The SAGES University Masters Program Series
Editor-in-Chief: Brian Jacob

The SAGES Manual of Foregut Surgery

Jayleen Grams
Kyle A. Perry
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Editors

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ISBN 978-3-319-96121-7 ISBN 978-3-319-96122-4 (eBook)
https://doi.org/10.1007/978-3-319-96122-4

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

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SAGES University MASTERS PROGRAM: Foregut Pathway

1

Daniel B. Jones, Linda Schultz, and Brian Jacob

The Masters Program organizes educational materials along clinical pathways into discrete blocks of content which could be accessed by a surgeon attending the SAGES annual meeting or by logging into the online SAGES University (Fig. 1.1) [1]. The SAGES Masters Program currently has eight pathways including Acute Care, Biliary, Bariatrics, Colon, Foregut, Hernia, Flex Endoscopy, and Robotic Surgery (Fig. 1.2). Each pathway is divided into three levels of targeted performance: competency, proficiency, and mastery (Fig. 1.3). The levels originate from the Dreyfus model of skill acquisition [2], which has five stages: novice, advanced beginner, competency, proficiency, and expertise. The SAGES MASTERS Program is based on the three more advanced stages of skill acquisition: competency, proficiency, and expertise. Competency is defined as what a graduating general surgery chief resident or MIS fellow should be able to achieve; proficiency is what a surgeon approximately 3 years out from training should be able to accomplish; and mastery is what more experienced surgeons should be able to accomplish after several years in practice. Mastery is applicable to SAGES surgeons seeking in-depth knowledge in a pathway, including the

Adopted from Jones DB, Stefanidis D, Korndorffer JR, Dimick JB, Jacob BP, Schultz L, Scott DJ (2017) SAGES University Masters Program: a structured curriculum for deliberate, lifelong learning. Surg Endosc 31:3061–3071

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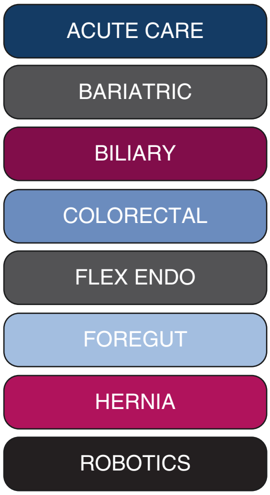
J. Grams et al. (eds.), *The SAGES Manual of Foregut Surgery*,
https://doi.org/10.1007/978-3-319-96122-4_1

Fig. 1.1 MASTERS program logo

Fig. 1.2 MASTER program clinical pathways



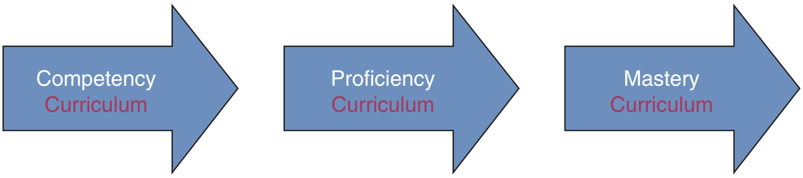


Fig. 1.3 MASTERS program progression

following: areas of controversy, outcomes, best practice, and ability to mentor colleagues. Over time, with the utilization of coaching and participation in SAGES courses, this level should be obtainable by the majority of SAGES members. This edition of the SAGES Manual – Foregut Surgery – aligns with the current version of the new SAGES University MASTERS Program Foregut Surgery Pathway (Table 1.1).

Foregut Curriculum

The key elements of the Foregut Surgery curriculum include a core lectures for the pathway, which provides a 45-minute general overview including basic anatomy, physiology, diagnostic work-up, and surgical management. As of 2018, all lecture

Table 1.1 Foregut surgery anchoring procedure by pathway

Curriculum elements	*Competency*
Anchoring procedure – competency	2
CORE LECTURE	1
CORE MCE 70%	1
Annual meeting content	5
Guidelines	1
SA CME hours	6
Sentinel articles	2
Social media	2
SAGES top 21 video	1
FLS	12
PEARLS	1
Motility module	1
Credits	**35**
Curriculum elements	*Proficiency*
Anchoring procedure – proficiency	2
CORE LECTURE	1
CORE MCE 70%	1
Annual meeting content	5
FUSE	12
Outcomes database enrollment	2
SA CME hours (ASMBS electives, SAGES or SAGES-endorsed)	6
Sentinel articles	2
Social media	2
SAGES top 21 video	1
PEARLS	1
Credits	**35**
Curriculum elements	*Mastery*
Anchoring procedure – mastery	2
CORE LECTURE	1
CORE MCE 70%	1
Annual meeting content	6
Fundamentals of surgical coaching	4
Outcomes database reporting	2
SA CME credits (ASMBS electives, SAGES or SAGES-endorsed)	6
Sentinel articles	2
Serving as video assessment reviewer and providing feedback (FSC)	4
Social media	6
SMART enhanced recovery	1
Credits	**35**

content of the annual SAGES meetings are labeled as follows: basic (100), intermediate (200), and advanced (300). This allows attendees to choose lectures that best fit their educational needs. Coding the content additionally facilitates online retrieval of specific educational material, with varying degrees of surgical complexity, ranging from introductory to revisional surgery.

