Original Article

The efficacy and safety of the left lateral position for endoscopic retrograde cholangiopancreatography

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Abstract

Background/Aim: Endoscopic retrograde cholangiopancreatography (ERCP) is typically performed in prone position. In cases of difficulty in prone position, ERCP can be performed in left lateral position. We aimed to evaluate the efficacy and safety of left lateral position for ERCP compared with those of prone position.

Patients and Methods: Between August 2015 and March 2016, a total of 62 patients with native papilla who underwent ERCP were randomly assigned to undergo the procedure in left lateral position ($n = 31$) or prone position ($n = 31$). The outcomes of procedures were compared between the two groups.

Results: There were no significant differences between the two groups in terms of the demographic data, indications for ERCP, comorbidities, anticoagulation agents, the types and doses of sedative agents, and procedural durations. The rates of technical success and adverse events were similar (96.8 and 40%, respectively, in left lateral group and 100 and 32.3%, respectively, in prone group). The rates of unintentional pancreatic duct (PD) cannulation and the acquisition of pancreatograms in left lateral group were significantly greater than those in prone group (9/30, 30.0% vs. 3/31, 9.7%, $P = 0.046$; 7/30, 23.3% vs. 1/31, 3.2%, $P = 0.020$, respectively). However, there was no significant difference in the rate of post-ERCP pancreatitis (6/30, 20% vs. 5/31, 16.1%, $P = 0.694$).

Conclusion: The left lateral position for ERCP can be as effective and safe as prone position. Due to increased rates of unintended PD cannulation and contrast injection, the initial use of left lateral position may be limited to cases that exhibit difficulty in prone position.

Keywords: Efficacy, endoscopic retrograde cholangiopancreatography, position, safety

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INTRODUCTION

Endoscopic retrograde cholangiopancreatography (ERCP) is widely used in diagnosis and treatment of pancreaticobiliary diseases.[1-3] ERCP is typically performed in the prone position. ERCP in the prone position can facilitate selective bile duct cannulation and offer a better fluoroscopic image of the pancreaticobiliary anatomy.[4] However, in cases of difficulty in the prone position, ERCP can be performed in the left lateral or supine positions. Compared with the prone position, the left lateral position is more comfortable for the patients particularly in cases with limited cervical movement, including cases of cervical

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cord injury, cervical spine operations, Parkinson's disease, muscle contracture due to cerebral infarction, and in cases of pregnancy, recent abdominal surgery, severe abdominal, and distension. However, fluoroscopic images of the bifurcation, right and left hepatic duct, and intrahepatic bile ducts, pancreatic duct (PD) are adversely affected by the left lateral position.[5] Furthermore, scope torsion and physician's need to look or turn away from patient or monitors can be additional setbacks of the left lateral position.

In cases of severe abdominal pain, severe abdominal distension, extensive ascites, recent abdominal surgery, cervical spine surgery, intraabdominal catheter insertion, and severe obesity, it is difficult to place the patient in the prone or left lateral position, and ERCP may therefore be performed in the supine position. However, ERCP in the supine position is associated with a documented increase in the risk of cardiopulmonary adverse events and a decreased selective bile duct cannulation success rate.[6]

Comparison of the efficacy and safety of the prone and supine positions for ERCP have previously been reported in several studies,[4,6,7] whereas there is a paucity of literature about the left lateral position for ERCP. In this prospective, controlled study, we compared the efficacy and safety of the use of the left lateral position and prone position for ERCP.

PATIENTS AND METHODS

Study design

This prospective, randomized study was performed from August 2015 to March 2016 at Hallym University, Chuncheon Sacred Heart Hospital in Korea. The study protocol was approved by the Institutional Review Board at our hospital. The study is registered at ClinicalTrials.gov (ClinicalTrials.gov number, NCT02594475).

