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Editors

Clinical Gastrointestinal Endoscopy

A Comprehensive Atlas

Second Edition

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ISBN 978-981-10-4994-1 ISBN 978-981-10-4995-8 (eBook)
https://doi.org/10.1007/978-981-10-4995-8

Library of Congress Control Number: 2018940899

Printed on acid-free paper

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd. part of Springer Nature
The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

First and foremost, I would like to thank my wife, Yeoun-Jin Lee, and my two daughters, Na-Young and Ji-Young, for standing beside me throughout my career. I would also like to express my gratitude to Hoon Jai Chun, our lead author, for his excellent leadership and direction. I would also like to appreciate my good colleagues Ki-Nam Shim, Jae Myung Park, Jae Young Jang, Jeong-Sik Byeon, and In Kyung Yoo for coordinating our numerous team members.Myung-Gyu Choi, M.D., Ph.D.I dedicate this work to my wife, Ji-Hyun Shin, and my son, Stephen.

Suk-Kyun Yang

I dedicate this work to my talented wife and two children, who have given me an endless supply of love and support, and to Prof. Emeritus Jin Hai Hyun, my wise mentor and friend.

Hoon Jai Chun

Preface

It has been 5 years since the first edition of *Clinical Gastrointestinal Endoscopy* was published. The first edition was a beneficial product that was made possible by the endeavors of many gastrointestinal endoscopists. In the first edition, approximately 2000 endoscopic images of the upper, middle, and lower gastrointestinal tract were included. It covered most major gastrointestinal lesions and disease processes, including neoplastic, inflammatory, and others. Clear, high-resolution images of both typical and atypical lesions and carefully selected endoscopic images of advanced techniques (such as endoscopic ultrasound, capsule endoscopy, and balloon-assisted endoscopy) were unique characteristics of the first edition. Thanks to these features, the first edition of *Clinical Gastrointestinal Endoscopy* has become one of the most revered gastrointestinal endoscopy atlases in the world.

Technical advances in recent years have led to a rapid development in the field of gastrointestinal endoscopy. The resolution of images has markedly improved. Light sources are varied, and post-image processing technologies have been developed. In addition, new instruments, such as the confocal laser endomicroscope, have been introduced. This progress over the past 5 years has encouraged us to prepare the second edition of *Clinical Gastrointestinal Endoscopy* to provide endoscopists with a timely version of the gastrointestinal endoscopy atlas.

The second edition has several new features. First, the majority of the endoscopy images have been changed to high-resolution pictures. High resolution is a key factor for the detection of early lesions and accurate endoscopic diagnosis. Most endoscopy providers now supply high-resolution endoscopies. To satisfy this need of the times, the second edition provides excellent, clear, high-resolution images throughout all the chapters. Second, a new section on novel endoscopy technologies is included. Equipment-based image-enhanced endoscopies, such as narrow-band imaging and computed virtual chromoendoscopy systems, are now widely used in clinical practice. Basic knowledge regarding these image-enhanced endoscopies, as well as carefully selected images, is included in the second edition.

Confocal laser endomicroscopy is another novel endoscopic technique for real-time histological diagnosis. The fundamental principles of confocal laser endomicroscopy are included, and typical images are provided for the benefit of advanced endoscopists. High-quality images of other new endoscopy techniques, such as transnasal endoscopy, full-spectrum colonoscopy, and colon capsule endoscopy, are also displayed. The final feature of the second edition is the inclusion of topical quiz questions. Interesting quizzes are provided at the end of chapters. These quizzes summarize the complex knowledge and images within relevant chapters and provide a fun challenge to the reader, thereby enhancing the understanding of the chapters and internalizing practical tips.

Besides these features, the second edition systematically organizes the contents of the atlas. Based on the anatomy of the gastrointestinal tract, sections are classified into four divisions: esophagus, stomach, small intestine, and colorectum. In each section, normal endoscopy findings are initially introduced. Common diseases are explained in individual chapters. Finally, rare conditions, including “miscellaneous” lesions, are covered by independent chapters. The fifth section discusses novel endoscopy technologies, as previously described. This organizational structure of the second edition will help readers to systematically study gastrointestinal endoscopies.

The variety of improved features in the second edition of *Clinical Gastrointestinal Endoscopy* includes excellent high-resolution images, a section on novel endoscopy technologies, and an interesting quiz at the end of every chapter. These features provide endoscopists with a valuable resource for systematic knowledge and clear insight into the identification and interpretation of gastrointestinal endoscopy findings. This book will be the ultimate guide to gastrointestinal endoscopy for both novice and advanced endoscopists and will definitely assist clinicians who need to manage various issues in their daily endoscopy practices.

We thank all the authors who participated in publishing the second edition of *Clinical Gastrointestinal Endoscopy* and the contributors who collected endoscopic images. Through their kind contributions and endeavors, we have created a brilliant piece of work. We hope this atlas will become a primary reference for gastrointestinal endoscopists.

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Normal Upper GI Findings and Normal Variants

1

Kyoung Oh Kim

Contents

1.1 Oral Cavity, Pharynx, and Larynx

When the endoscope is inserted into the body, the areas interfaced at first are the oral cavity, pharynx, and larynx. Often, these regions are not observed carefully, since there are laryngeal refluxes in these regions, and the observer does not consider these areas important. However, these regions should be observed carefully, because there are various tumors and other diseases in the oral cavity, pharynx, and larynx. When forward-viewing endoscope is used, the tongue is located on the upper side, while the hard palate is observed on the lower side (Fig. 1.1a). When the endoscope is inserted deeper, there is a transformation from the hard palate to soft palate, and the uvula is observed (Fig. 1.1b). When the uvula is visible, the endoscope is inserted without touching the uvula. The epiglottis is observed after the uvula, while the vocal cords and pharynx are observed after the epiglottis (Fig. 1.2). When the endoscope is inserted toward the pyriform sinus through the left wall of the pharynx, the operator should be careful not to allow the endoscope to enter above the left pyriform fossa. And then the monitor shows the upper esophageal sphincter and the upper esophagus, respectively. Because the upper esophagus is not anatomically dense, there is a risk of perforation when the endoscope is roughly inserted. Both the laryngopharynx and esophagus are composed of a squamous epithelium. The larynx is part of the throat, between the base of the tongue and the trachea. The larynx contains the vocal cords, which vibrate and make sound when air is directed against them. There are three main parts of the larynx:

Supraglottis: the upper part of the larynx above the vocal cords, including the epiglottis.
Glottis: the middle part of the larynx where the vocal cords are located.
Subglottis: the lower part of the larynx between the vocal cords and the trachea.