SAGES identified the need to develop targeted, complex content for its mastery level curriculum. The idea was that these 25-min lectures would be focused on specific topics. It assumes that the attendee already has a good understanding of diseases and management from attending/watching competency and proficiency level lectures. Ideally, in order to supplement a chosen topic, the mastery lectures would also identify key prerequisite articles from *Surgical Endoscopy* and other journals, in addition to SAGES University videos. Many of these lectures will be forthcoming at future SAGES annual meetings.

The MASTERS Program has a self-assessment, multiple-choice exam for each module to guide learner progression throughout the curriculum. Questions are submitted by core lecture speakers and SAGES annual meeting faculty. The goal of the questions is to use assessment for learning, with the assessment being criterion-referenced with the percent correct set at 80%. Learners will be able to review incorrect answers, review educational content, and retake the examination until a passing score is obtained.

The MASTERS Program Foregut Surgery curriculum taps much of the SAGES existing educational products including FLS, FES, FUSE, SMART, Top 21 videos, and Pearls (Fig. 1.4). The Curriculum Task Force has placed the aforementioned modules along a continuum of the curriculum pathway. For example, FLS, in general, occurs during the Competency Curriculum, whereas the Fundamental Use of Surgical Energy (FUSE) is usually required during the Proficiency Curriculum. The Fundamentals of Laparoscopic Surgery (FLS) is a multiple-choice exam and a skills assessment conducted on a video box trainer. Tasks include peg transfer, cutting, intracorporeal and extracorporeal suturing, and knot tying. Since 2010, FLS has been required of all US general surgery residents seeking to sit for the American Board of Surgery qualifying examinations. The Fundamentals of Endoscopic Surgery (FES) assesses endoscopic knowledge and technical skills in a simulator. FUSE teaches about the safe use of energy devices in the operating room and is available at FUSE.didactic.org. After learners complete the self-paced modules, they may take the certifying examination.

The SAGES Surgical Multimodal Accelerated Recovery Trajectory (SMART) Initiative combines minimally invasive surgical techniques with enhanced recovery pathways (ERPs) for perioperative care, with the goal of improving outcomes and patient satisfaction. Educational materials include a website with best practices, sample pathways, patient literature, and other resources such as videos, FAQs, and an implementation timeline. The materials assist surgeons and their surgical team with implementation of an ERP.

Top 21 videos are edited videos of the most commonly performed MIS operations and basic endoscopy. Cases are straightforward with quality video and clear anatomy.

Pearls are step-by-step video clips of ten operations. The authors show different variations for each step. The learner should have a fundamental understanding of the operation.

SAGES Guidelines provide evidence-based recommendations for surgeons and are developed by the SAGES Guidelines Committee following the Health

Fig. 1.4 SAGES educational content: FLS, FES, FUSE, SMART and Medicine Division of the National Academies of Sciences, Engineering, and Medicine standards (formerly the Institute of Medicine) for guideline development [3]. Each clinical practice guideline has been systematically researched, reviewed, and revised by the SAGES Guidelines Committee and an appropriate multidisciplinary team. The strength of the provided recommendations is determined based on the quality of the available literature using the GRADE methodology [4]. SAGES Guidelines cover a wide range of topics relevant to the practice of SAGES surgeon members and are updated on a regular basis. Since the developed guidelines provide an appraisal of the available literature, their inclusion in the MASTERS Program was deemed necessary by the group.

The Curriculum Task Force identified the need to select required readings for the MASTERS Program based on key articles for the various curriculum procedures. Summaries of each of these articles follow the American College of Surgeons (ACS) Selected Readings format.

Facebook™ Groups

While there are many great platforms available to permit online collaboration by user-generated content, Facebook(™) offers a unique, highly developed mobile platform that is ideal for global professional collaboration and daily continuing surgical education (Fig. 1.5). Facebook groups allow for video assessment, feedback, and coaching as a tool to improve practice.

Based on the anchoring procedures determined via group consensus (Table 1.2), participants in the MASTERS Program will submit video clips on closed Facebook groups, with other participants and/or SAGES members providing qualitative feedback. For example, for the Foregut Curriculum, surgeons would submit the critical views during a laparoscopic paraesophageal hernia repair such as identification of the anterior and posterior vagus nerves. Using crowdsourcing, other surgeons would comment and provide feedback.

