



A National Survey on the Environment and Basic Techniques of Endoscopic Retrograde Cholangiopancreatography in Korea

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Background/Aims: The work environment in which endoscopic retrograde cholangiopancreatography (ERCP) is conducted has influence on its efficacy and safety. We aimed to assess the current status of ERCP work environments and to investigate the trends associated with the basic techniques of ERCP in Korea.

Methods: The work environment and information on the basic techniques of ERCP were acquired by the Korean Pancreatobiliary Association (KPBA) through a national survey in 2019. The survey was performed at the KPBA conference in 2019. The contents of survey comprised of the current environment of ERCP, preparation before ERCP, and the preferred basic techniques used in ERCP.

Results: Completed questionnaires were returned from 84 KPBA members. The mean ERCP volume per year was approximately 500. About 60% (50/84) reported that they worked with a dedicated ERCP team with experienced nurses. Two-thirds (57/84, 68%) answered that they had a fluoroscopy room used solely for ERCP procedures. All respondents intravenously hydrated the patient to prevent post-ERCP pancreatitis (84/84, 100%). The preferred procedural sedations were balanced propofol sedation (50%) and midazolam-only sedation (47%). Wire-guided cannulation was most commonly used for selective cannulation (81%). Endoscopic retrograde biliary drainage was preferred over endoscopic nasobiliary drainage (60% vs 22%). The initial method of ampullary intervention was endoscopic sphincterotomy in 60%.

Conclusions: Data from the survey involving a large number of Korean ERCP doctors revealed considerable variabilities with regard to the work environment and basic techniques of ERCP in Korea. The study provides information regarding the current trends of ERCP that can be used to establish ERCP standards in Korea. (*Gut Liver* 2021;15:904-911)

Key Words: Endoscopic retrograde cholangiopancreatography; Current status; Survey

INTRODUCTION

Since the introduction of endoscopic retrograde chol-

angiopancreatography (ERCP) in the 1968,¹ it has been one of the most important procedures to treat biliary and pancreatic diseases. ERCP demands a long procedure time

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and requires substantial training with the considerable risk of complications.² The total volume of its practice has increased significantly the recent years in Korea.³ According to a previous study with a Health Insurance Review and Assessment data in Korea, the number of patients who underwent ERCP was 47,027 in 2017, and the annual ERCP rate was reported to be approximately 91 per 100,000 in 2017.⁴ However, the number of studies about the current status and trend of ERCP at a national scale in Korea are lacking.

The environment of endoscopy includes the factors such as endoscopy room, medical professionals, and preparation for endoscopic procedure. Although the overall environment of ERCP is similar to that of esophagogastroduodenoscopy or colonoscopy, it differs with regard to the number of required additional assistants and the need for a radiology technician. The dedicated room and medical professionals for ERCP are important factors that may affect the results. The patient's position and mode of anesthesia or sedation can ensure an easier and better outcome. Moreover, the ERCP procedure and the techniques associated with the cannulation and stone removal must considerably influence the outcomes.⁵ Since technical variations must be associated with differences in quality and safety, it is important to consider these parameters in practice.

Current status of ERCP related with specific issues had been published in Japan.^{6,7} There was a study regarding the Korean trend of ERCP based on publicly open Health Insurance Review and Assessment data.⁴ Recently, a national survey by Korean investigators had been conducted to investigate the ERCP practices and outcomes.⁸ However, it did not identify the current trends of basic ERCP procedures or present a detailed information on its operational setup in Korea.

We conducted a national survey about ERCP, which focused on basic techniques and the associated operational setups. This study is aimed to assess the current trend of ERCP in Korea.

MATERIALS AND METHODS

1. Conduct of the survey

This study was designed as a national survey. It was organized by the committee of policy and quality management in Korean Pancreatobiliary Association. The committee members accumulated the important issues associated with ERCP and constructed key questions about the basic techniques for the same. The questionnaires were prepared and revised by the committee of policy and quality management, and finally constructed in 2019. The survey

was performed through a papered questionnaire (Supplementary Material) for participants in Annual Congress of Korean Pancreatobiliary Association 2019 in Korea. Additionally, an online survey with same questions was released for Korean Pancreatobiliary Association members who were unable to attend the congress. It consisted of 36 questions and the contents were classified into three categories: (1) the current environment of ERCP; (2) the preparation for ERCP; and (3) the current trend of basic techniques for ERCP in Korea. The questionnaire was considered valid if all of the required information was provided.