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H. J. Chun et al. (eds.), *Clinical Gastrointestinal Endoscopy*, https://doi.org/10.1007/978-981-10-4995-8_1

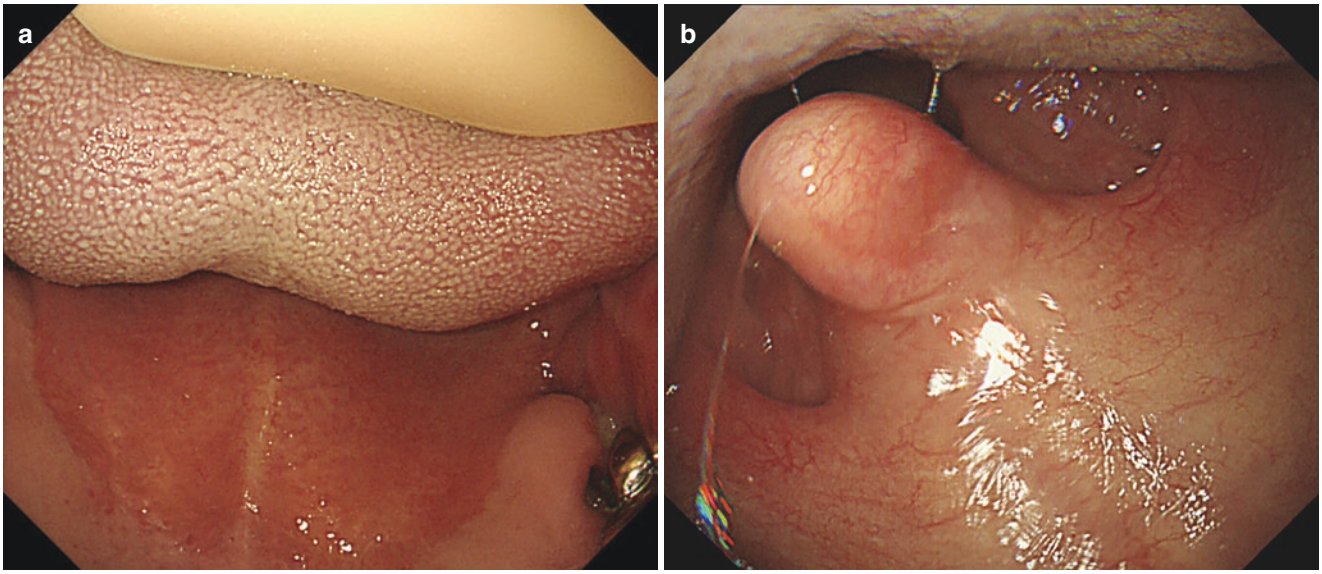

Fig. 1.1 Endoscopic finding of the oral cavity. (**a**) Oral cavity. (**b**) The uvula is noted between the tongue and hard palate

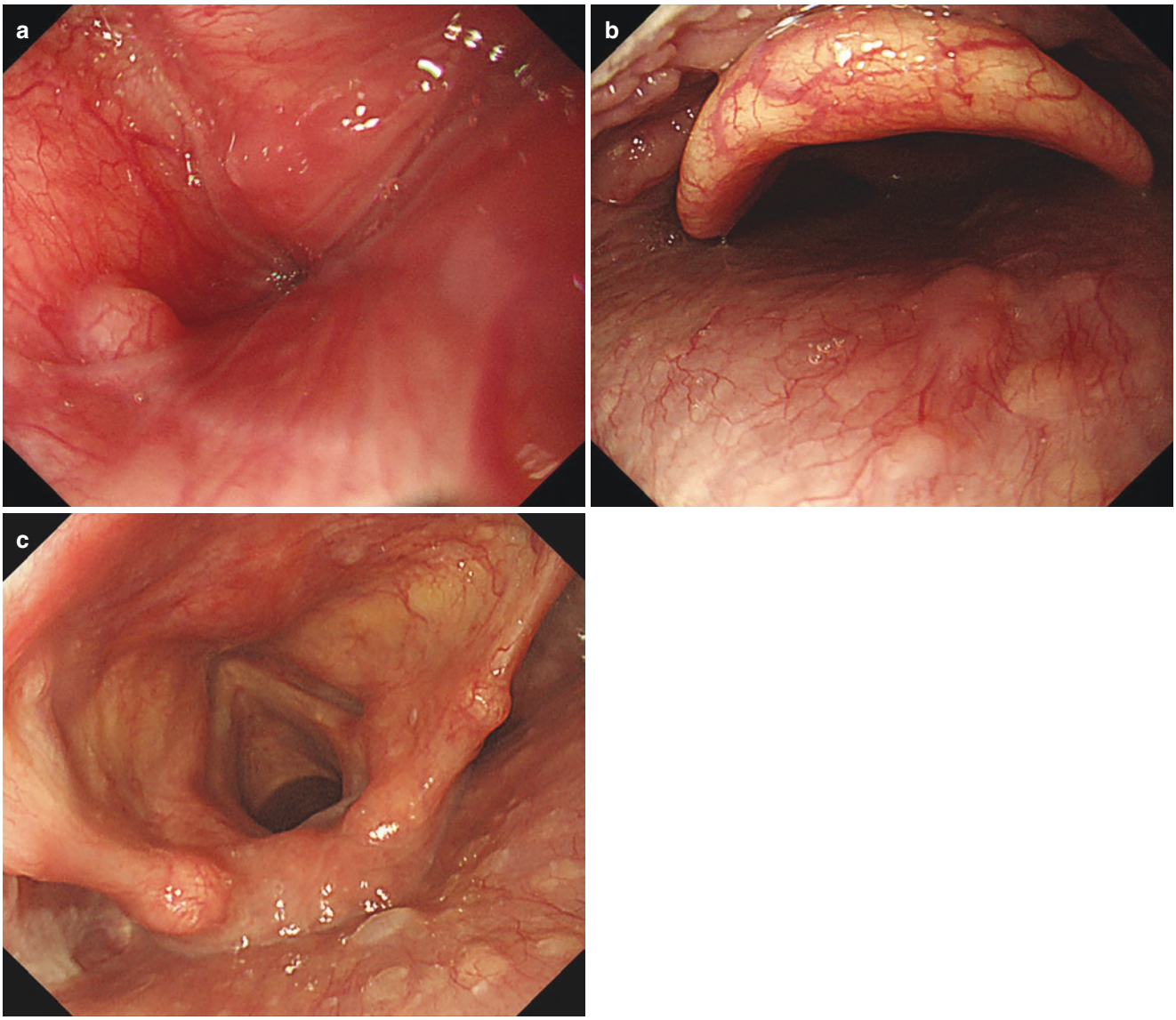

Fig. 1.2 Endoscopic finding of the larynx. (**a**) Pyriform sinus. (**b**) Epiglottis and pharynx. (**c**) Larynx, vocal cords

1.2 Esophagus

The normal esophageal mucosa is shiny, pale white, and thinner than that of the stomach. The superficial vessel runs longitudinally at the entrance of the esophagus and the esophagogastric junction (EGJ) and then branches out at other areas.