Eight unique vetted membership-only closed Facebook groups were created for the MASTERS Program, including a group for bariatrics, hernia, colorectal, biliary, acute care, flexible endoscopy, robotics, and foregut. The Foregut Surgery Facebook group is independent of the other groups and will be populated only by physicians, mostly surgeons or surgeons in training interested in foregut surgery.

The group provides an international platform for surgeons and healthcare providers interested in optimizing outcomes in a surgical specialty to collaborate, share, discuss, and post photos, videos, and anything related to a chosen specialty. By embracing social media as a collaborative forum, we can more effectively and transparently obtain immediate global feedback that potentially can improve patient outcomes, as well as the quality of care we provide, all while transforming the way a society's members interact.

Fig. 1.5 Foregut surgery facebook Facebook(™)group

Table 1.2 MASTERS program colon curriculum outline

Anchoring procedure by pathway	Level
Foregut Surgery	
Lap Nissen	Competency
Lap Paraesophageal or Heller Myotomy	Proficiency
Lap Redo Nissen	Mastery

For the first two levels of the MASTERS Program, competency and proficiency, participants will be required to post videos of the anchoring procedures and will receive qualitative feedback from other participants. However, for the mastery level, participants will submit a video to be evaluated by an expert panel. A standardized video assessment tool, depending on the specific procedure, will be used. A benchmark will also be utilized to determine when the participant has achieved the mastery level for that procedure.

Once the participant has achieved mastery level, s/he will participate as a coach by providing feedback to participants in the first two levels. MASTERS Program participants will therefore need to learn the fundamental principles of surgical coaching. The key activities of coaching include goal setting, active listening, powerful inquiry, and constructive feedback [5, 6]. Importantly, peer coaching is much different than traditional education, where there is an expert and a learner. Peer coaching is a "co-learning" model where the coach is facilitating the development of the coachee by using inquiry (i.e., open-ended questions) in a noncompetitive manner.

Surgical coaching skills are a crucial part of the MASTERS curriculum. At the 2017 SAGES Annual Meeting, a postgraduate course on coaching skills was developed and video recorded. The goal is to develop a "coaching culture" within the SAGES MASTERS Program, wherein both participants and coaches are committed to lifelong learning and development.

The need for a more structured approach to the education of practicing surgeons as accomplished by the SAGES MASTERS Program is well recognized [7]. Since performance feedback usually stops after training completion and current approaches to MOC are suboptimal, the need for peer coaching has recently received increased attention in surgery [5, 6]. SAGES has recognized this need, and its MASTERS Program embraces social media for surgical education to help provide a free, mobile, and easy to use platform to surgeons globally. Access to the MASTERS Program groups enables surgeons at all levels to partake in the MASTERS Program curriculum and obtain feedback from peers, mentors, and experts. By creating surgeon-only private groups dedicated to this project, SAGES can now offer surgeons posting in these groups the ability to discuss preoperative, intraoperative, and postoperative issues with other SAGES colleagues and mentors. In addition, the platform permits transparent and responsive dialogue about technique, continuing the theme of deliberate, lifelong learning.

To accommodate the needs of this program, SAGES University is upgrading its web-based features. A new learning management system (LMS) will track progression and make access to SAGES University simple. Features of the new IT infrastructure will provide the ability to access a video or lecture on-demand in relation to content, level of difficulty, and author. Once enrolled in the MASTERS Program, the LMS will track lectures, educational products, MCE, and other completed requirements. Participants will be able to see where they stand in relation to module completion, and SAGES will alert learners to relevant content they may be interested in pursuing. Until such time that the new LMS is up and running, it is hoped that the SAGES Manual will help guide learners through the Masters Program Curriculum.

Conclusions

The SAGES MASTERS Program Foregut Surgery Pathway facilitates deliberate, focused postgraduate teaching and learning. The MASTERS Program certifies completion of the curriculum but is *not* meant to certify competency, proficiency, or mastery of surgeons. The MASTERS Program embraces the concept of lifelong learning after fellowship, and its curriculum is organized from basic principles to more complex content. The MASTERS Program is an innovative, voluntary curriculum that supports MOC and deliberate, lifelong learning.

References

1. Jones DB, Stefanidis D, Korndorffer JR, Dimick JB, Jacob BP, Schultz L, Scott DJ. SAGES University masters program: a structured curriculum for deliberate, lifelong learning. Surg Endosc. 2017;31:3061–71.
2. Dreyfus SE. The five-stage model of adult skill acquisition. Bull Sci Technol Soc. 2004;24: 177–81.
3. Graham R, Mancher M, Miller Woman D, Greenfield S, Steinberg E. Institute of Medicine (US) committee on standards for developing trustworthy clinical practice guidelines. Clinical practice guidelines we can trust. Washington, DC: National Academies Press (US); 2011.
4. Guyatt GH, Oxman AD, Vist GE, Kunz R, Falck-Ytter Y, Alonso-Coello P, Schünemann HJ, GRADE Working Group. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. BMJ. 2008;336:924–6.
5. Greenberg CC, Ghousseini HN, Pavuluri Quamme SR, Beasley HL, Wiegmann DA. Surgical coaching for individual performance improvement. Ann Surg. 2015;261:32–4.
6. Greenberg CC, Dombrowski J, Dimick JB. Video-based surgical coaching: an emerging approach to performance improvement. JAMA Surg. 2016;151:282–3.
7. Sachdeva AK. Acquiring skills in new procedures and technology: the challenge and the opportunity. Arch Surg. 2005;140:387–9.