Patients

The inclusion criteria were as follows: (1) Any of following indications for ERCP: common bile duct (CBD) stone, gallstone pancreatitis, obstructive jaundice due to malignancy (e.g., pancreatic cancer, bile duct cancer, and ampulla of Vater cancer), and benign biliary stricture; (2) naïve papilla; and (3) age over 20 years. Exclusion criteria included any of the following: (1) History of ERCP with previous endoscopic sphincterotomy (EST) or endoscopic papillary balloon dilation (EPBD), (2) altered gastric and duodenal anatomy due to intraabdominal surgery (e.g., Billroth gastrectomy and total gastrectomy), (3) patients with severe infections or hemodynamic instability (e.g., due to septic shock, intubation, ventilator, or the use of an inotropic agent), (4) recent myocardial infarction (within 6 months) or uncontrolled arrhythmia, unstable angina, or congestive heart failure, (5) severe neurologic disease, (6) patients with conditions that increased the difficulty of the use of the prone position (e.g., severe abdominal pain, severe abdominal distension, extensive ascites, recent intraabdominal surgery, neck surgery, intraabdominal catheter insertion, and severe obesity), (7) pregnancy, and (8) need for pancreatogram.

Study protocol

Patients were aware of the study and consented to participation. Written informed consent for ERCP was obtained from all patients. In patients with combined cholangitis, blood cultures were performed and intravenous third-generation cephalosporin was administered. Before the endoscopic procedures, the patients were randomly assigned to the left lateral position or prone position group based on a computer-generated randomization. Conscious/moderate to deep sedation was performed via a nonanesthesiologist-assisted method.[8,9] Intravenous midazolam (0.05–0.1 mg/kg) and/or intravenous propofol (0.5–1 mg/kg) was administered. The administered analgesics were intravenous meperidine (25 mg) in patients older than 50 years and meperidine (50 mg) in patients younger than 50 years. To limit duodenal peristalsis, hyoscine-*N*-butylbromide was intravenously administered. Prophylactic rectal nonsteroidal antiinflammatory drugs (NSAIDs) were not used because it was commercially unavailable. All patients were provided oxygen at 2 l/min via nasal prongs. The patients' oxygen saturation, heart rate, blood pressure, and respiration were monitored during the procedures. All adverse events that occurred during the endoscopic procedures were recorded in case report forms as intraprocedural adverse events. Four hours, 24 h, 2 weeks, and 6 weeks after the procedure, the white blood cell, hemoglobin, and platelet counts, the total bilirubin, aspartate transaminase, alanine transaminase, alkaline phosphatase, gamma glutamyl transaminase, amylase, and lipase levels were recorded, and abdomen and chest X-rays were performed. Patients were hospitalized after ERCP for observation based on the resumption of feeding at 24 h (oral feeding was initiated with sips of water 24 h after EST and/or EPBD). Age, sex, body mass index (BMI), the indication for ERCP, comorbidities, anticoagulation agent use, the American Society of Anesthesiologists (ASA) class, the types and doses of sedative agents, the doses of analgesics, the duration of procedure including the approach to the ampulla, cannulation time, and total procedure time, the type of periampullary diverticulum,[10] PD cannulation, the acquisition of pancreatogram, the requirement of a precut, the type of papillary

sphincter therapy, technical success, clinical success, and ERCP-related adverse events, including pancreatitis, bleeding, infection, cardiopulmonary complication, basket impaction, and mortality were recorded.

Endoscopic procedure

All ERCPs were performed by a single endoscopist (P.T.Y.), and had performed approximately 100 native ERCPs per year. ERCP was performed using a conventional side-viewing endoscope (TJF240, 260 V; Olympus Optical Co. Ltd., Tokyo, Japan). Selective bile duct cannulation was attempted using an ERCP catheter (Glo-Tip®, GT-1-UT; Cook Endoscopy, Winston-Salem, NC) with the wire-guided cannulation method (VisiGlide, G-240-2545A; Olympus Medical Systems, Japan).[11] In cases of difficult biliary cannulation (10 cannulation attempts within 5 min),[12] a precut fistulotomy was made using a needle-knife (Micro-knife XL®; Boston Scientific Co., Natick, MA) without PD stent.[13] Sphincter therapy was performed via EST (Sphincterotome with DomeTip®; Cook Endoscopy, Winston-Salem, NC) and/or EPBD (CRE balloon dilator; Boston Scientific, Natick, MA). Prophylactic PD stent was not used. The procedures were performed with a fixed fluoroscopic arm.