2. Statistical analysis

All continuous variables were presented as mean \pm standard deviations. Categorical variables were presented as numbers or proportions. Data were analyzed using the Statistical Package for the Social Sciences version 24.0 (IBM Corp., Armonk, NY, USA).

RESULTS

A total of 84 completed questionnaires were collected. The mean age of answered ERCP doctors was 46.9 ± 7.7 years. There were 80 male doctors and four female doctors. In total, 59% of doctors had an experience of over 11 years and 41% of doctors had performed ERCP for more than 5,000 cases.

1. The environment for ERCP procedure

Fig. 1 shows the results pertaining to the doctors' experience and ERCP volume. With regard to the number of ERCP procedures performed per week, 41% of doctors performed the procedure for 5 to 10 cases, and 30% performed for 11 to 20 cases. In total, 16% of doctors performed over 20 cases per week. However, 60% of doctors answered that they had a dedicated ERCP team with experienced nurses, and 40% of doctors performed ERCP with endoscopy nurses (Fig. 2A). In total, 68% of doctors reported the presence of a fluoroscopy room dedicated for ERCP in the endoscopy or radiology intervention unit (Fig. 2B). Emergency ERCP was available in 69%, regardless of a weekend or a holiday.

2. The preparation of ERCP

Whereas 50% of ERCP doctors used a balanced propofol sedation for procedural sedation for ERCP, 47% of ERCP doctors preferred to use midazolam only for procedural sedation (Fig. 3). Only 1% of the doctors performed the procedure using general anesthesia in Korea. Table 1 presents the preference of patient position and premedi-

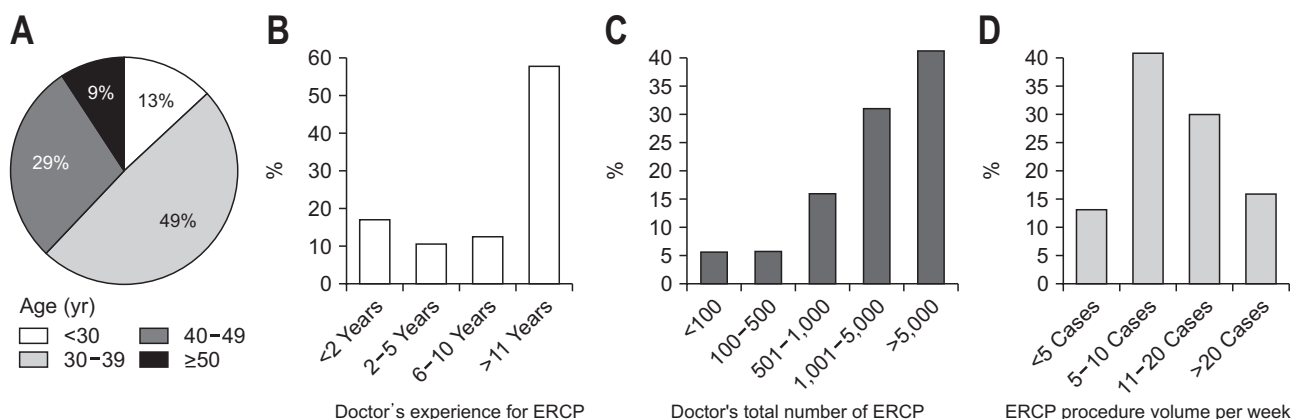


Fig. 1. Endoscopic retrograde cholangiopancreatography (ERCP) experience of Korean doctors and their current ERCP volume. (A) Age, (B) ERCP experience, (C) total number of ERCP, (D) current ERCP volume.