Anatomy and Physiology of the Esophagus and Lower Esophageal Sphincter

2

Lawrence F. Johnson

As surgeons address foregut disease in their patients with different procedures, a review of relevant anatomy and physiology of the esophagus and LES will complement discussion with their patients and decision-making. As will be apparent in this chapter, the esophagus is more than a conduit that directs liquids and food to other organs, deters reflux, or serves as a passageway for radiographic contrast, or endoscopes to define more distant foregut disease/disorders. Instead, the esophagus is a very complex organ whose function is directed by CNS and intrinsic esophageal control that is implemented by skeletal and smooth muscle. In preparing this manuscript rather than use time-tested anatomical illustrations by Frank Netter, MD, I chose where possible to use operative photographs, anatomical dissections undertaken by interested clinicians addressing perplexing problems, as well as illustrations from 3D printers, dissections, and combined techniques. Animal models were held to a minimum and only used to confirm a clinical point in humans or when these studies lead to important discoveries in humans. In some instances, the reader will need to refer to the original references since permissions could not be obtained for all of the intended figures. While this text was limited to anatomy and physiology, I could not resist the temptation for brief clinical departures to emphasize the importance of learning the anatomy and physiology so that it might be implemented in every day practice.

Introduction

Measurements in adult human cadavers have shown the esophageal length when measured from cricoid cartilage/bone to stomach opening ranges from 24 to 34 cm with an average of 27.6 cm [1]. While the cricoid cartilage or bone if calcified can be identified radiographically on the lateral barium swallow [2, 3] and at

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J. Grams et al. (eds.), *The SAGES Manual of Foregut Surgery*,
https://doi.org/10.1007/978-3-319-96122-4_2

laryngoscopy [4], this orad landmark has not been clinically popular even though it could be anatomically justified because the cricopharyngeus muscle inserts into the cricoid cartilage or bone [5]. Instead, endoscopists use the incisors teeth as the orad landmark and termination of the gastric rugal folds and/or distal margin of the esophageal palisade veins as a close approximation of the esophagogastric junction (approximately 40 cm) [6]. Using this definition and subtracting 15 cm (distance incisor teeth to UES) [7], the esophageal length again measures 25 cm. When esophageal length is measured using high-resolution esophageal motility from the inferior margin of the UES to the superior margin of the LES in patients without a hiatal hernia, the mean distance is again 25 cm [8]. Thus, the adult human esophagus appears to be approximately 25 cm long when measured by different techniques in vivo or cadavers.

As one would expect, the esophagus grows in length as the individual ages and gains height [9]. For instance, esophageal length when measured at the superior border of the LES directly correlates with height. When all age groups from infancy to adulthood are combined, a regression analysis shows that the esophagus grows in length as the individual grows in height [9]. However, only in children less than 2 years old can their height accurately predict LES location (90% of predictions within 1 cm of actual location). Unfortunately, in all other age groups, height poorly predicts LES location probably because some individuals are developing hiatal hernias and/or esophageal shortening.

UES and Proximal Esophagus

The esophageal body is a muscular tube composed of an inner layer of circular and an outer layer of longitudinal muscle and includes a sphincter at either end. The proximal or upper esophageal sphincter is more macroscopically defined than that of the distal or lower esophageal sphincter, which some think is primarily a manometric phenomenon. While we think of the upper esophageal sphincter as the cricopharyngeus muscle, the anatomy is more complex (Fig. 2.1). For instance, the cricopharyngeus muscle inserts into the posterior surface of the cricoid cartilage, and as a result the anterior wall of the sphincter is the cricoid lamina or posterior surface of the cricoid cartilage, which encircles the airway as opposed to tracheal rings. In turn, the cricopharyngeal muscle forms a horseshoe or C-like sphincter with the posterior surface of the cricoid cartilage closing the anterior gap [10]. The attachment of the cricopharyngeus muscle or UES to the cricoid cartilage is so tight that any movement of the larynx reflects that of the cricopharyngeus muscle or upper esophageal sphincter [11]. Contrary to common thought, there is no connection between the UES and pre-cervical vertebral fascia because this space in human dissections shows only loose adipose tissue and pools of amorphous substance (Fig. 2.2), but no dense connective tissue strands between

