Training of Surgical Endoscopists in Korea: Assessment of the Learning Curve Using a Cumulative Sum Model

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OBJECTIVE: Surgeons' interest and participation in endoscopy have increased recently. The aims of the present study were to assess the learning curve for surgical training in upper endoscopy and to suggest an appropriate training program for surgeons in Korea.

DESIGN: Under the supervision of skilled endoscopists, 4 trainees who participated in this study performed more than 150 esophagogastroduodenoscopy procedures, according to the recommendations of the American Society for Gastrointestinal Endoscopy. The success of the procedures was defined as the fulfillment of designated time and checkpoints. A cumulative sum model was used to assess the learning curve.

RESULTS: During the same period, the 4 trainees completed 158, 160, 166, and 180 procedures, respectively. Plateau points occurred on the learning curve at the 81st, 90th, 98th, and 111th case in the cumulative sum model and the mean value of the plateau was the 95th case.

CONCLUSIONS: An intensive education tool and training module that meets the conditions of surgical residents is mandatory for the training of proficient surgical endoscopists. (J Surg 69:559-563. © 2012 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEYWORDS: cumulative sum model, education, endoscopy, learning curve, surgeon

COMPETENCIES: Medical Knowledge, Practice Based Learning and Improvement, Systems Based Practice

INTRODUCTION

Gastric cancer is one of the leading causes of cancer mortality worldwide; however, its incidence is declining, especially in many industrialized countries.[1] Endoscopy is the most important tool for the diagnosis and follow-up of gastric cancer. In Far East Asian countries, such as Korea and Japan, the incidence of gastric cancer is very high, and mass screening programs using esophagogastroduodenoscopy (EGD) have been well developed.[2,3] However, EGD represents a burden to patients, who often complain of pain, inconvenience, and fear depending on the examiner's skill level. Sedative endoscopy is a widely used, safe, and popular screening method. Thus, it is important that gastric cancer specialists acquire the ability to conduct speedy and safe endoscopic procedures and accurately interpret findings. Gastric cancer surgeons, in particular, should have a profound knowledge of endoscopic instruments and procedures, and the 3-dimensional structure of the stomach.

The American Society for Gastrointestinal Endoscopy (ASGE) defined the following objectives of gastrointestinal endoscopic training: (1) appropriate recommendations; (2) safe, complete, and expeditious performance; (3) understanding of the principle of conscious sedation; (4) correct interpretation of endoscopic findings and integration with treatment; (5) identification and minimization of risk factors and appropriate management of complications; and (6) acknowledgment of the limitation of personal skills and recognition of when to request help.[4] The ASGE has also recommended that to achieve these objectives in upper endoscopy and colonoscopy, the completion of 130 and 140 cases, respectively, are required for typical trainees.[5] The American College of Surgeons and the Society of American Gastrointestinal Endoscopic Surgeons (SAGES) offer hands-on workshops and validated training programs in endoscopy, and have developed a structured endoscopy curriculum.[6]

Until recently, gastric cancer surgeons in Korea have shown low interest in and demand for training in endoscopic procedures. Basic guidelines for the endoscopic training of surgical residents have, thus, not been developed. In our institution, surgeons perform EGDs to diagnose and follow pre- and post-gastrectomy patients. Thus, we designed this study to calculate the learning curve for surgical endoscopists and to suggest an appropriate training program for surgeons in Korea with poor endoscopic educations.

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METHODS

Participants and Procedures

Three faculty members (K.Y.S., C.H.P., and H.M.J.) and 3 fellows belonging to the Division of Gastrointestinal Surgery in the Department of Surgery, Seoul St. Mary's Hospital, Seoul, Korea, performed EGDs each weekday morning. A total of 4 trainees, 1 new fellow, and 3 senior residents who will participate in next year's fellowship were enrolled in this study. The 4 trainees had no previous experience in EGD procedures. They had been educated in the basic concepts and procedures of EGD and underwent a 4-week observation period. Before these individuals performed EGD procedures, they were trained using an endoscopy simulator (AccuTouch® Endoscopy Simulator; Immersion Medical, Gaithersburg, MD, USA).

Trainees performed EGDs using 2 endoscopic systems (CV-240, CV-260; Olympus, Tokyo, Japan). Each trainee was scheduled to perform at least 150 procedures within a 2-month period, according to the recommendation of the ASGE. One of the 3 faculty members, who had performed more than 3000 endoscopic procedures, observed each trainee-performed EGD as a supervisor and trainer. When the trainee exceeded the designated time limit, the patient was uncomfortable, or the procedure could no longer proceed, the supervisor stepped in to complete the EGD. All patients were informed that the endoscopies were to be performed by a trainee. Patients with postoperative changes that prevented the advance of the endoscope, such as anastomotic stricture, were excluded from the study.

This study was approved by the institutional review board of the ethical committee of the College of Medicine, Catholic University of Korea (KC11RISI0390).

Protocol

EGD procedures were evaluated using checkpoints based on the procedural technique (Table 1). The checkpoints included items that applied to EGDs in general, as well as items specific to the anatomical state of the stomach. These items were derived from valid parameters that have been used in previous studies of endoscopy training.[5,7,8] Time limits were designated for each anatomical state; these provided trainees with about 1.5 times the average duration required by supervising faculty surgeons to complete the procedure.

A procedure was given a passing score when all general and specific checkpoints had been accomplished within the designated time limit. For example, even if the passage and manipulation of the endoscope and the visualization of a certain part were completed within the designated time limit, a procedure was considered a failure if the captured photo was indistinct or endoscope manipulation caused mucosal bleeding.

TABLE 1. Protocol for Endoscopic Training

		Endpoint
General		Smooth endoscope manipulation Definite photo acquirement No organ injury
State		**Time**
Normal	Passage through the throat and esophagogastric junction Passage through the pylorus Visualization of ampulla Visualization of angular fold Retroflexion maneuver Detection of abnormality (performance of biopsy)	15 min
Postoperative	Passage through the throat Visualization of anastomosis with retroflexed view Detection of recurrence (performance of biopsy)	
Billoth I	Passage through esophagogastric junction Visualization of duodenum Retroflexion maneuver	5 min
Billoth II	Passage through esophagogastric junction Visualization of afferent and efferent loops Retroflexion maneuver	8 min
Roux-en-Y	Visualization of Roux limb (and blind loop)	3 min

Statistical Analysis

Changes in the outcomes of EGD procedures with the progression of each trainee's case sequence were measured using a cumulative sum (CUSUM) model. The successful achievement of each checkpoint was scored as 0 and failure was scored as 1. The total score for each procedure was recorded as 0 when all check point scores were 0, or as 1 when any checkpoint score was 1. The total score was entered into the CUSUM model and the model was analyzed using Minitab software (ver. 14.0; Minitab, Inc., State College, PA, USA).

RESULTS

The 4 trainees performed diagnostic EGDs in patients with anatomically normal stomachs and follow-up EGDs in postgastrectomy patients with 3 types of reconstructions. Subtotal gastrectomy reconstructions used the Billroth I and II methods, and total gastrectomy reconstructions used the Roux-en-Y procedure. One junior fellow performed 166 EGDs and 3 senior residents completed 180, 160, and 158 EGDs, respectively, during a 2-month period. Table 2 lists the number of EGD procedures according to anastomotic stomach conditions. Although about 50% of cases had Billroth II reconstructions, the gastric conditions encountered did not differ significantly among trainees ($p = 0.560$).