THE OESOPHAGUS

FLAVELL

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LONDON

BUTTERWORTHS

963

Printed in Great Britain at the Pitman Press, Bath

PREFACE

The oesophagus unfortunately remains something of a surgical no-man's-land, into whose top end ear-nose-and-throat surgeons make light reconnaissances, and whose bottom end is often attacked by abdominal surgeons under cover of the diaphragm. Physicians (from their greater elevation) still like to drop consignments of antacids down it, but these do not alter its abnormal configurations. It has in many ways proved an awkward terrain.

The easy approach to the oesophagus is through the thorax, and the oesophageal surgeon must be at home there; but he must be equally at home in the neck and in the abdomen, and as accustomed to operate upon the newborn as upon the very old. Successful oesophageal surgery is deeply rewarding, for few ills are more intolerable than the inability to swallow comfortably.

I have tried to set down in this small book as simply as possible a brief account of oesophageal diseases and the techniques I have found satisfactory in dealing with them surgically.

My grateful thanks are due to the many surgical colleagues, physicians and general practitioners who have sent me their patients; to Mr. R. N. Lane for his beautiful drawings; and to Dr. John Rae and Dr. Denys Jennings of the Department of Radiology of the London Hospital for allowing me to reproduce a number of their x-ray plates.

GEOFFREY FLAVELL

London, 1963

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1—Anatomy and Physiology

ANATOMY

Embryology

The primitive foregut is composed of an inner endodermal layer and an outer component of the splanchnic mesoderm. The development of the oesophagus itself may be considered in two parts: an upper (later retro-tracheal) segment which, with the trachea, evolves from the pharyngeal foregut; and a lower or pre-gastric segment.

The upper foregut undergoes some complicated mutations. In the 23-day embryo an external ridge appears on its anterior wall, and a groove, the laryngo-tracheal sulcus, corresponds to it internally. Within the groove the single layer of cells normally lining the foregut gives way to two or three layers of transitional or columnar cells.

By 27 days the ridge has extended caudally, widening as it goes, and eventually bulges forward in a bilobed lung bud close to the sinus venosus. The internal groove deepens, and as it does so lateral ridges appear which first define it more sharply from the rest of the foregut and eventually cut it off from it altogether to form a separate ventral tube. This is the trachea (now lined by columnar cells) whereas the original dorsal part of the foregut forms the upper oesophagus.

In the 36-day embryo separation of the two tubes is usually complete, but as both elongate with growth, there is a marked diminution of the oesophageal lumen at the level of the tracheal bifurcation.

Somewhat later in development ciliated cells appear in the epithelium of the middle third of the oesophagus and spread both up and down to line the whole. At 130 mm these give way in turn to stratified squamous cells, the upper end being the last area to lose its ciliated lining. At both upper and lower extremities are areas where the epithelium is composed of a single layer of columnar cells in contrast to the remainder where the cells are in several layers. Caudally these tall cells are indistinguishable from those lining the stomach, and from them deeper extensions form acini giving rise to simple tubular superficial mucous glands. The deeper glands (which penetrate the muscularis mucosae) develop later from the stratified layers. In the adult oesophagus this difference between the final 1–2 cm of the mucosal lining above the stomach and the rest of the oesophageal mucosa remains.

Relationships

The adult pharynx becomes continuous with the oesophagus at the level of the lower border of the sixth cervical vertebra (or the inferior margin of the cricoid cartilage). Lying posteriorly in the mediastinum the oesophagus then traverses the thorax to pierce the diaphragm at the oesophageal hiatus and joins the stomach at about the level of the tenth or eleventh dorsal vertebra. It is thus relatively fixed only at its upper and lower ends, so that lateral displacement does not easily cause dysphagia; nor does indentation by an intramural or extrinsic mass unless encirclement or infiltration becomes nearly complete, for the mobility of the opposing wall is usually amply sufficient to compensate except in the zone of the thoracic inlet where the bony ring formed by vertebral body, first ribs and sternum is severely limited in its extent.

The average length of the oesophagus as measured from the upper incisors to the cardia is 40 cm in the male, and 37 cm in the female. In the cervical region the lumen is flattened from before back by the configuration of the larynx, lower down where it lies loosely in the mediastinum its form is tubular.

Although in general a midline structure, in the neck the oesophagus lies somewhat to the left (and is therefore best approached surgically from that side); whereas for most of its mid-course it is most accessible through the right hemithorax, the arch and descending aorta screening it from the left. In its lower third it once more inclines leftwards to reach the diaphragmatic hiatus.