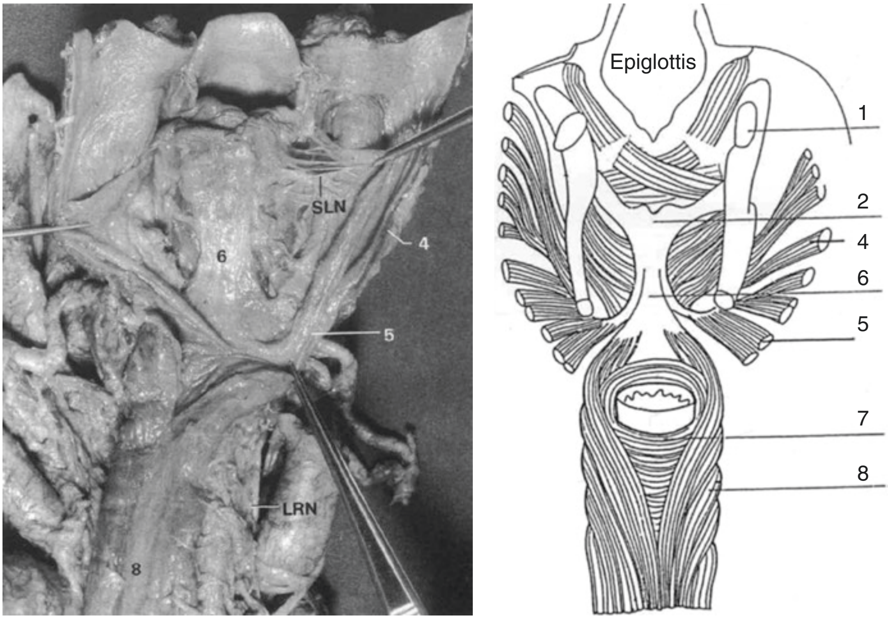

Fig. 2.1 Dissection and schematic drawing of the pharyngoesophageal junction viewed from the dorsal aspect, with the pharynx and esophageal wall both opened in the midline. Note broad-based exposed cricopharyngeal tendon (6) that attaches to the posterior surface of cricoid cartilage (2) and thereby serves to attach the left and right branching of the outer longitudinal esophageal muscle wall (8) to the lateral aspect of the cricoid cartilage. The tip of the metal forceps is attached to the upper esophageal sphincter [cricopharyngeus muscle (5), a component of the inferior pharyngeal constrictor (4)]. If not cut, the UES would have a U appearance when attached to the flat lateral surface of the post-cricoid cartilage, its anterior wall. Components: 1 = thyroid cartilage, 2 = cricoid cartilage, 3 = trachea, 4 = inferior pharyngeal constrictor, 5 = cricopharyngeus muscle, 6 = cricopharyngeal tendon, 7 = inner circular wall of the esophagus, 8 = outer longitudinal wall of the esophagus, 9 = arytenoid muscle, and 10 = aryepiglottic muscle. *SLN* superior laryngeal nerve, *RLN* recurrent laryngeal nerve. (With permission from Liebermann-Meffert [10])

UES and pre-cervical vertebral fascia [11]. In contrast, at C1–C4 the pharyngeal and cervical vertebral fascia intertwines and stabilizes the pharynx to the cervical spine [12]. More caudad, the cricopharyngeal muscle continues into the internal circular muscle of the esophagus without any attachment to the cricoid cartilage. However, to make up for this lack of attachment, the outer longitudinal muscle of the esophagus inserts into the cricoid cartilage via the cricoesophageal tendon, thereby giving the proximal esophagus a stability point. The cricoid cartilage is unique for it is only one of a few instances in which skeletal muscle directly inserts on cartilage.