1.2.1 Cervical Esophagus

The cervical esophagus begins just below the upper esophageal sphincter and is 6 cm long (approximately 16–20 cm from incisor). The cervical esophagus posterior wall just below the esophageal sphincter has laimer triangle without an outer longitudinal muscle. When this site weakens, the hypopharynx mucosa develops Zenker's diverticulum that forms a pouch in the posterior esophagus along with the weak part of the cricopharyngeal.

Perforation may occur if operator forces the endoscope into diverticulum. Frequently red or salmon-colored mucosal patches were found in the cervical esophagus. This mucosal patch is lined by gastric columnar epithelium, the so-called heterotopic gastric mucosa, or gastric inlet patch. The esophageal heterotopic gastric mucosa is generally regarded as a congenital condition, resulting from an incomplete embryologic esophageal epithelialization process. Predominantly localization of the esophageal heterotopic gastric mucosa is the region just below the upper esophageal sphincter (Fig. 1.3). Most of the esophageal heterotopic gastric mucosa does not cause clinical symptoms; however, some individuals with HGM complain of dysphagia, odynophagia, or heartburn. The cervical esophagus is the site where patients feel the most discomfort during endoscopy, so the operator should pay more attention when inserting the endoscope in this site.

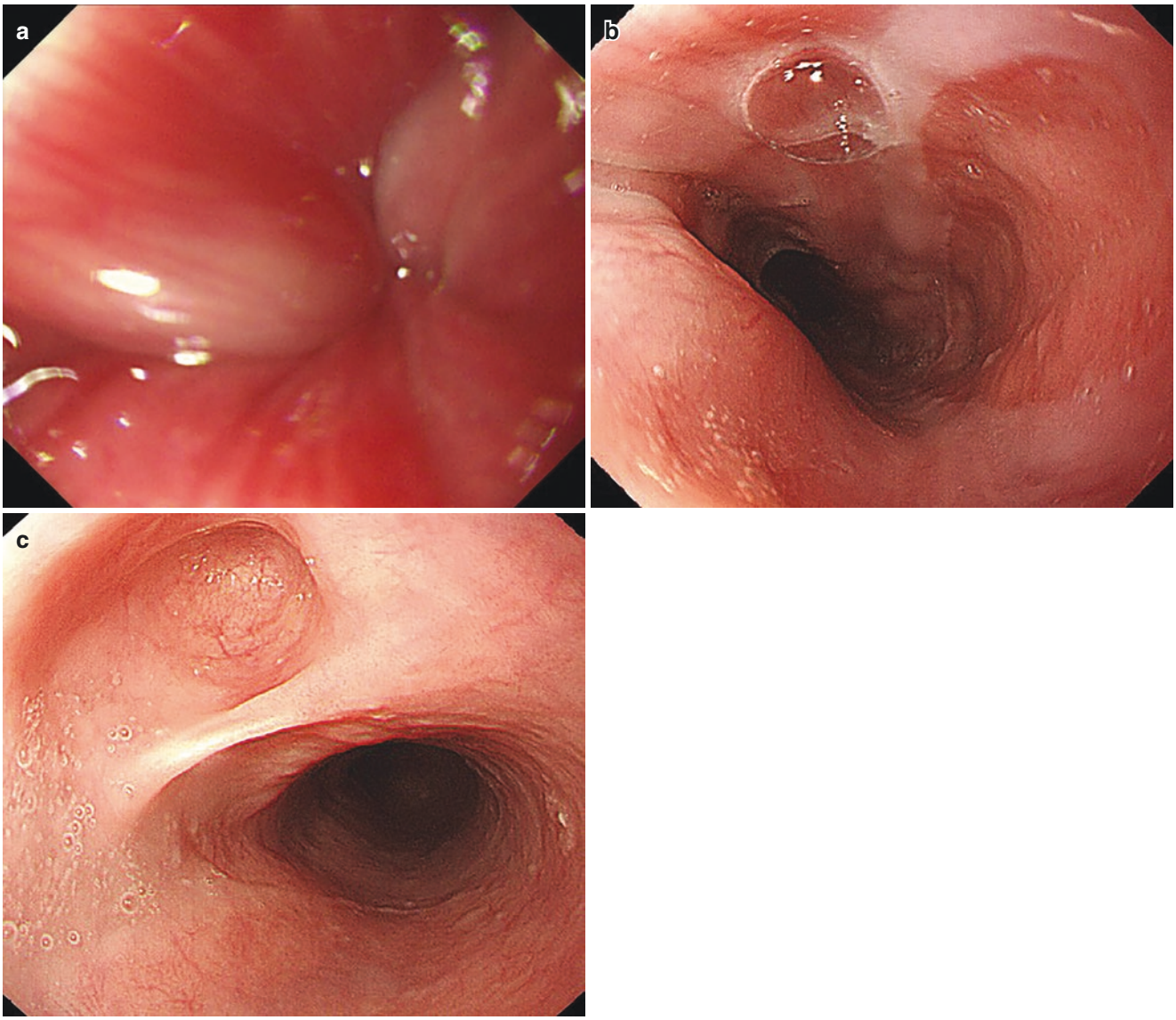

Fig. 1.3 Cervical esophagus. (**a**) Upper esophageal sphincter. (**b**) Heterotopic gastric mucosa. (**c**) Zenker's diverticulum

1.2.2 Thoracic Esophagus

The thoracic esophagus begins at the thoracic inlet to EGJ and is divided into three parts: upper, middle, and lower thoracic esophagus (approximately 20–40 cm from incisor).