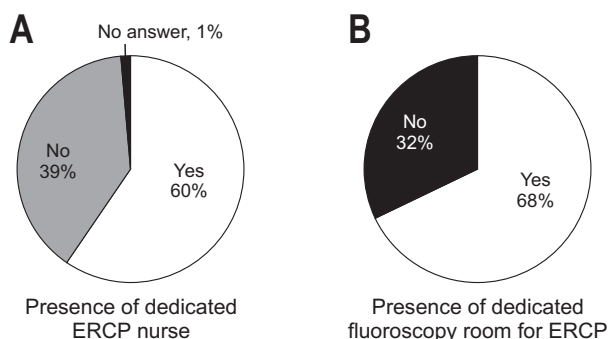


Fig. 2. Specialized nurse staff (A) and designated unit for endoscopic retrograde cholangiopancreatography (ERCP) (B).

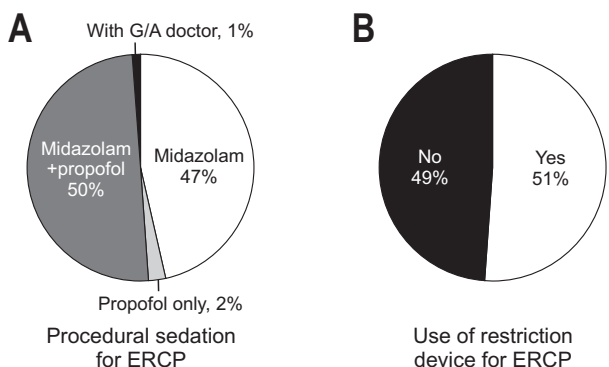


Fig. 3. (A, B) Preferred method of procedural sedation for ERCP in Korea.

ERCP, endoscopic retrograde cholangiopancreatography; G/A, general anesthesia.

cation. Most doctors preferred the prone position. The number of positive answers was 80 (95%) for prophylactic use of opioid drug, 68 (80%) for prophylactic use of anti-peristaltic agent, and 50 (60%) regarding the use of prophylactic antibiotics before diagnostic ERCP. While 51% of the doctors routinely use a restriction device for patient's

Table 1. Patient's Position and Prophylactic Treatment for ERCP

Variable	No. (%)
No. of ERCP doctor	84
Patient's position for ERCP	
Prone position	77 (92)
Left lateral position	4 (5)
Position change as prone after duodenal approach	3 (3)
Use of restriction device	
Yes	43 (51)
No	41 (49)
Use of opioid analgesics	
Meperidine	72 (86)
Fentanyl	8 (9)
None	4 (5)
Use of antiperistaltic agent	
Yes	67 (80)
No	17 (20)
Use of prophylactic antibiotics	
Yes	50 (60)
No	34 (40)

ERCP, endoscopic retrograde cholangiopancreatography.

position in ERCP, 49% did not use it. Sixteen percent of ERCP doctors answered that they routinely conducted endoscopic ultrasonography before therapeutic ERCP. In the questionnaire about prevention methods against post-ERCP pancreatitis (multiple choices are available), most ERCP doctors answered that they usually used the combination of techniques by intravenous hydration, intravenous protease inhibitor and pancreatic stenting against post-ERCP pancreatitis (Table 2). Table 2 shows data about preparation for ERCP and management after procedure.

3. The preferred basic technique of ERCP

Table 3 presents the current trend of prepared device and technique for ERCP in Korea. Regarding selective deep cannulation, 46% of doctors preferred to use sphinctero-

Table 2. Preparation for ERCP and Management after Procedure

Variable	Value
No. of ERCP doctor	84
Routine diagnostic EUS before therapeutic ERCP	
Yes	13
No	70
No answer	1
Routine follow-up ERCP after successful ERCP	
Yes	3
No	80
No answer	1
Performing urgent ERCP*	
Yes	58
No	24
No answer	2
Prevention against post-ERCP pancreatitis [†]	
Intravenous hydration over 1 L fluid	52
Intravenous protease inhibitor	64
Oral protease inhibitor	5
Pancreatic stenting	53
Others	2
Timing to permit a diet after ERCP	
4–6 Hours	14
6–12 Hours	22
>12 Hours	47
No answer	1
First diet on the day after ERCP	
Water only	27
Liquid diet	17
Soft diet	12
Regular diet	5
NPO on the day	23

ERCP, endoscopic retrograde cholangiopancreatography; EUS, endoscopic ultrasonography; NPO, nil per os.