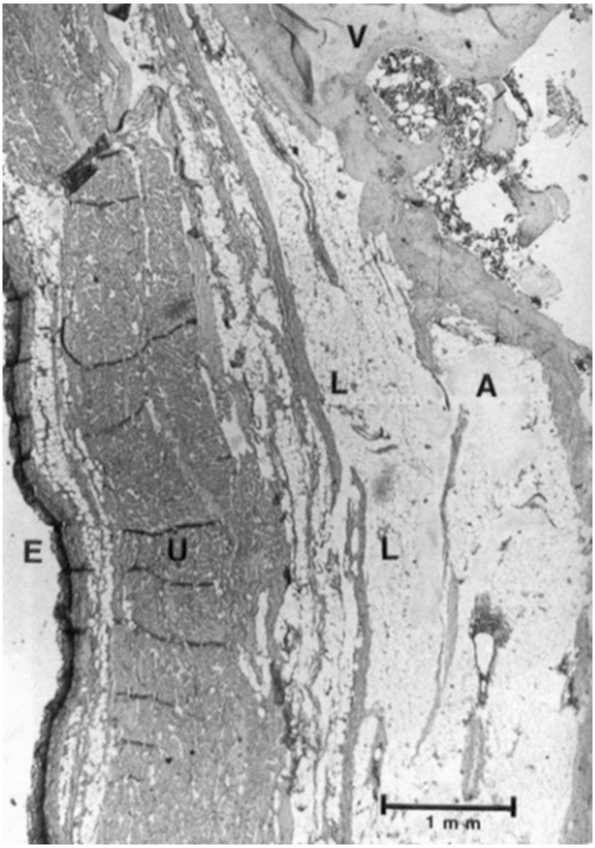

Fig. 2.2 This cross section of the prevertebral space in region of the upper esophageal sphincter (U) shows loose fatty tissue (L) with pools of an amorphous substance (A). Note esophageal epithelium (E) and the vertebral body (V). This paraffin section was stained with hematoxylin-eosin. (With permission from Nilsson et al. [11])

The change in direction of skeletal muscle fibers both above and below the cricoid cartilage causes weakness in the wall of the pharyngoesophageal junction [13]. Above the cricoid cartilage, when oblique muscle fibers of the inferior pharyngeal sphincter meet more horizontal muscle fibers of the cricopharyngeal muscle, the wall is weakened resulting in Killian's triangle, which is the site of Zenker's diverticulum that develops posterior above the cricopharyngeus muscle. In contrast, below the cricoid cartilage when the outer layer of longitudinal esophageal muscle begins to separate in order to join the cricoesophageal tendon for insertion into the cricoid cartilage, gaps in the muscle area are created where only the inner circular esophageal muscle is left to constitute the esophageal wall, and as a result the wall is weakened. This area is known as Laimer's triangle [14] that predisposes to the formation of Killian-Jamieson diverticula that develop lateral or anterolateral [15] located below the cricopharyngeus muscle. While weakness in the pharyngoesophageal junction wall causes both diverticula to form, Zenker's is the more common, i.e., 4:1 [15]. While pharyngosphincteric incoordination or lack of sphincter relaxation was thought to cause Zenker's diverticula, investigators have shown increased intrabolus pressure correlated with reduced sphincter opening [16, 17] and the latter appeared caused by replacement of cricopharyngeal muscle fibers by fibrous adipose tissue and degenerative changes, which appears to cause lack of sufficient sphincter elasticity [18]. This diminished elasticity or alteration in the composition of the sphincter causes increased hypopharyngeal pressure that result in the diverticulum subsequently causing symptoms such as dysphagia and overflow aspiration. These patients may benefit from a myotomy [19]. However, the therapeutic benefit of a myotomy might not apply to patients with Killian-Jamieson diverticula. These diverticula are small and often cause no symptoms, because they occur below the cricopharyngeus muscle [15], and a myotomy may not be of similar benefit. Most important, anatomically – the recurrent laryngeal nerve (right or left) may travel across the base of the diverticulum (Fig. 2.3) as the nerve passes between the cricopharyngeus muscle and the cricoid cartilage in the region of the articulation between thyroid and cricoid cartilage [20, 21]. These nerves innervate all intrinsic muscles of the larynx (except for the cricothyroid) and provide sensory input to the mucosa of the larynx below the vocal fold including the inferior surface of the vocal fold, as well as mucosa of the upper trachea and esophagus. Thus, the anatomic relationship between the base of the diverticulum and recurrent laryngeal nerve in the region of the cricoid cartilage suggest a direct approach to addressing Killian-Jamieson diverticula if indicated [22] and even sometimes sensory testing of the nerve during the conduct of the procedure [23].

While with conventional manometry, we think of the UES as a bell-shaped curve with two slopes that culminate at the apex showing the peak pressure or with high-resolution manometry, a horizontal pressure bar of various colors with the highest displayed in the center of the bar, the UES is anatomically complex. For instance, when 360 degree circumferential unidirectional pressure probes are used to determine resting basal LES pressure over the length of the sphincter, the pressure profile is asymmetrical

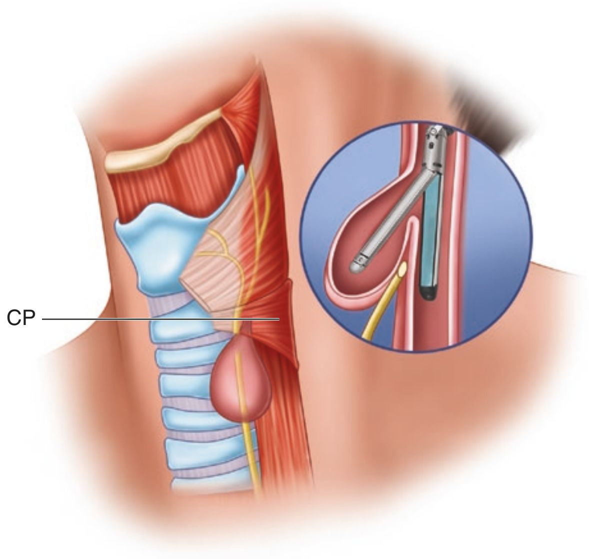

Fig. 2.3 Illustration depicting the location of the Killian-Jamieson diverticulum, which is closely related to the recurrent laryngeal nerve (RLN), seen in yellow. Inset, illustration showing how endoscopic diverticulotomy might damage the RLN [20]. CP cricopharyngeus muscle