Definitions

Technical success was defined as success in the selective bile duct cannulation, and clinical success was defined as success in the acquisition of the therapeutic goals. The therapeutic goals were defined as follows: (1) Suspected CBD stone and gallstone pancreatitis: complete CBD stone removal; (2) obstructive jaundice due to malignant biliary stricture: endobiliary biopsy and biliary drainage (endoscopic retrograde biliary drainage [ERBD] or endoscopic nasobiliary drainage [ENBD]); and (3) benign biliary stricture: EST or EPBD with biliary stent (covered metal or plastic) insertion. The complications according to timing were defined as follows: (1) intraprocedural adverse event: complication occurring from the entry of the preparation area to departure from the endoscopy room; (2) postprocedural adverse event: complication occurring from the departure of the endoscopy room until 14 days later; and (3) delayed procedural adverse event: complication occurring any time after 14 days.[14] ERCP-related noncardiopulmonary adverse events were defined as follows: (1) post-ERCP pancreatitis: typical abdominal pain with elevated amylase or lipase levels >3 times the upper normal limits within 24 h after procedure; (2) bleeding: clinical or endoscopic evidence of bleeding (defined as follows: mild: no need for transfusion; moderate: transfusion required but no need for angiographic or surgical intervention; and severe: transfusion and angiographic or surgical intervention required); (3) bowel perforation: retroperitoneal contrast or air outside the bile duct and duodenum on radiologic images or bowel wall perforation documented on endoscopic images; and (4) sepsis: the presence of any microorganism in the blood culture combined with a systemic response.[15-17] ERCP-related cardiopulmonary adverse events were defined as follows: (1) hypotension: <90/50 mmHg or a decrease of 20% or greater; (2) hypoxia: peripheral oxygen saturation <85%; (3) myocardial infarction: elevation of a cardiac enzyme; and (4) acute exacerbation of underlying cardiopulmonary disease.[14]

Statistical analysis

The Chi-square test for categorical variables and the Student's *t*-test for continuous variables were used to compare the two groups. A $P < 0.05$ was considered statistically significant. All statistics were performed by using IBM SPSS statistics software, version 20.0 (IBM Corp. Armonk, NY).

RESULTS

Baseline characteristics

A total of 64 patients with naïve papilla who underwent ERCP were identified. Among these patients, two cases were excluded due to septic shock ($n = 1$) and subtotal gastrectomy with Billroth I anastomosis ($n = 1$). Sixty-two cases were randomly assigned to the left lateral position ($n = 31$) or the prone position ($n = 31$) group prior to the procedures. One case was dropped out due to failure of CBD cannulation due to ampulla edema. A flowchart of the study cohort selection is provided in Figure 1.

There was no significant difference in the age and gender of the patients between the left lateral group (13 male/28 female, mean age 65.2 ± 15.9 years) and the prone position group (19 male/22 female, mean age 62.0 ± 17.1 years). The indications for ERCP were CBD stones in 31 patients (50.0%), gallstone pancreatitis in 9 patients (14.5%), benign biliary stricture in 9 patients (14.5%), bile duct cancer in 8 patients (12.9%),

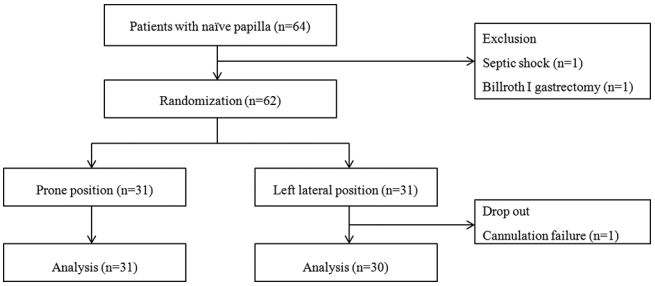

Figure 1: Flowchart of the study cohort selection

and pancreatic cancer in 4 patients (6.5%). There were no significant differences between the two groups in terms of the demographic data, indications for ERCP, comorbidities, anticoagulation agents, or ASA class. The baseline characteristics of the study patients are summarized in Table 1.