*ERCP as urgent treatment at night or over the weekend; [†]Multiple choices are available.

tome and guidewire, but 35% preferred using a cannulation catheter. Additionally, 19% preferred to use a contrast agent than a guidewire. There were differences with regard to the basic accessories used in the procedure. A 0.035-inch guidewire with a straight tip was used by 42%. But 28% chose a 0.025-inch angled guidewire, and 23% preferred a thin straight guidewire. The device used to crush a large stone were as follows; Trapezoid™ basket (Boston Scientific, Marlborough, MA, USA), 55%; Power-Catch basket (MTW, Wesel, Germany), 24%; BML lithotripsy basket (Olympus, Tokyo, Japan), 16%; and Fusion® lithotripsy extraction basket (Cook Medical, Bloomington, IN, USA), 3%. Endoscopic sphincterotomy was more dominantly used than the endoscopic papillary balloon dilatation for papilla dilatation in patients with naïve ampulla (Fig. 4A). The preferred methods for biliary drainage included endoscopic retrograde biliary drainage in 60%, endoscopic retrograde nasobiliary drainage in 22%, and both methods

Table 3. Current Status of Prepared Devices and Techniques Used in ERCP

Variable	No. (%)
No. of ERCP doctor	84
Device for selective cannulation	
Sphincterotome	44 (52)
Cannulation catheter	40 (48)
Initial check-up for bile duct cannulation	
Guidewire	68 (81)
Contrast	16 (19)
Favorite cannulation technique	
Sphincterotome+guidewire	39 (46)
Cannulation catheter+guidewire	29 (35)
Sphincterotome+contrast	5 (6)
Cannulation catheter+contrast	11 (13)
Type of guidewire	
Straight tip with 0.035-inch diameter	35 (42)
Angled tip with 0.035-inch diameter	4 (5)
Straight tip with 0.025-inch diameter	19 (23)
Angled tip with 0.025-inch diameter	24 (28)
Others	2 (2)
Product for mechanical lithotripsy in ERCP	
BML lithotripsy basket (Olympus)	14
Fusion® Lithotripsy basket (Cook Medical)	2
Trapezoid™ (Boston Scientific)	46
MTW Basket (MTW)	20
Others	2

ERCP, endoscopic retrograde cholangiopancreatography.

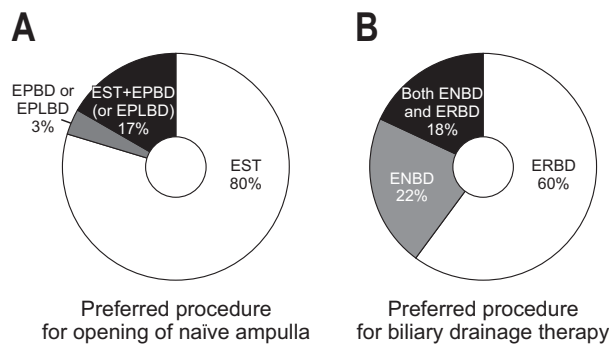


Fig. 4. Preferred basic technique for ERCP. (A) Basic procedure for opening of the naïve ampulla. (B) Basic procedure for bile drainage. ERCP, endoscopic retrograde cholangiopancreatography; EPBD, endoscopic papillary balloon dilatation; EPLBD, endoscopic papillary large balloon dilatation; EST, endoscopic sphincterotomy; ENBD, endoscopic nasobiliary drainage; ERBD, endoscopic retrograde biliary drainage.

at simultaneously in 18% (Fig. 4B). The mostly preferred salvage technique was wire assisted technique and double guidewire technique.

