A novel interactive demonstration in clinical gastroenterology for first-year medical students

MAURICE F. CRASS III AND DAVID S. HODGES
Department of Physiology and Division of Gastroenterology, Department of Internal Medicine, Texas Tech University Health Sciences Center, Lubbock, Texas 79430

Crass, Maurice F., III, and David S. Hodges. A novel interactive demonstration in clinical gastroenterology for first-year medical students. Am. J. Physiol. 264 (Adv. Physiol. Educ. 9): S1-S3, 1993.—A unique clinical correlation in gastroenterology for first-year medical students is described. This interactive demonstration is conducted in a clinical setting and is designed to introduce the student to a broad range of topics in clinical gastroenterology while complementing lecture material in gastrointestinal (GI) physiology. Faculty and fellows of the Department of Internal Medicine at Texas Tech University Health Sciences Center present minilectures and demonstrations at five different stations held in endoscopy rooms of the GI Diagnostic Center (GI Lab). The first-year class is divided into groups of 20 students or less. Each group visits a given station for 30 min, and each station has a specific topic. The topics are motility studies, esophagogastroduodenoscopy, gastric analysis, endoscopic retrograde cholangiopancreatography, and colonoscopy and sigmoidoscopy. At each station, physicians pose clinical questions related to the students' understanding of GI physiology and, in turn, respond to students' questions. For students who have been learning basic concepts of GI physiology, this clinical demonstration offers a more meaningful clinical correlation than standard clinical lectures could afford. In addition, the demonstration brings enhanced interest and enthusiasm for the subject matter.

The teaching of physiology to first-year medical students very often includes clinical correlation sessions. These sessions are designed mainly to underscore the importance of understanding basic physiological concepts as they apply to clinical medicine, using patient case studies. These correlations have proven to be a motivational experience as well as a relaxing break in the often tedious continuum of new didactic material. Before the initiation of the demonstration to be described, our clinical correlations in gastrointestinal physiology involved classroom lectures by clinicians on such topics as liver disease, liver function tests, peptic disease, tests for gastric function, endoscopy, and surgical treatment of gastrointestinal disease. Because of time constraints within the curriculum, only one, or maximally two, clinical correlations on specific topics were possible; thus many areas of interest were not covered.

The purpose of this report is to convey the design and content of a new and unique clinical correlation, namely, a clinical gastroenterology interactive demonstration for first-year students. This demonstration was developed by the faculties of the Department of Physiology and Division of Gastroenterology in the Department of Internal Medicine, Texas Tech University Health Sciences Center, and is conducted in a clinical setting. It is designed to expose the student to a broad range of topics in clinical gastroenterology, at the same time complementing lecture material in gastrointestinal physiology. The demonstration has been conducted with annual revisions and improvements for the past seven years, and we feel it is a valuable addition to our curriculum. The response by both students and faculty has been very positive.

LECTURES IN GASTROINTESTINAL PHYSIOLOGY
The first-year medical students are given ~20 lecture hours of gastrointestinal physiology. The lectures include electrophysiology and mechanics of gastrointestinal muscle; motility patterns of the esophagus, stomach, and small and large bowel; secretory and excretory mechanisms of the salivary glands, exocrine pancreas, liver, and gallbladder; stomach and intestinal mucosa; digestive and absorptive mechanisms; and hormonal and neural regulatory mechanisms associated with motility, secretory, digestive, and absorptive functions.

In the lectures, references are made to gastrointestinal and hepatic diseases and related specific functional abnormalities; however, they are insufficient to impart a feeling for diagnostic capability or subsequent treatment modalities of these pathophysiological states. We believed that both the former and latter could be addressed in an intensive, clinically oriented demonstration session.

DESCRIPTION OF INTERACTIVE DEMONSTRATION
After completion of the lecture series and before a pre-examination review of physiological principles, a 3- to 4-h demonstration is held in the Gastrointestinal Diagnostic Center (GI Lab) in the Health Sciences Center. Faculty and fellows of the Division of Gastroenterology present minilectures and demonstrations lasting ~30 min. These presentations cover diagnosis and treatment of disorders encountered in clinical gastroenterology utilizing five stations, the stations being held in the endoscopy rooms of the GI Lab. The first-year medical class, numbering ~100, is divided equally into five groups that rotate through the same number of demonstration stations. Each group visits a given station for 30 min with an additional 3–5 min allowed for moving to and reassembling at the next station. The small groups of 20 students permit the physicians to respond to students' questions...
and to pose clinical questions related to the students’ understanding of gastrointestinal physiology. The following paragraphs describe the content of the different instructional stations and how it relates to the content of the previous didactic instruction.