The extrinsic compression can be observed in the posterior wall of the upper esophagus, and the compression by aortic arch and left main bronchus can be observed in the second physiologic stricture site (approximately 28 cm from incisor). The pulsating aspect with the left atrium compressing from the front can be observed in the middle esophagus (Fig. 1.4). Especially, this finding became apparent in patients with cardiac hypertrophy. The aorta moves toward the back of the esophagus at the left posterior wall of the esophagus. At the thoracic esophagus, glycogenic acanthosis is frequently observed in one out of ten patients undergoing endoscopy. This finding is not pathological, and chromoscopy or biopsy is not required.

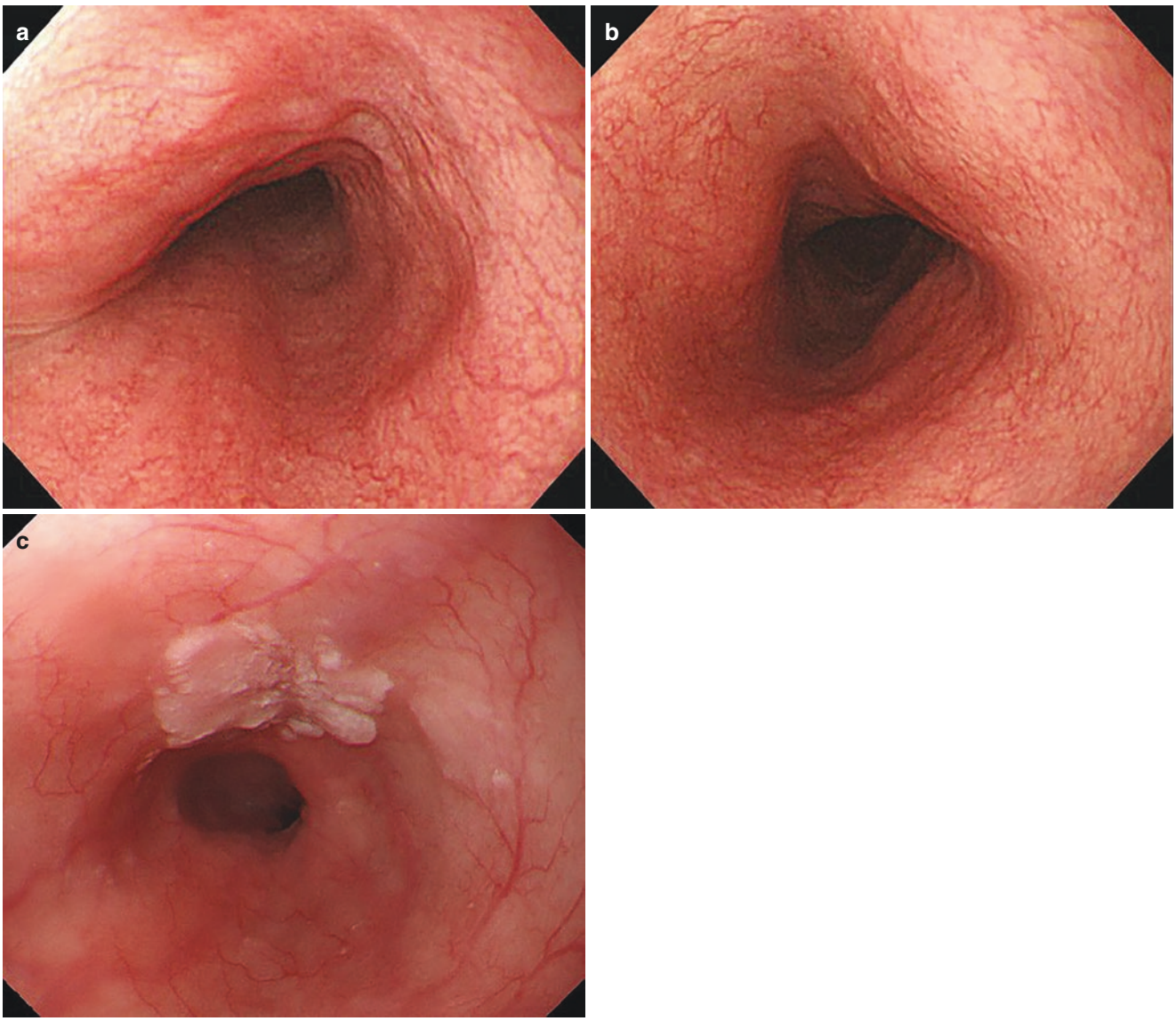

Fig. 1.4 Thoracic esophagus. (**a**) Extrinsic compression by aortic arch and left main bronchus. (**b**) Extrinsic compression by the heart, left atrium. (**c**) Glycogenic acanthosis

1.2.3 Esophagogastric Junction

EGJ is the region between which the stratified squamous mucosa-lined esophagus ends and the columnar mucosa-lined stomach begins. EGJ is approximately 2 cm long with the proximal 2 cm positioned at the level of the esophageal hiatus of the diaphragm, and the distal 2 cm of EGJ lies below the diaphragm in the abdominal cavity. In patients with esophageal hiatal hernia, EGJ is loosely open and gastric mucosa is observed in the esophagus side.

The esophageal veins run longitudinally in the submucosal layer of the body of the esophagus, where their structure is truncal, consisting of a few large columns. At the EGJ, the veins penetrate the muscularis mucosa and exist superficially, forming the longitudinal palisade vessels (Fig. 1.5). In Japanese, EGJ is endoscopically defined as the end of the longitudinal palisade vessels. However, in Western countries, the landmark for the EGJ is defined as the proximal end of the gastric folds.