Except at this point, where it also passes forward, it follows throughout its length the curvature of the vertebral column which constitutes, together with the longus colli muscles and pre-vertebral fascia, its immediate posterior relation. The thoracic duct interposes between them, lying in loose areolar tissue from the level of the diaphragm to the arch of the aorta when it passes leftwards behind the arch to continue upwards to the thoracic outlet in close continuity with the left subclavian artery.

From the cricoid to its bifurcation at the level of the fifth dorsal vertebra, the trachea lies directly in front of the oesophagus, and (in their cervical course) the recurrent laryngeal nerves lie laterally in the grooves between the two, the left being closer than the right because of the leftward inclination of the oesophagus in the neck. The carotid sheaths and thyroid lobes are also lateral relations in this region.

In the upper half of the thorax the oesophagus is related laterally to both pleural cavities. On the left the arch of the aorta crosses it antero-laterally making mobilization of the oesophagus in this area difficult from the left side; and the descending aorta continues to be closely related to its left side until shortly above the hiatus when the oesophagus curves forward and they diverge.

The left subclavian artery leaves the aortic arch anterior to the oesophagus and passes upwards antero-laterally to it in company with the thoracic duct. As the trachea bifurcates behind the aortic arch the left main bronchus crosses immediately in front of the oesophagus, and this is the commonest site for malignant oesophago-bronchial fistula (see page 3) (*Figure 1*).

On the right side the azygos vein crosses the oesophagus laterally to join the superior vena cava just above the hilum of the right lung. Otherwise the only important lateral relationship on this side is with the pleural sac and the right lung itself. If the azygos is ligated and divided the whole intra-thoracic oesophagus is readily accessible from the right thorax.

Below the tracheal bifurcation the pericardium and the left atrium of the heart (with the pulmonary veins on either side) are immediately anterior. Enlargement of the left atrium in heart failure or as a result of mitral stenosis may therefore press upon the oesophagus in this position causing dysphagia; and a barium swallow provides valuable evidence of left atrial enlargement.

In its lower third as the oesophagus curves forward and to the left to reach the hiatus, the left ventricle lies in front of it and to its right. Behind, both right and left mediastinal pleurae are closely related on either side, for

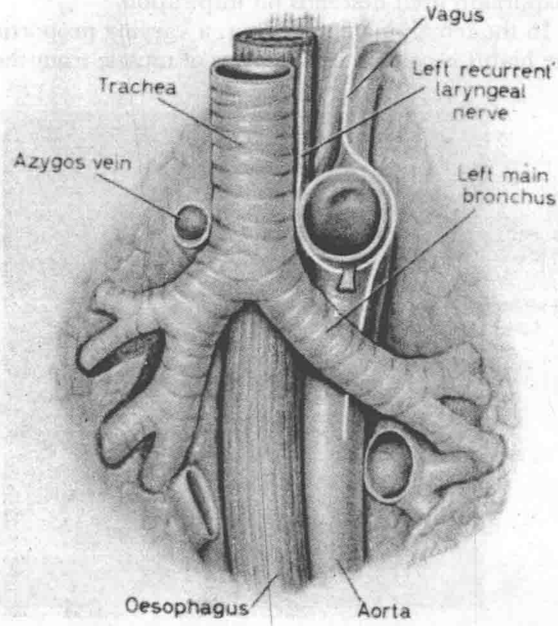

Figure 1.—The relations of the mid-oesophagus from the front

the aorta continues on its downward course more posteriorly. It is at this point the lower oesophagus is most accessible through the left chest.

The hiatus

The oesophagus now passes through the diaphragmatic hiatus, the structure and relations of which are of great practical importance. In its course from mouth to anus the gut traverses two diaphragms: that between chest and belly and that of the pelvis. In both it is partially encircled by a muscular loop or sling, at the first constituted mainly by the right diaphragmatic crus, at the pelvis by the pubo-rectalis muscle, the effective sphincter of the rectum. The action of the crural sling, however, is not wholly analogous with that of the pelvis for its action is not primarily sphincteric.

The hiatus is oval in shape with a relatively rigid, firmly defined horizontal anterior margin composed of the encircling fibres of the right crus as they are inserted into the central tendon of the diaphragm. Posteriorly, the margin is not well demarcated for the two limbs of the crus fall away as they curve down to their origins from the anterior aspects of the upper lumbar vertebrae and the median arcuate ligament (*Figure 2*).