Station 1: motility studies. Motility disorders of the gastrointestinal tract are common, and most can be readily diagnosed by manometric studies. Students are brought into the manometry room and are shown the equipment used to perform motility studies of the esophagus, small bowel, and anorectum. Unique features of the manometry catheters employed for each specific area are discussed. Additionally, the water perfusion system and the computer used to display and store manometric tracings are shown. A brief presentation by the physician details the step-by-step performance of a manometry study. Motility tracings from patients are displayed, demonstrating normal esophageal contractions, intestinal migrating motor complexes, and rectoral inhibitory reflex (RAIR). To contrast these physiologically normal studies, students have the opportunity to question the physician about disorders of swallowing and esophageal motility and the use of manometry to identify diffuse esophageal spasm, nutcracker esophagus, and abnormal myenteric plexus function in achalasia of the esophagus. Students also learn how lower esophageal sphincter (LES) function is assessed and therapeutic approaches to LES dysfunction. Other topics of discussion include small bowel myopathies and neuropathies, analysis of the RAIR in patients with constipation, and the testing of external anal sphincter function in patients with incontinence.

Station 2: esophagogastrroduodenoscopy (EGD). Fiberoptic endoscopy, with its extraordinary diagnostic and therapeutic capabilities, has revolutionized the practice of modern gastroenterology. Students are particularly fascinated with the endoscopic equipment. An endoscopy room is prepared in a manner similar to that for a real patient, with a video gastroscope connected to its light source and suction apparatus. The physician shows the different parts of the flexible endoscope and demonstrates the remote maneuverability of the distal end. Use of biopsy forceps with the gastroscope is demonstrated, and the usefulness of biopsies in clinical situations is discussed. Other accessory equipment is shown, including balloon dilators used to dilate strictures, sclerotherapy needles to inject bleeding esophageal varices, and electrocoagulation catheters used to arrest hemorrhage from other bleeding lesions such as peptic ulcers and arteriovenous malformations.

A description follows that highlights the chronological performance of an upper intestinal endoscopy. The informal atmosphere encourages students to ask questions at any point during the presentation (and they invariably do). The group views a video of a portion of a previously recorded EGD on a real patient. Although students tend to be amazed with the technical capabilities at the gastroenterologist’s disposal, the limitations and potential complications of endoscopy are discussed.

Student-physician discussion at this station centers around acid hypersecretory states and, relatedly, the balance between aggravative factors (acid, pepsin, bile acids) and protective factors (mucous-bicarbonate layer, prostaglandins, mucosal blood flow) in peptic disease. The students have the opportunity to rethink the nature of the gastric mucosal barrier and its vulnerability as related also to exogenous factors, such as aspirin, alcohol, and nonsteroidal anti-inflammatory agents.

Station 3: gastric analysis. Patients suspected of a gastric acid hypersecretory state, or recurrent peptic ulcer after vagotomy surgery, are candidates for gastric acid analysis. The performance and interpretation of these tests require a thorough understanding of gastric acid secretion by the physician. Thus students see a direct clinical application of gastrointestinal physiology that they have recently learned. A brief presentation of the equipment used to collect gastric acid and measure its pH is given. The physician then presents an overview of the definition and calculation of basal, maximal, and peak acid outputs. Diagnosis of a hypersecretory state by gastric acid analysis, such as Zollinger-Ellison syndrome, is discussed. This affords an excellent opportunity to discuss normal gastrin physiology and states in which gastrin physiology is altered secondary to a decreased parietal cell mass with resultant alkalinization of the antrum. The importance of the vagus nerve in acid secretion is reinforced by discussion of the sham feeding test, which measures the increase in gastric acid secretion after vagal stimulation. Because frequency of disorders of gastric acid secretion is relatively high, including the local medical student population, interest in the various facets of peptic disease is similarly high. Thus this station offers an excellent opportunity for informed student-physician dialogue on topics such as the secretory cell population of the stomach mucosa, the mechanisms of acid secretion and its neural and endocrine controls, and pharmacological interventions that suppress gastric acid production and/or secretion.