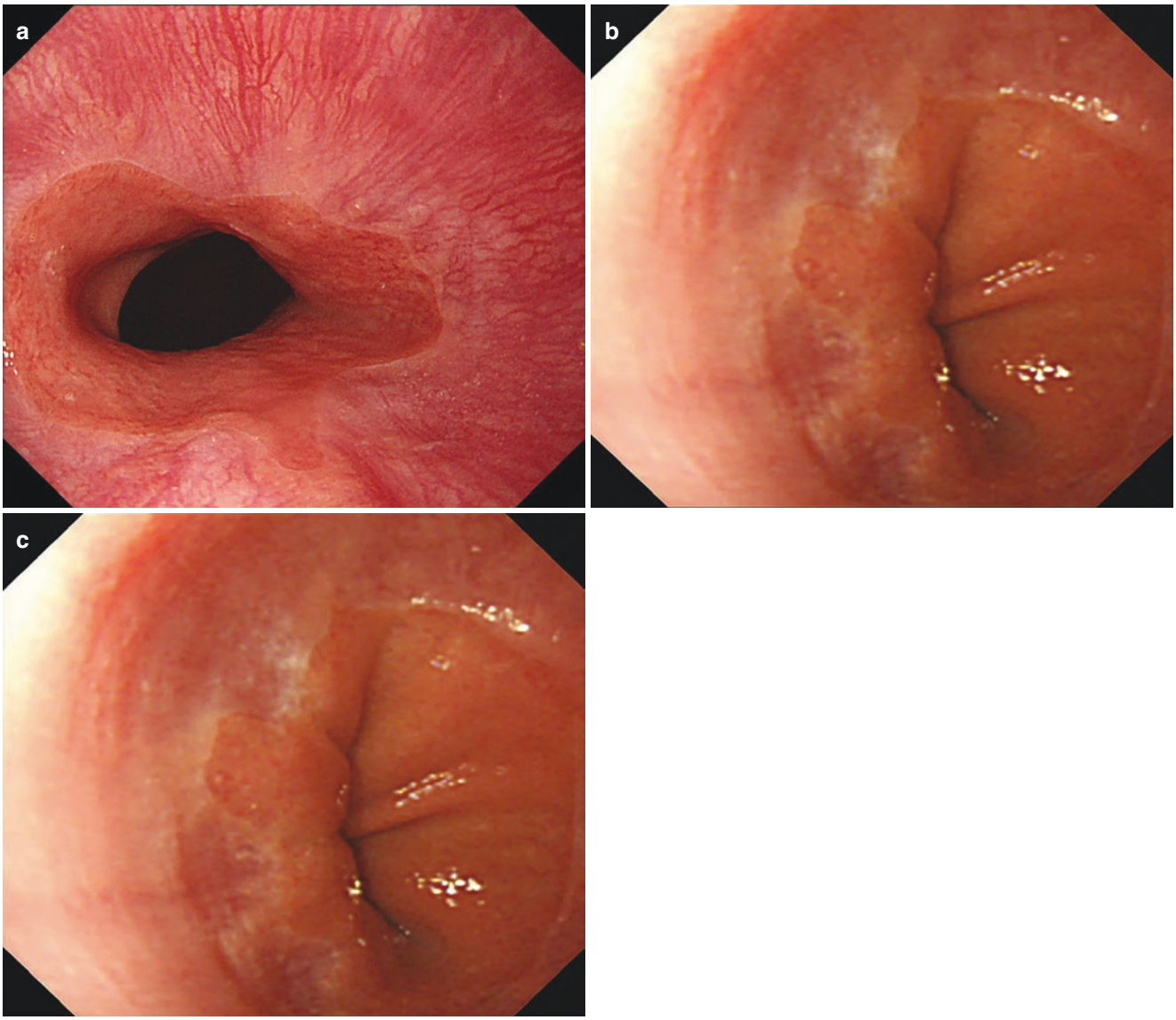

Fig. 1.5 Esophagogastric junction. (**a**) Longitudinal palisade vessels were noted at the low esophagus. (**b**) Landmark of esophagogastric junction; proximal end of gastric folds. (**c**) Esophageal hiatal hernia

1.3 Stomach

The mucosa of the stomach is redder and thicker compared to that of the esophagus. The stomach can be categorized into cardia, fundus, body, and antrum (Fig. 1.6). Reddish mottling of collecting venule is observed in the fundic gland area.

1.3.1 Antrum

The antrum is an orange-colored area from the bottom of the gastric angle to the pyloric ring. There is no longitudinal fold of greater curvature side (which is observed in the body) (Fig. 1.6c), and the contracting ring (or antral ring: circular fold moving toward pyloric ring by peristalsis) is observed (Fig. 1.6b).

The posterior wall near the gastric angle is a difficult area to observe; therefore, it should be confirmed by consciously observing with endoscopy. The vascular pattern is not observed normally, but the branched vascular pattern is observed if the blood vessel is inflated with air. Thus, it has to be distinguished from the mucosal atrophy. The extrinsic compression can be observed in the antrum anterior wall when the patient's gallbladder is inflated due to fasting (Fig. 1.6e). These compressions can be removed by changing the posture of the patient. Normal pylorus is circular type. If this round is distorted, it may be suspicious of a lesion around the pylorus, including antral or duodenal ulcer.

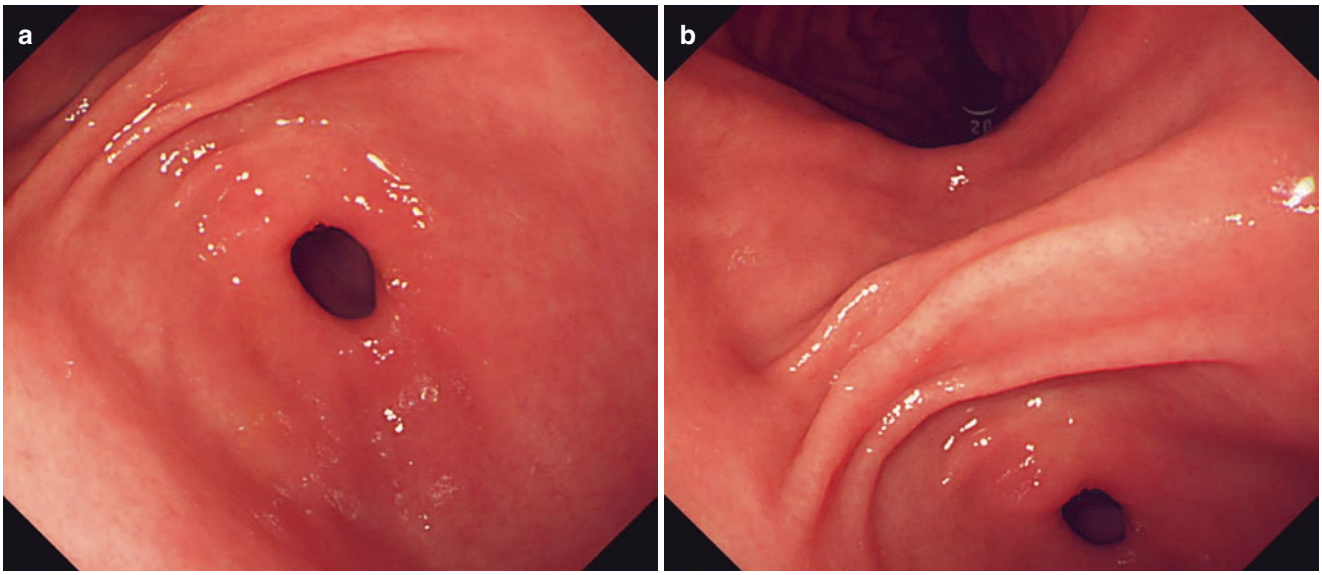

Fig. 1.6 Normal endoscopic finding of the stomach. (**a**) Pyloric channel in the antrum. (**b**) The antral ring is noted below the angle. (**c**) Longitudinal fold is not observed at the greater curvature side of the antrum. (**d**) Angle. (**e**) Extrinsic compression by the gallbladder is noted at the anterior wall of the antrum. (**f**) The deformity of pylorus accompanying duodenal ulcer