In 50 per cent of subjects the muscular confines of the hiatus are formed wholly by the fibres of the right crus, the layers of the muscle which are more anterior at its origin arching upwards and forwards to constitute the right hiatal margin, the deeper layers passing more laterally, and then upwards and forwards, to make the left margin. Near their origin from the vertebral bodies they overlap in varying degrees, so that on contraction there is a scissors effect which tends to narrow the hiatus at the same time as the muscular sling shortens, drawing the hiatus downwards and backwards as the diaphragm itself descends on inspiration.

In the remaining 50 per cent, a varying proportion of the right margin of the hiatus is contributed by slips of muscle from the left crus crossing below

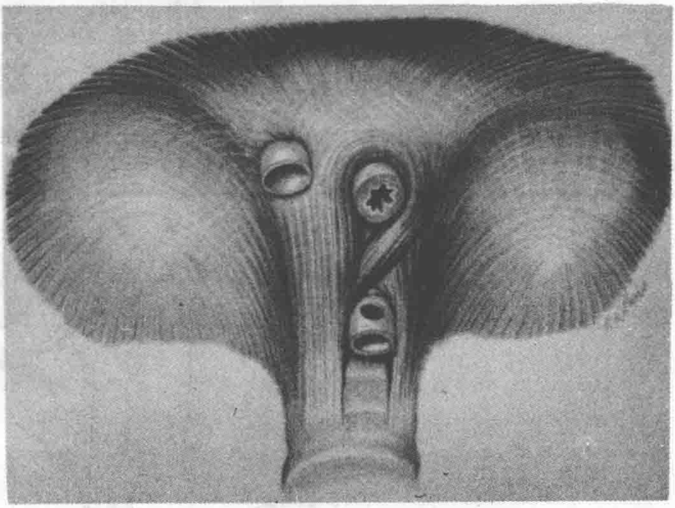

Figure 2.—A view of the undersurface of the diaphragm showing the relations of the cardia and its encirclement by the fibres of the right crus

and behind the oesophagus. These also promote the scissors action as they contract.

The oesophagus does not fill the hiatus as it traverses it, but lies in a sheath of fatty areolar tissue which permits easy mobility and lubricates, as it were, the up-and-down excursion of the diaphragm around it.

On the upper anterior and lateral aspects of the hiatus parietal pleura is reflected away from the mediastinum on to the superior surface of the diaphragm. Deep to it lies endothoracic fascia, which, with the transversalis fascia lining the undersurface of the diaphragm, fuses to form the much-discussed 'phreno-oesophageal ligament'. This fascial sheet, rich in elastic fibres, extends up through the fat around the hiatus as a conical investment of the oesophagus, to be inserted in the adventitia around it some 2 cm above the oesophago-gastric junction. Its fibres fan out into the oesophageal muscles as deeply as the submucosa and provide a useful *point d'appui* for the insertion of sutures. The word 'ligament' used in connection with it is, however, a misnomer. It is definite, but tenuous and highly extensible (*Figure 3*).

On the undersurface of the diaphragm the parietal peritoneum is reflected from the anterior lip of the hiatus, but posteriorly it is extraperitoneal and filled with fat. Thus, sliding hernias have an anterior investment of peritoneum but none behind. The inferior phrenic vessels run transversely on the undersurface of the diaphragm anterior to the hiatus.

After passing through the diaphragm, the oesophagus has a short intra-abdominal course (during which it is related anteriorly and on the right to the left lobe of the liver, and more distantly on the left to the tip of the spleen) before its oblique junction with the stomach below the fundus on the lesser curvature. These terminal few centimetres of the oesophagus are referred to in this book as 'the cardia'. The angle of their junction (or incisura cardiaca) is surrounded by obliquely disposed smooth muscle

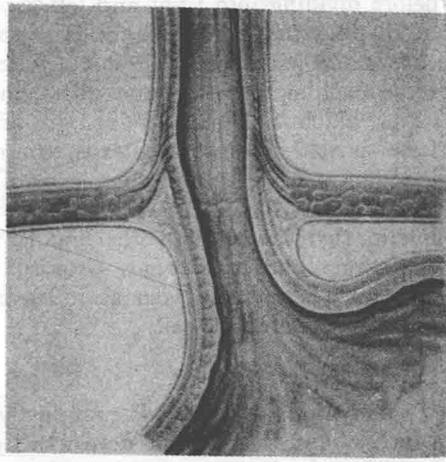

Figure 3.—The cardia. The so-called 'cardio-phrenic ligament' consists of extensions of the transversalis and endothoracic fascia which pass upwards to be inserted in the longitudinal muscle coat of the oesophagus. Columnar epithelium, similar to that of the stomach, lines the first few centimetres of the cardia

fibres of the gastric wall (the 'loop of Willis' or 'collar of Helvetius') and is reflected on the inner surface by a mucosal fold, the valve of His. Providing the angle is maintained this flap prevents reflux from the stomach at physiological pressure. The visceral peritoneum, firmly attached over the stomach, becomes loose as it approaches the oesophago-gastric junction, and is soon reflected from it as the gastro-hepatic and gastro-phrenic ligaments.