Endoscopic procedures

There was no significant difference in the durations of the procedure between the two groups (27.7 ± 11.7 min in the left lateral vs. 24.9 ± 14.0 min in the prone group, $P = 0.396$). The types and doses of sedative agents, and the doses of analgesics were similar between the two groups [Table 2].

In the left lateral group, the rates of unintentional PD cannulation and acquisition of pancreatograms were significantly greater than those in the prone group (9/30, 30.0% vs. 3/31, 9.7%, respectively $P = 0.046$; 7/30, 23.3% vs. 1/31, 3.2%, respectively, $P = 0.020$). There were no significant differences between the two groups in terms of the periampullary diverticulum, the rate of precutting, or the type of sphincter therapy. Details about the endoscopic procedures are described in Table 3.

ERCP outcomes

The ERCP outcomes are summarized in Table 4. The technical success and clinical success rates were similar between the two groups (96.8 and 96.8%, respectively, in the left lateral and 100 and 100%, respectively, in the prone group). In one case with gallstone pancreatitis, the cannulation of the CBD failed due to ampulla edema. There was no significant difference in the occurrence of adverse events between the two groups (12/30, 40.4% in the left lateral vs. 10/31, 32.3% in the prone group, $P = 0.529$). There was no significant difference in the rate of post-ERCP pancreatitis between the two groups (6/30, 20% in the left lateral vs. 5/31, 16.1% in the prone group, $P = 0.694$). No bowel perforations occurred, and there were no ERCP-related mortalities in either group.

Timings and severities of ERCP-related adverse events

The timings of the ERCP-related adverse events are summarized in Table 5. There was one case of intraprocedural cardiopulmonary event in left lateral position group. One desaturation event occurred due to the sedative agent during a left lateral position procedure. There were two cases of postprocedural cardiopulmonary event in prone position group. Two cases of acute exacerbation of bronchial asthma occurred within 1 or 2 days after the procedures in the prone position group.

Table 1: Baseline characteristics of the study patients

	Lateral position (*n*=31)	Prone position (*n*=31)	*P*
Age, years, mean±SD	65.2±15.9	62.0±17.1	0.449
Male gender, no (%)	13 (41.9)	19 (61.3)	0.127
BMI, kg/m^2, mean±SD	24.0±3.2	25.5±3.5	0.098
Indications for ERCP, no (%)			0.454
Common bile duct stone	18 (58.1)	13 (41.9)	
Gallstone pancreatitis	5 (16.1)	4 (12.9)	
Bile duct cancer	4 (12.9)	4 (12.9)	
Pancreatic cancer	2 (6.5)	2 (6.5)	
Benign biliary stricture	2 (6.5)	7 (22.6)	
Comorbidity, no (%)			0.522
Hypertension	17 (54.8)	15 (48.4)	
Diabetes mellitus	5 (16.1)	4 (12.9)	
Old myocardial infarction	2 (6.5)	1 (3.2)	
Congestive heart failure	1 (3.2)	1 (3.2)	
Angina pectoris	1 (3.2)	3 (9.7)	
Obstructive lung disease	1 (3.2)	2 (6.5)	
Cerebral infarction	1 (3.2)	2 (6.5)	
Arrhythmia	0	2 (6.5)	
Anticoagulation agent, no (%)			0.275
Aspirin + clopidogrel	4 (12.9)	3 (9.7)	
Aspirin	4 (12.9)	0	
Clopidogrel	1 (3.2)	1 (3.2)	
Warfarin	0	1 (3.2)	
Rivaroxaban	0	1 (3.2)	
ASA class, no (%)			0.843
I	7 (22.6)	9 (29.0)	
II	23 (74.2)	21 (67.7)	
III	1 (3.2)	1 (3.2)	

BMI: Body mass index; ERCP: Endoscopic retrograde cholangiopancreatography; ASA class: American Society of Anesthesiologists class; SD: Standard deviation