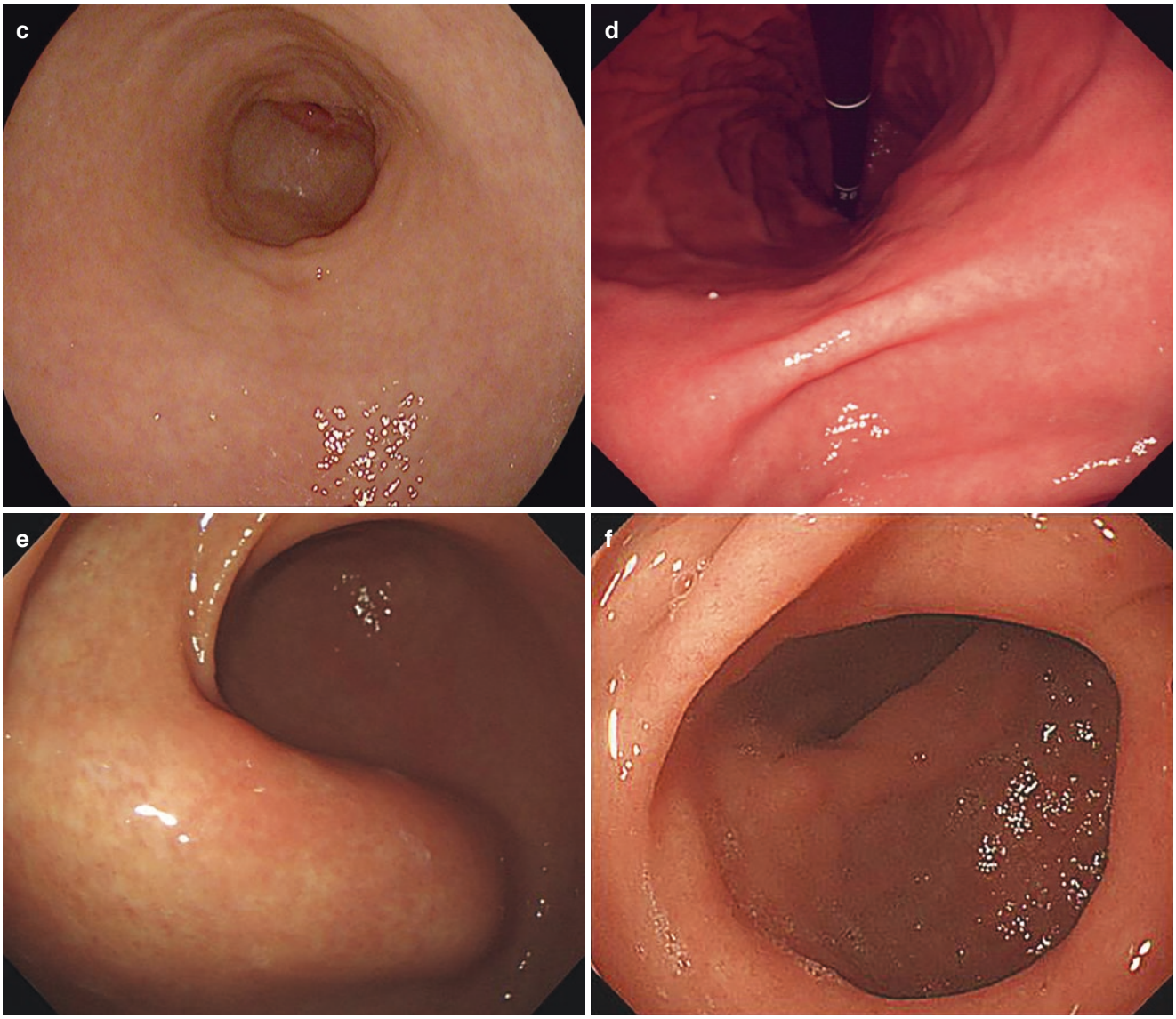

Fig. 1.6 (continued)

1.3.2 Body

The body is the distal area observed at right downward side up to the angle based on the watershed when the endoscope is inserted through the EGJ. The body is divided into three parts such as upper body, middle body, and lower body. Reddish mottling of collecting venule is observed. Longitudinal folds are observed in the greater curvature, and these folds are straightened when air is injected (Fig. 1.7). The operator must make a sufficient insufflation when observing folds of greater curvature, because small lesions can exist between the folds. The following compressions can be observed: compression of the pancreas at the posterior wall of the body (Fig. 1.7d), compression by the transverse colon on the greater curvature (Fig. 1.7c), and compression of the whole wall of the gastric upper body by the liver.

