coiled with a diameter greater than 15 cm to prevent transducer damage from excessive bending.

2.4 Complication Prevention and Observation

Bleeding: Hemorrhage typically results from excessive sphincterotomy, deviated incision direction, papillary vascular anomalies, or coagulation dysfunction [10]. Most intraoperative bleeding is oozing that stops spontaneously. In cases of significant bleeding, endoscopic electrocoagulation, balloon tamponade, or epinephrine saline spray through the sphincterotome can achieve hemostasis. For delayed bleeding, titanium clips can be used to seal vessels [11].

Perforation: Perforation is a rare complication with an incidence of 0.1-0.6%, commonly caused by excessive sphincterotomy adjacent to a diverticulum, incorrect incision direction, guidewire or instrument trauma, tumor-induced bile duct distortion, or stent migration [12]. Therefore, manipulations must be gentle and precise. Guidewire insertion requires controlled force, and sphincterotomy should be performed when peristalsis is minimal and the visual field is clear to avoid intestinal wall injury. No perforations occurred in our cohort.

Hyperamylasemia or Pancreatitis: Temporary post-ERCP serum amylase elevation is common, with pancreatitis incidence of 1-7% [13]. Causes include

repeated cannulation causing papillary edema and impaired pancreatic juice drainage, excessive electrocautery during sphincterotomy causing papillary congestion and temporary pancreatic duct obstruction, and contrast medium reflux into the pancreatic duct from repeated high-pressure injections [14]. To minimize risk, reduce pancreatic duct cannulation attempts, adjust electrosurgical parameters appropriately, avoid repeated cautery at the same site to prevent tissue edema, and inject contrast medium slowly with minimal pressure and volume to prevent pancreatic reflux.

Biliary Infection: Post-ERCP infection occurs in approximately 1-3% of cases but carries a mortality rate of 16-40% [15]. The most common causes include altered biliary flora following ERCP intervention, increased biliary pressure from contrast injection, and incomplete bile drainage. Strict aseptic technique is essential during ERCP. While the endoscope and IDUS probe are reusable, all accessories are single-use sterile items. When withdrawing accessories through the biopsy channel, they should be wiped with alcohol gauze and placed on a sterile field. Long, thin ERCP accessories can be coiled and secured with alcohol gauze or placed in sterile containers to prevent contamination. After successful cannulation in patients with severe bile duct dilation, bile should be aspirated before contrast injection to prevent excessive pressure and infection. At procedure conclusion, contrast medium should be aspirated as completely as possible.

2.5 Postoperative Care

Postoperatively, patients remain on bed rest with oxygen administration and bedside cardiac monitoring. Vital signs, consciousness, temperature, pulse, blood pressure, respiratory rate, and oxygen saturation are closely observed, with particular attention to hematemesis and melena. In our series, [number] cases of delayed bleeding were successfully managed with titanium clip placement. Patients fast for 24 hours, after which dietary guidance is provided based on 24-hour postoperative blood tests (complete blood count, amylase, lipase). In the absence of abdominal pain, fever, or hematochezia, and with normalized laboratory values, patients may consume easily digestible, low-fat, non-irritating liquids or semi-solids such as rice soup or lotus root powder. Treatment includes proton pump inhibitors for gastric protection, antibiotics for infection prevention, somatostatin for pancreatic enzyme suppression, and nutritional support. Hyperamylasemia in [number] cases resolved with extended enzyme inhibition and PPI therapy. Fever in [number] cases normalized after combination antibiotic therapy.

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3. Discussion

Accurate diagnosis of benign versus malignant biliary strictures critically influences treatment selection and prognosis. Unexplained biliary strictures pose

significant clinical challenges, as misdiagnosing benign strictures as malignant may lead to unnecessary surgery, while misclassifying malignant strictures as benign can delay optimal surgical timing. ERCP combined with IDUS offers superior diagnostic capability by providing proximity to lesions, reduced interference, and higher image resolution, facilitating detection of minute lesions while precisely measuring bile duct wall thickness and demonstrating wall layer architecture. Furthermore, dual guidance from ultrasound imaging and fluoroscopy enables targeted biopsy, significantly improving diagnostic yield [16], making this approach worthy of broader adoption.

Malignant biliary strictures exhibit characteristic IDUS features including destruction or deep infiltration of normal bile duct wall structure, irregular lesion margins, and heterogeneous echogenicity. In contrast, benign strictures demonstrate preservation of all three bile duct wall layers with smooth margins, uniform echogenicity, or homogeneous hyper echoic full-layer thickening without obvious infiltration [17].

ERCP combined with IDUS is a technically demanding procedure whose success rate and complication incidence are closely related to skilled cooperation between physicians and nurses. Preoperative preparation requires comprehensive imaging review and thorough assessment. Intraoperatively, nurses must master procedural steps, anticipate physician needs, and correctly utilize various instruments while performing gentle, precise manipulations and maintaining strict aseptic technique to prevent accessory contamination and iatrogenic infection. Prompt and decisive management of intraoperative issues and complications is essential. Postoperative monitoring and nursing care ensure patient safety. Seamless cooperation not only reduces procedure time and patient discomfort but also decreases complications and surgical risks.

Conflict of Interest Statement: The authors declare no conflicts of interest.

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Note: Figure translations are in progress. See original paper for figures.