Table 2: Sedation and procedure durations

	Lateral position (*n*=31)	Prone position (*n*=31)	*P*
Sedative agent, no (%)			
Midazolam	16 (51.6)	18 (58.1)	0.782
Propofol	2 (6.5)	1 (3.2)	
Midazolam + propofol	13 (41.9)	12 (38.7)	
Sedative dose, mg, mean±SD			
Midazolam	4.1±2.0	4.3±1.5	0.616
Propofol	18.3±25.5	15.4±21.2	0.631
Meperidine	30.7±12.4	28.2±8.5	0.375
Procedure time, min, mean±SD			
Approach to ampulla	2.3±1.3	1.8±0.6	0.068
Cannulation time	11.8±10.5	8.2±9.9	0.170
Acquisition of planned goal	13.6±7.4	14.9±10.9	0.583
Total time of procedure	27.7±11.7	24.9±14.0	0.396

SD: Standard deviation

The severities of the ERCP-related adverse events are summarized in Table 6. All cases of post-ERCP pancreatitis were mild and did not require prolongation of the planned hospitalization. All cases of EST-site bleeding involved mild oozing bleeding and were stopped spontaneously, via the use of epinephrine irrigation and retrieval balloon compression, or via the use of an epinephrine injection during the procedure. Second-look endoscopy and transfusions were not required in any of these cases. Postprocedural infection occurred in three cases in left

Table 3: Endoscopic procedures

	Lateral position (*n*=30)*	Prone position (*n*=31)	*P*
Periampullary diverticulum, no (%)			
None	17 (56.7)	20 (64.5)	0.867
Type I	1 (3.3)	1 (3.2)	
Type II	5 (16.7)	3 (9.7)	
Type III	7 (23.3)	7 (22.6)	
PD cannulation, no (%)	9 (30.0)	3 (9.7)	0.046
Pancreatogram, no (%)	7 (23.3)	1 (3.2)	0.020
Precut, no (%)	10 (33.3)	7 (22.6)	0.349
Sphincter therapy, no (%)			
EST	21 (70.0)	23 (74.2)	0.516
EPBD	0	1 (3.2)	
EST + EPBD	9 (30.0)	7 (22.6)	

*In one case with gallstone pancreatitis, the cannulation of the CBD failed due to ampulla edema. PD: Pancreatic duct; EST: Endoscopic sphincterotomy; EPBD: Endoscopic papillary balloon dilation

Table 4: Outcomes

	Lateral position (*n*=31)	Prone position (*n*=31)	*P*
Technical success, no (%)	30/31 (96.8)*	31/31 (100)	0.313
Clinical success, no (%)	30/31 (96.8)	31/31 (100)	-
Overall adverse event, no (%)	12/30 (40.0)	10/31 (32.3)	0.529
Pancreatitis	6 (20.0)	5 (16.1)	0.694
Bleeding	4 (13.3)	3 (9.7)	0.654
Infection	3 (10.0)	1 (3.2)	0.285
Cardiopulmonary event**	1 (3.3)	2 (6.5)	0.573
Basket impaction	0	1 (3.2)	0.321
Perforation	0	0	-
Mortality	0	0	-

*In one case with gallstone pancreatitis, the cannulation of the CBD failed due to ampulla edema. **Acute exacerbation of bronchial asthma (*n*=2), desaturation due to sedation (*n*=1)

Table 5: Timings of ERCP-related adverse events

	Lateral position (*n*=30)	Prone position (*n*=31)	*P*
Pancreatitis			
Postprocedural*	6 (20.0)	5 (16.1)	0.694
Bleeding			
Intraprocedural*	4 (13.3)	3 (9.7)	0.654
Infection			
Postprocedural	3 (10.0)	1 (3.2)	0.285
Cardiopulmonary event			
Intraprocedural	1 (3.3)	-	-
Postprocedural	-	2 (6.5)	-
Basket impaction			
Intraprocedural	-	1 (3.2)	0.321