over the 3 cm UES length [24]. This asymmetry occurs because the cricopharyngeal muscle attaches to both the right and left lateral margin of the cricoid lamina [25] so that the sustained basal contraction is greatest in the anterior and posterior dimension rather than lateral. That the cricoid cartilage is instrumental in causing this pressure asymmetry is evident by its removal following laryngectomy. For instance, when the cricopharyngeus muscle is closed in a three-layer manner after laryngectomies, the basal pressure decreases because of the myotomy and now becomes symmetrical because the muscle lost its bilateral attachment to the lamina of the cricoid cartilage [24].

That the length of the post-cricoid lamina and manometric UES are comparable in length (approximately 3 cm) [25, 26] yet the cricopharyngeus muscle is only 1 cm in longitudinal length [2] suggests other muscle(s) may be measured in the UES pressure profile. The muscle best documented to contribute to the UES pressure profile concerns the caudad portion of the inferior pharyngeal sphincter sometimes known as the thyropharyngeal muscle [26] with oblique fibers that attach to the cricoid and thyroid cartilages and a ligament that spans between these cartilages [27]. In support of the above assertion, the cricopharyngeus muscle occupies only the distal 3rd of the cricoid cartilage and appears best to represent the descending slope of the bell-shaped curve. In several studies the apex of the bell curve is above the cricopharyngeus and in the region of the thyropharyngeal, which correlates with the ascending portion of the bell shape curve and indeed is located in the region of the apex of that curve [26]. There is no apparent data to support a contribution to the pressure curve by circular muscle from the proximal esophagus that at best is controversial [26].

Anatomic markers on the lateral x-ray of the pharynx that correlate with the length and apex of the UES bell-shaped pressure curve (a distance of 2–4 cm) [26] are as follows: the orad margin consists of the arytenoid cartilage (arytenoid mass) [12], which also serves for the opening of the laryngeal airway and the caudad margin of the UES, the terminus of the cricoid cartilage, which can also be seen radiographically [2, 3, 12]. Alternatively, one might use the superior surface of the tracheal air column seen on the lateral x-ray of the pharynx, which represents the level of the vocal folds that in turn marks the start or ascending limb of the bell-shaped UES pressure curve, and the caudad margin of the descending UES curve would be the caudad margin of the cricopharyngeus muscle, if observed (Fig. 2.4), or pick a location 2–4 cm below the laryngeal opening [26]. To anatomically identify the area related to the apex of the UES bell-shaped pressure curve, one might use an area 1.6 cm below the vocal folds, i.e., tracheal air column [5] or the mid-cricoid cartilage region [28].

In support of other muscle(s) contributing to the UES pressure curve other than the cricopharyngeus concerns a study [29] that measured changes in sequential UES pressure before anesthesia and then during different stages of a 6 cm myotomy at the pharyngoesophageal junction. The initial incision was 2 cm on the proximal cervical esophagus, then a 2 cm incision on the cricopharyngeus identified by cricoid cartilage, followed by a 2 cm incision on the hypopharynx (i.e., presumed inferior sphincter or thyropharyngeal muscle), and after anesthesia recovery for a final pressure determination (Fig. 2.5). After controlling for changes related to anesthesia, they found that the cervical esophageal incision did not alter UES pressure. However, that of the cricopharyngeus did significantly

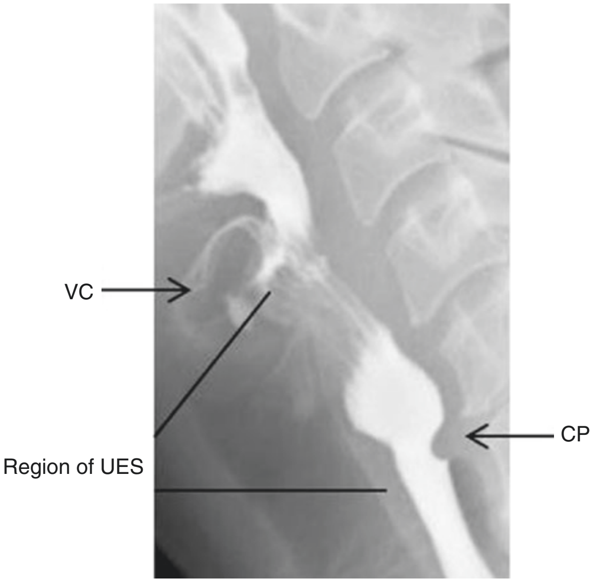

Fig. 2.4 Lateral radiograph of a barium esophagram in a patient with a prominent cricopharyngeal bar (arrow). Note that cricopharyngeus muscle is present in the lower part of the cricoid cartilage. Measured in this manner, the upper esophageal sphincter (UES) would extend from the level of the vocal folds to the lower border of the cricoid cartilage. VC vocal cords, CP cricopharyngeus muscle. (Photo courtesy of Michelle McNamara, MD)