Table 4. Comparison of ERCP Procedure by Experience

Variable	<5 Years	5–10 Years	>10 Years
No. of ERCP doctor	23	11	50
Preparation for ERCP, No. (%)			
Patient's position			
Prone position	22 (96)	11 (100)	44 (88)
Left lateral or changing position	1 (4)	0	6 (12)
Use of antiperistaltic agent			
Yes	20 (87)	10 (91)	37 (74)
No	3 (13)	1 (9)	13 (26)
Use of prophylactic antibiotics			
Yes	13 (57)	8 (73)	29 (58)
No	10 (43)	3 (27)	21 (42)
Preferred technique & device for ERCP, No. (%)			
Cannulation technique			
Sphincterotome+guidewire	9 (39)	8 (73)	22 (44)
Cannulation catheter+guidewire	10 (43)	3 (27)	16 (32)
Sphincterotome+contrast	0	0	5 (10)
Cannulation catheter+contrast	4 (17)	0	7 (14)
Type of guidewire			
Straight tip/0.035-inch diameter	7 (30)	1 (9)	11 (22)
Angled tip/0.035-inch diameter	8 (35)	6 (55)	22 (44)
Straight tip/0.025-inch diameter	7 (30)	4 (36)	12 (24)
Angled tip/0.025-inch diameter	1 (4)	0	3 (6)
Others			2 (4)
Opening of naïve ampulla			
EST	20 (87)	10 (91)	37 (74)
EPBD (or EPLBD)	0	0	3 (6)
EST+EPBD (or EPLBD)	3 (13)	1 (9)	10 (20)
Biliary drainage therapy			
ERBD	14 (61)	10 (91)	26 (52)
ENBD	6 (26)	0	12 (24)
ERBD+ENBD	3 (13)	1 (9)	11 (22)
Device for small CBD stone			
4-Wired basket	11 (48)	2 (18)	26 (52)
8-Wired basket	7 (30)	5 (45)	13 (26)
Retrieval balloon	5 (22)	4 (36)	11 (22)

ERCP, endoscopic retrograde cholangiopancreatography; EST, endoscopic sphincterotomy; EPBD, endoscopic papillary balloon dilatation; EPLBD, endoscopic papillary large balloon dilatation; ENBD, endoscopic nasobiliary drainage; ERBD, endoscopic retrograde biliary drainage; CBD, common bile duct.

4. The difference of ERCP procedure between groups by experience

Table 4 shows the difference of preparation, basic procedure and preferred device for ERCP between three groups by doctor's experience in Korea. There were no significant differences in each group by their experiences.

DISCUSSION

This study is a national survey regarding ERCP operational environment and basic ERCP technique trends in

Korea. The result was primarily collected from well-experienced ERCP doctors. Most Korean ERCP doctors in this survey perform over five cases requiring ERCP procedures per week, with an overall experience of more than 10 years. Therefore, the trend in the survey represents highly active endoscopists. Notably, the status of ERCP in Korea showed that it somewhat differed from that in other countries.

The staff required for the ERCP procedure typically include minimum of one physician, two assistants, and a radiology technician.⁹ It is recommended to have a fluoroscopy room for endoscopic procedure, specifically in medical centers that perform over 600 ERCP annually.¹⁰ The quality of Korean ERCP doctors showed to be in a well-controlled state. However, the lack of specialized ERCP nurses and appropriate systems for emergency ERCP are often noted. In other countries, 40% of endoscopists perform fewer than 50 sphincterotomies in Canada,¹¹ and a large number of ERCPs tend to be performed in low volume centers in America and United Kingdom.^{12,13} According to the national data obtained from Health Insurance Review and Assessment Service, ERCP is mostly performed in university hospitals or tertiary care institutions.⁸ Our survey in Korea revealed that a large number of ERCPs were performed by small number of well-experienced ERCP doctors. We found that ERCP procedures in Korea had a tendency to be concentrated on doctors in university hospitals or tertiary referral centers.