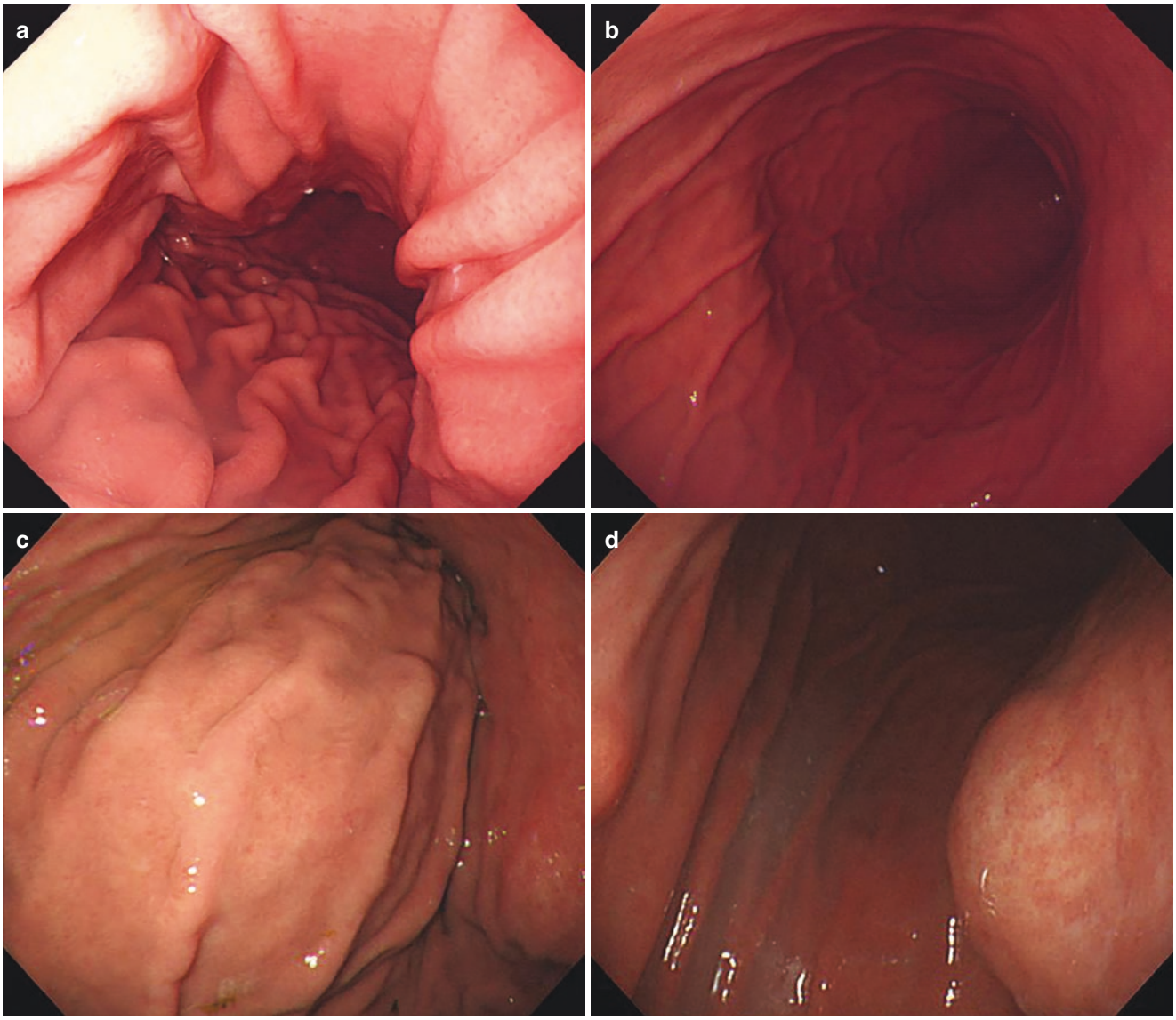

Fig. 1.7 Body of the stomach. (**a**) Collapsed body shows tortuous mucosal folds on the greater curvature side. (**b**) Distended body after air inflation shows straightening of mucosal folds. (**c**) Extrinsic compression of the greater curvature of the body by the transverse colon. (**d**) Extrinsic compression of the posterior wall of the body by the pancreas

1.3.3 Cardia and Fundus

The cardia is 2 cm distal from the EGJ, and the fundus is the area between the cardia and the body. Endoscopy should be retroflexed to observe these areas. It is important to keep in mind that endoscopy has a blind spot because endoscope that enters the cardia hides part of the cardia in the field of view. Therefore, the endoscope axis must be rotated enough so that there is no blind spot. Often a small amount of gastric juice or food material can be seen in the fundus, because this part is the most dependent portion of the stomach. The compression on posterior wall of greater curvature due to the spleen can be observed at the fundus (Fig. 1.8c), and the compression due to the aorta can be observed in the cardia (Fig. 1.8d).