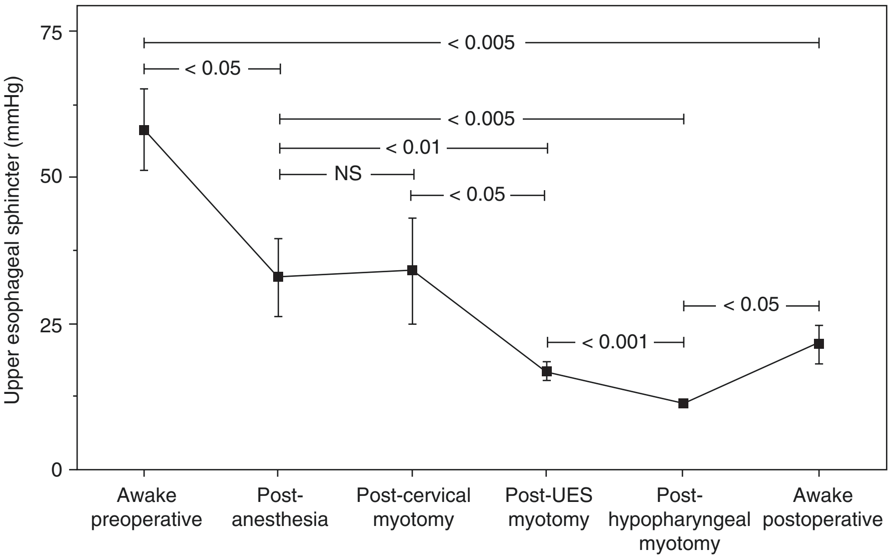

Fig. 2.5 The effects of myotomy on the resting pressure when staged at the cricopharyngeal junction [29]. Post-cervical myotomy denotes 2 cm incision on proximal esophagus

lower UES pressure, and a further significant reduction in pressure occurred after the hypopharyngeal incision. After recovery from anesthesia, the 6 cm myotomy significantly lowered LES pressure over that noted prior to anesthesia. Most importantly, the reduction in pressure appeared to result from the incision on the cricopharyngeus and the thyropharyngeal muscles rather than that on the proximal cervical esophagus.

While the inferior pharyngeal constrictor (thyropharyngeal) and the cricopharyngeus muscles insert on the thyroid and cricoid cartilages helping to form the bell-shaped curve of the UES, both muscles and cartilages have very dissimilar anatomy. For instance, the thyroid cartilage has no posterior surface as does the cricoid cartilage with its posterior lamina. As a result, the pharyngeal constrictor muscle itself serves as the anterior wall, and these muscle fibers insert posteriorly into a median raphe, not present in the cricopharyngeus muscle that inserts into the cricoid cartilage, its anterior wall. Thus, the UES is a more anatomically complex structure than that depicted by a bell-shaped pressure curve with an apex as observed during conventional manometry or that of a multicolor bar seen during high-resolution motility.

Esophageal Body

In the forthcoming discussion of the esophageal body, when necessary, the UES and LES will be included, especially, since the terminal esophagus joins the stomach as much as 3–6 [30] or 0.5–2.5 [31] cm below the diaphragmatic hiatus and this esophageal "submerged segment" can be seen on retroflexion at endoscopy (Fig. 2.6a) [6] or x-ray (Fig. 2.6b) [32]. However, because the esophagogastric junction inclusive of the LES has equally complex anatomy as that of the pharyngoesophageal junction, the former junction deserves special attention in a dedicated section and that will follow a general discussion of the esophageal body.

In traveling from the neck through the chest and into the abdomen below the diaphragm to join the stomach, the esophagus is not a straight open organ as sometimes depicted anatomically in the anterior-posterior dimension. For instance, at the pharyngoesophageal junction, the esophagus is immediately posterior to the cricoid cartilage as previously discussed. Immediately below that location in the neck, the esophagus deviates to the left of the trachea down to the base of the neck. At the level of the seventh cervical vertebra, the esophagus deviates to the right of the spine and continues on that course to the diaphragmatic hiatus. Just below the hiatus, the terminal esophagus turns to the left and joins the stomach in a left lateral position. Surface markers for the EG junction include a position just left of the xiphoid process and lateral to the 12th thoracic vertebral body [13]. In the upper mediastinum, the esophagus is positioned between the trachea and heart [33]. The esophagus in the oblique and lateral positions follows the thoracic vertebrae [34, 35]. Contrary to common anatomical depiction, the