*Intraprocedural: From entry into the preparation area through departure from the endoscopy room; Postprocedural: From departure of the endoscopy room through the subsequent 14 days; Delayed-procedural: Any time after 14 days. ERCP: Endoscopic retrograde cholangiopancreatography

Table 6: Severities of the ERCP-related adverse events

	Lateral position (*n*=30)	Prone position (*n*=31)	*P*
Pancreatitis			
Mild	6 (20.0)	5 (16.1)	0.694
Bleeding			
Mild	4 (13.3)	3 (9.7)	0.654
Infection			
Mild	2 (6.7)	-	-
Moderate	1 (3.3)	-	-
Severe	-	1 (3.2)	-
Cardiopulmonary event			
Mild	1 (3.3)	1 (3.2)	0.981
Moderate	-	-	-
Severe	-	1 (3.2)	-
Basket impaction			
Mild	-	1 (3.2)	-

ERCP: Endoscopic retrograde cholangiopancreatography

lateral position group and one case in prone position group. One patient of CBD stone in the left lateral position group developed cholangitis with jaundice that required ERCP and repeated ENBD insertion. The other two patients with CBD stone with cholangitis in left lateral group had aggravated cholangitis, but improved with medical therapy without intervention. In prone position group, one case of sepsis needed intensive care and one case of acute exacerbation of bronchial asthma required intubation and ventilator care.

DISCUSSION

The current study was designed to evaluate the efficacy and safety of the use of the left lateral position in ERCP compared with those of the prone position. There were no differences in rates of successful CBD cannulation or acquisition of the therapeutic goals between the two groups (96.8 and 96.8%, respectively, in the left lateral; 100 and 100%, respectively, in the prone groups). The rates of adverse event were also similar between the groups (40.4% in the left lateral vs. 32.3% in the prone group). Therefore, the present results suggest that the left lateral position for ERCP is as effective and safe as the prone position. However, due to high rates of unintended PD cannulation and PD contrast injection in the left lateral position group, the left lateral position should be initially preferred for patients with limitations, that increase the difficulty of prone positioning, such as cervical movement limitations due to cervical cord injury, cervical spine operation, and neck surgery, Parkinson's disease, muscle contracture due to cerebral infarction, severe abdominal pain, severe abdominal distension, extensive ascites, recent intraabdominal surgery, intraabdominal catheter insertion, severe obesity and pregnancy.

The rate of ERCP-related adverse events in the present study is relatively high compared with that of a previously reported study.[18] The reason for this difference is likely the application of strict criteria for adverse events in the present study. Furthermore, analyses of small sample sizes in low volume centers can be associated with high rates of adverse events. However, the majority of adverse events were mild and noncardiopulmonary problems. Moreover, the cases involving severe cardiopulmonary events and

intensive care (one case of sepsis and one case who required intubation and a ventilator) recovered without sequelae. There were no bowel perforations, which can be associated with high mortality, in either group. There were no mortalities in the present study.