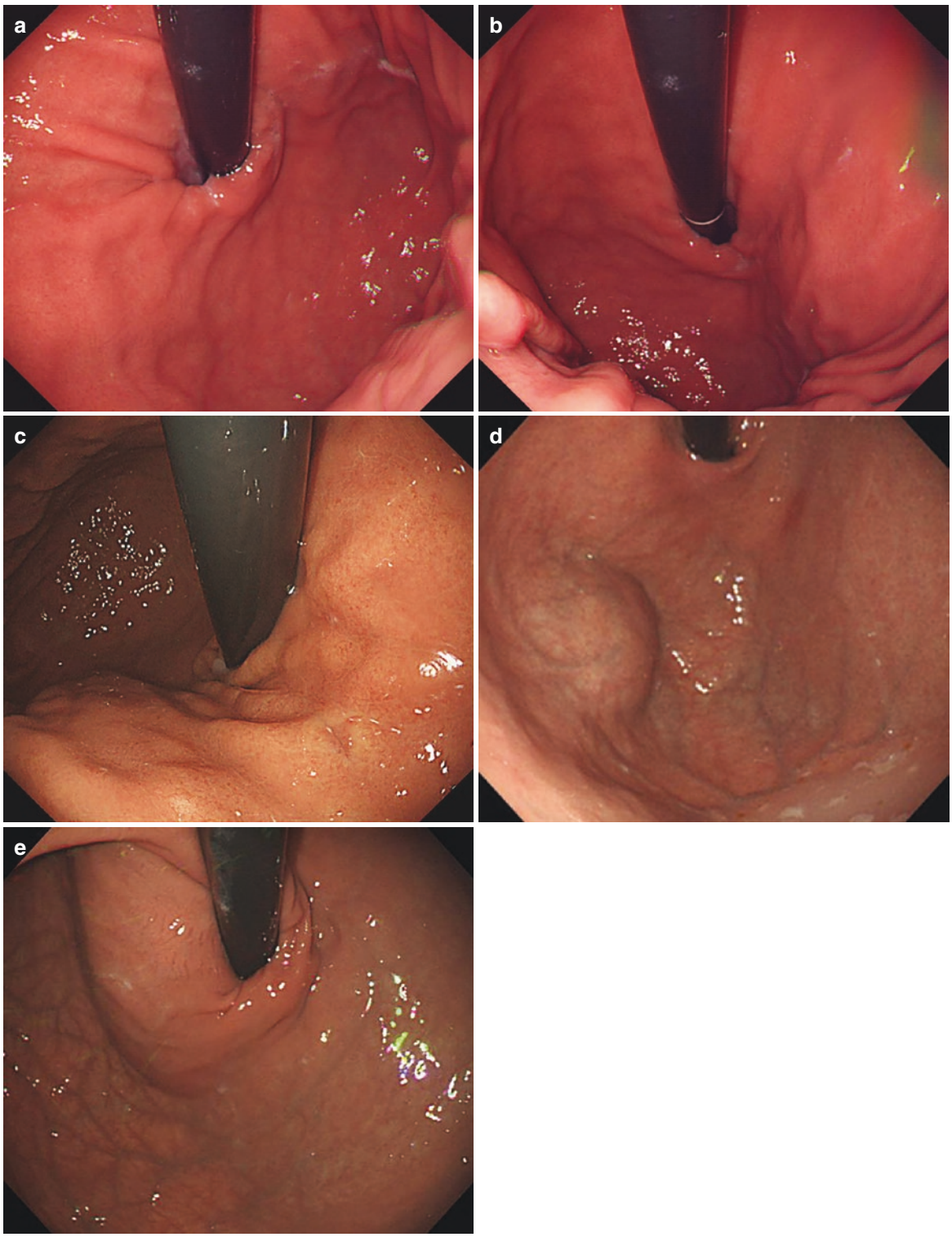

Fig. 1.8 Cardia and fundus. (**a**) Retroflexed view of the cardia. (**b**) Retroflexed view of the cardia and fundus. (**c**) Cardia site concealed by endoscope. (**d**) Extrinsic compression of the fundus by the spleen. (**e**) Extrinsic compression of the cardia by the aorta

1.4 Duodenum

Unlike the mucosa of the esophagus or stomach, that of the duodenum can be distinguished clearly from that of the esophagus and stomach, since the vessel is not shown and covered with villi. Duodenum is curved like C-shape around the pancreas head. From the broad foldless area after the pyloric ring to the supraduodenal angle at the right side of distal area is called bulb. When inserting the endoscope into the duodenal bulb, the endoscope should be carefully inserted so that tip of endoscope does not touch the anterior wall of the bulb. As shown in the picture, the location of the duodenal bulb is determined based on the supraduodenal angle (Fig. 1.9a).

If the endoscopy is performed beyond supraduodenal angle, it passes through the second portion.

Because the posterior segment of the supraduodenal angle is a blind spot in the endoscopic procedure, it should be closely observed. The circular fold and the ampulla of Vater are observed in this area (Fig. 1.9b).

Two ampullae (major and minor) can be observed, with the minor only observed with the presence of the accessory pancreatic duct. The minor is usually observed 2 cm proximal to the location where the major is usually observed (Fig. 1.9c). The ampulla is located at just distal to the Kerckring's fold that is perpendicular to the long axis of the duodenum. The area where the ampulla exists is called the inner wall, the opposite area is called the outer wall, and the ventral side is called the anterior wall. The wall of the dorsal side refers to the posterior wall. Sometimes, the external compression by the gallbladder can be observed at the duodenal bulb.

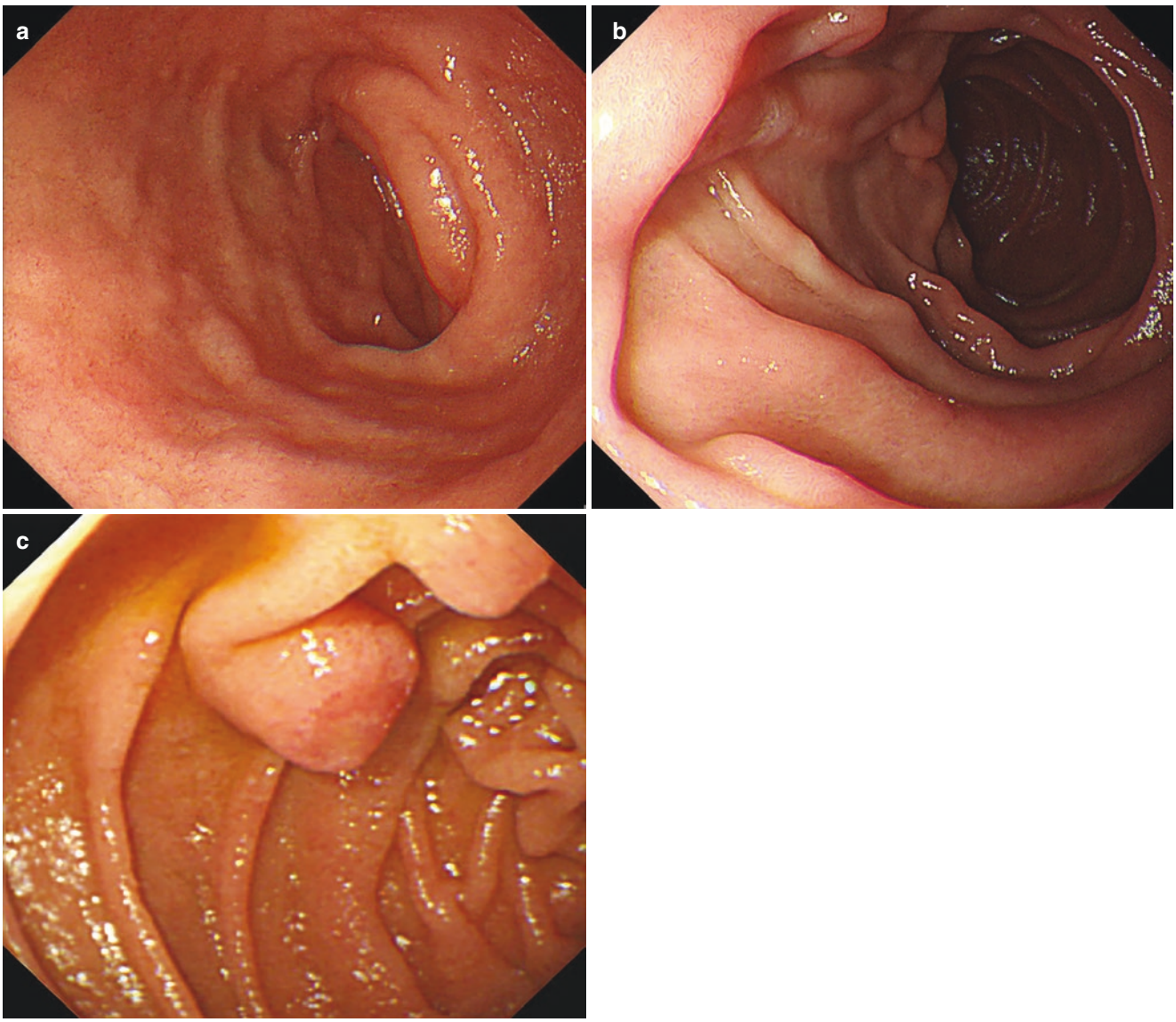

Fig. 1.9 Normal duodenum. (**a**) Duodenal bulb, (**b**) duodenal second portion, and (**c**) major and minor papillae are observed