Station 4: endoscopic retrograde cholangiopancreatography (ERCP). One of the most exciting uses of fiber-optic technology is the development of a side-viewing endoscope that allows cannulation of the papilla of Vater and injection of dye into the pancreatic and common bile duct for precise anatomic visualization of these structures. Before ERCP, good delineation of these structures was obtained only by a percutaneous route through the liver, a more invasive procedure. Students are brought into the fluoroscopy room of the GI Lab where ERCPs are performed. The side-viewing duodenoscope is shown. Common biliary and pancreatic diseases diagnosed and treated with the aid of ERCP are discussed. For example, gallstones lodged in the common bile duct can be removed endoscopically by widening the papilla of Vater with electrocautery and then extracting the stone into the intestine with a basket or balloon catheter. This spares the patient the need for major surgery. A short video is presented of a patient showing actual cannulation of the papilla with an ERCP catheter. Discussion points include the utility of ERCP in evaluating causes of obstructive jaundice, such as common bile duct strictures or stones, and suspected pancreatic disease such as chronic pancreatitis or carcinoma. Mention is also made of the new
technique for sphincter of Oddi manometry, which specifically looks for abnormal resting pressure or phasic contraction waves in patients with postcholecystectomy sphincter of Oddi dysfunction. Discussion also centers around changes in the physicochemical states of gallbladder bile, and liver function tests as related to the differentiation of hepatocellular from obstructive liver disease.

Station 5: colonoscopy and sigmoidoscopy. Endoscopic examination of the entire colon is now performed in most medical centers on a routine basis. Because curious students always seem to ask who requires such an exam, the indications for colonoscopy are explained by the physician at the beginning of the station. A typical colonoscope and shorter sigmoidoscope are on display, and certain operating features, similar to the gastroscope, are shown. A major focus of endoscopy of the lower intestinal tract is the detection and removal of premalignant polyps in the colon. Wire-loop snares and coagulation forceps used to remove colon polyps are shown, and the removal technique is discussed. Subsequently, a portion of an actual colonoscopy is played back on the video monitor.

DISCUSSION

It should be clear from the details of the content of each of the above stations that the demonstration affords the opportunity for physicians to touch on many of the areas of learning in the just completed physiology lectures. For the students who have been zealously learning the basic concepts of gastrointestinal physiology, we believe this interactive demonstration offers a more meaningful correlation of these basic concepts than standard clinical lectures could afford, i.e., the students see the direct application of physiology to the daily practice of medicine. Furthermore, the demonstration provides the physician an opportunity to inform the students of what has been so clearly stated elsewhere (2), that is, “Perhaps the most important lesson that can be taught in medical physiology is this: there are no rigid answers when studying an individual. A good understanding of established principles, however, enables one to ask the right questions to obtain the best possible understanding of the functioning of one’s subject.”

An added feature of this demonstration is the opportunity for clinical faculty to present not only state-of-the-art gastroenterology but also the limitations of existing technology and therapy and where these areas are evolving. It should be apparent to physiology faculty that the basic format of this clinical gastrointestinal interactive demonstration could easily be extrapolated to other areas of the medical physiology course, for example cardiovascular or pulmonary physiology interfaced with similar clinical demonstrations. The small group size enables the basic science faculty to evaluate student comprehension and can assist faculty in lecture preparation with respect to areas of emphasis or focus. Furthermore, this gastrointestinal demonstration model brings basic science and clinical faculties and their respective teaching efforts together in a medical curriculum that is getting more complex and thus difficult to plan and coordinate, with scientific advancements and instructional time constraints often in conflict (1). Such correlations may also aid in bridging the first two years of the curriculum, i.e., the basic concepts taught in the first year with the pathology, pathophysiology, and pharmacology of the second year. Finally, it should be emphasized that the clinical gastrointestinal demonstration described in this report is a clinical correlation exercise and is in no way intended to substitute for experimental physiology laboratories.

Evaluations of this novel clinical gastroenterology demonstration (GI Lab) by the first-year medical students have been uniformly positive and enthusiastic. Typical written student comments include the following: “The GI Lab experience was excellent; it helps to remind us that some day we will actually be using what we learn”; “…GI Lab was great and very well integrated with medicine as it really happens”; “During the GI section, I found the trip to the GI Lab very informative and relevant to the material”; and “The GI Lab was absolutely marvelous—it reinspired me.”

Address for reprint requests: M. F. Crass III, Dept. of Physiology, Texas Tech Univ. Health Sciences Center, Lubbock, TX 79430.

Received 17 November 1992; accepted in final form 5 March 1993.

REFERENCES