There are some differences of ERCP preparation in Korea compared with other Western countries. Sedation is one of the important issues in therapeutic endoscopy and related with reducing the failure rate.^{14,15} Anesthesia-administered sedation can improve the success of advanced endoscopic procedures.¹⁶ In most Western countries, ERCP is usually performed with deep sedation or general endotracheal anesthesia. In Asian countries such as Korea, ERCP is often performed under sedation by an endoscopist. A previous survey in Korea suggested that ERCP procedures were usually performed under sedation rather than general anesthesia and the most preferred agent for sedation was propofol and/or midazolam.⁸ Agents such as propofol, midazolam or dexmedetomidine can be used to achieve moderate sedation for the procedure.¹⁷ Previously, propofol alone provided identical or superior sedation quality than combination with midazolam in regard of both the recovery time and patient tolerance.¹⁸⁻²¹ In this survey, half of ERCP doctors in Korea preferred to use a balanced propofol sedation technique for ERCP preparation.

Post-ERCP pancreatitis is the most common complication with incidence up to 15%.²² It is sometimes severe and potentially fatal, with a mortality rate of 0.1% to 0.5%. A

number of agents or techniques have been investigated previously to prevent post-ERCP-pancreatitis. Previous meta-analyses suggested that the use of rectal nonsteroidal anti-inflammatory drug,²³⁻²⁵ aggressive hydration with lactated Ringer's solution and prophylactic pancreatic stent placement are effective in reducing the incidence and severity of post-ERCP pancreatitis.^{26,27} Since rectal nonsteroidal anti-inflammatory drug is not commercially available in Korea, it cannot be used for ERCP premedication as prophylaxis. In the future, more research will be needed to develop the optimal prophylactic treatment for ERCP. Since prone position ERCP is favorable with a higher technical success rate and easy to visualize an abdominal image than lateral position,²⁸ prone position is dominantly used for patient's position during ERCP in Korea.

Among the ERCP techniques, there are important basic techniques such as selective cannulation, biliary sphincterotomy, and stone extraction. In practice, most ERCP doctors opt to cannulate the naïve papilla a sphincterotome rather than catheter.⁹ Generally, guidewire with a hydrophilic tip is used commonly and the use of an angled or J-tip guidewire is recommended as a standard technique.²⁹ When performing ERCP, doctors often encounter some difficult cases such as repeated failure of selective cannulation or impacted large stones. In cases of a failed initial cannulation attempt, a salvage technique should be selected to approach the common bile duct. European Society of Gastrointestinal Endoscopy and Japan Gastroenterological Endoscopy Society recommend needle-knife fistulotomy as the salvage technique.^{30,31} For large common bile duct stones over 2 cm or impacted stones, fragmentation of the stones within the bile duct is frequently required before removal. In Korea, Trapezoid™ basket was dominantly preferred as lithotripsy device during ERCP. Most ERCP doctors choose endoscopic retrograde biliary drainage rather than endoscopic retrograde nasobiliary drainage for biliary drainage therapy. However, the advantage and effectiveness are still unclear. Thus, comparative study would be required to establish a standard biliary drainage therapy.

We found no significant differences for preferred devices or techniques between groups by doctor's experiences. The doctor's preference of basic techniques and accessories might be more closely related with the mentor's taste than the individual taste in Korea. However, this national survey in Korea has some limitations. The accuracy of the answers depended on the participants' memory, due to which recall bias could not be avoided. The lack of opinion from young doctors is another limitation of this study. The answers about ERCP environment might be inaccurate among individual doctors. National survey for all hospitals and medical centers could guarantee accurate results for

ERCP environment. Furthermore, multinational survey or prospective registry will be required to subsequent study for current trend of ERCP. Some important factors about safety such as radiation exposure, medical outcomes and complication rates are missing from the content of survey.

In conclusion, data from this survey involving ERCP doctors in Korea showed a diversity of preferences in the basic techniques and ERCP environment. More studies are required to develop ERCP standards in Korea.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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AUTHOR CONTRIBUTIONS

Analysis and interpretation of data: J.M.L., H.K.C., T.J.S., D.W.A., Y.S.L., D.W.L. Drafting of the manuscript, statistical analysis: J.M.L. Study design, administrative, technical and material support: C.H.P., K.B.C. Critical revision of the manuscript: C.H.P., K.B.C., E.S.L., Y.N.L., H.K.C. Acquisition of data, study supervision: S.H.M., S.W.P., W.H.P., C.N.P., B.K.S., T.J.J. All authors read and approved the final manuscript.

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