In the left lateral group, the rates of PD cannulation and acquisition of pancreatograms were significantly higher than those in the prone group (9/30, 30.0% vs. 3/31, 9.7%, respectively, $P = 0.046$; 7/30, 23.3% vs. 1/31, 3.2%, respectively, $P = 0.020$). The reason for high rate of PD cannulation in the left lateral position could have been related to the altered axis of the CBD, instability of en face view, difficulty of ampullary visibility, and scope manipulation (torsion and position). In the left lateral position, the axis of the CBD and the PD are rotated further counter-clockwise relative to the prone position. Furthermore, regular use of standard catheter, which lacks ability to bow the catheter, can have an impact on difficulties in adjusting the catheter to the altered axis of the CBD. Consequently, the guidewire tends to more easily cannulate the PD. The reason for the high rate of the acquisition of pancreatograms is likely attributable to the increased need for contrast injection due to the superimposition of the CBD and the PD in the 12 o'clock direction in the left lateral position. In the left lateral position, the CBD and PD can be superimposed in the 12 o'clock direction, whereas the CBD is in the 11–12 o'clock direction and the PD is in the 1–2 o'clock direction in the prone position. Consequently, in the left lateral position, the guidewire in the PD is relatively difficult to distinguish from the guidewire in the CBD, and thus the need for contrast injection into the PD may be increased with the left lateral position. Despite the high rates of inadvertent PD cannulation and contrast injection, there were no significant differences in the rate of post-ERCP pancreatitis between the two groups (6/30, 20% in the left lateral vs. 5/31, 16.1% in the prone group, $P = 0.694$). It is notable that despite higher rates of PD cannulation, which is known as an independent risk factor of post-ERCP pancreatitis, in the left lateral position, this did not seem to affect the development of pancreatitis in the present study. There could be several possible factors that relieved the development of post-ERCP pancreatitis despite high rates of unintended PD cannulation. First, in cases of difficult cannulation, early rescue intervention using needle-knife precut was performed, and most of them were successful in selective cannulation without difficulty. Second, wire-guided cannulation rather than contrast-induced cannulation was used as a routine cannulation method, and the contrast injection to the PD could be minimized. Third, most of the cases enrolled in the present study were patients who were at non-high risk of post-ERCP pancreatitis. Fourth, indications for ERCP were carefully selected, and most of the cases were therapeutic ERCPs, not diagnostic ERCP. Due to potentially multiple conflicting factors described above, the impact of PD cannulation on development of post-ERCP pancreatitis could be relieved in the present study.

The reported incidences of the rate of post-ERCP pancreatitis are generally in the range of 1–7% for standard procedures in nonhigh-risk patients.[19] In the present study, patients with average risk conditions were enrolled, and the rate of post-ERCP pancreatitis was about 18% (11/61). There can be several reasons for the unusually high rates of post-ERCP pancreatitis in the present study. First, low-volume of ERCP (approximately 100 ERCPs of naïve papilla per year) by a single endoscopist can affect the high rate of post-ERCP pancreatitis. Second, no use of prophylactic PD stent for preventing post-ERCP pancreatitis can also affect the development of pancreatitis. Third, pharmacologic prevention of post-ERCP pancreatitis using rectal indomethacin cannot be performed because rectal indomethacin is commercially unavailable in South Korea. Moreover, other pharmacologic agents were not used practically because of their unclear effect and medical insurance issues in South Korea. Fourth, the use of standard ERCP catheter rather than sphincterotome for initial routine cannulation could be associated with the unusual high rate of post-ERCP pancreatitis. Fifth, EPBD, a well-recognized risk factor of post-ERCP pancreatitis, was used for sphincter therapy with or without EST in the present study.[20-23]

The fixed arm fluoroscopy was used because C-arm fluoroscopy is not available in our hospital. The fixed arm fluoroscopy does not have rotatable movement of fluoroscopy, and adjustment of fluoroscopic direction to obtain optimal cholangiogram can be limited. Therefore, the effect of having fixed arm as opposed to C-arm fluoroscopy in performing ERCP can limit optimal evaluation of biliary tree in the present study.

There are several limitations to the present study. First, this study was performed in a single center with a low case volume by a single endoscopist, and these factors might reduce the general applicability of the left lateral position for ERCP in routine practice. Second, the small sample size could have resulted in an overestimation of ERCP-related adverse events. Third, the evaluation of risk for post-ERCP pancreatitis could not be considered in the present study. Fourth, regular use of standard catheter instead of sphincterotome for routine cannulation

can also be a potential weakness in terms of the clinical applicability, given that a majority of endoscopists use wire-guided sphincterotomes rather than standard catheter. Fifth, the lack of rotatable C-arm can limit the adjustment of fluoroscopic direction, and limit to obtain optimal cholangiogram.

In conclusion, the current findings would suggest that the left lateral position for ERCP is as safe as the prone position. Due to the increased rates of unintended PD cannulation and PD contrast injection, the left lateral position for ERCP should initially be preferred for patients with limitations that increase the difficulty of the application of the prone position. Therefore, a randomized, controlled, multicenter trial with a large number of selected patients is required to evaluate the safety and effectiveness of the two different patient positions during ERCP in the future.

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Conflicts of interest

There are no conflicts of interest.

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