Muscles

The muscles of the oesophagus are striated in the upper third, smooth and involuntary in the lower two-thirds. They are usually described as consisting of an inner circular and an outer longitudinal, but are better envisaged as two spirals, the inner curves being short and almost horizontal, the outer long and almost vertical. At its upper end the inner coat is continuous with the cricopharyngeus muscle, whereas the outer divides, its fibres passing forward to be attached to the posterior aspect of the cricoid cartilage.

Blood vessels

The oesophageal blood supply is good, and much disruption of it is tolerated without sloughing; indeed, anastomotic breakdowns are almost always due to inadequate blood supply on the distal side of the junction rather than on the oesophageal. (In removing one very extensive leiomyoma which had virtually destroyed the muscle, the author left the lower half of the mucosal tube almost bare without ill-effect. Nevertheless, whenever possible excessive mobilization is to be avoided.)

In the neck, branches of the inferior thyroid arteries supply the oesophagus and twigs may also reach it directly from the subclavian, common carotid superior thyroid, costocervical or vertebral arteries. In the upper thorax oesophageal branches arise from the bronchial vessels and sometimes also directly from the aorta. Lower down are two branches from the descending aorta, one (usually the smaller) arising from its right antero-lateral aspect at the level of the sixth or seventh dorsal vertebra, the other, large, from 4 or 5 cm lower down. Each reaches the posterior wall of the oesophagus before dividing into right and left ascending and descending vessels. The subdiaphragmatic oesophagus is supplied by the branches from the left gastric and left inferior phrenic arteries. All these vessels anastomose with those reaching the oesophagus above and below. Having supplied the muscle coats (which they penetrate at right-angles), the terminal arteries ramify to form a rich submucosal plexus, communicating at the oesophago-gastric junction with the submucous plexus of the stomach wall.

The veins from the cervical part arise mostly on the sides and join the inferior thyroid veins and other smaller vessels; those in the thorax drain into the azygos and hemiazygos systems. Below the diaphragm 3 or 4 veins enter the left gastric vein as it leaves the lesser omentum to reach the posterior abdominal wall.

Lymphatic system

The lymphatic pattern is completely independent of the vascular supply. Mucosal and submucosal networks freely intercommunicate (there being more lymphatic vessels than capillaries), and at the lower end they anastomose directly with those of the stomach. Injection studies show longitudinal spread in them to be six times as extensive as that occurring transversely; and in the mid-third of the oesophagus they may reach the neck in the submucosa before passing through the muscle coats to enter nodes. This is clearly of significance when planning cancer surgery.

In general, lymph drainage from the upper two-thirds of the oesophagus is upwards towards the neck, that from the lower third downwards to the abdomen, but this is by no means exclusive.

From above down the principal groups of lymph glands are: the deep cervical chain, especially those related to the internal jugular; the post-tracheal and para-oesophageal groups in the superior mediastinum; the nodes in the inferior pulmonary ligaments; and the glands lying in the loose fat surrounding the oesophagus at the hiatus and just below the diaphragm, whence there is free communication with those at the coeliac axis and along the lesser gastric curve.

Nerves

The pharyngo-oesophageal area receives motor fibres from the vagus, glossopharyngeal and recurrent laryngeal nerves which communicate freely with each other and with sympathetic fibres to form the pharyngeal plexus.

trunks

The remainder of the oesophagus is supplied by the vagi whose main trunks run down on both lateral aspects for most of its length, branching and intermeshing in the plexus gulae; and by sympathetic branches which reach it from the cardiac and bronchial plexi, from the splanchnics, the thoracic ganglionated chain, and from the coeliac ganglion forming a peri-oesophageal plexus.

Between the muscle layers lies Auerbach's plexus with occasional parasympathetic ganglia; in the submucous layer is Meissner's plexus, devoid of ganglia.

The nerve supply is thus of considerable elaboration and complexity, but beyond the fact that vagal stimulation causes muscular relaxation at the cardia and vagotomy (in some animals) spasm, remarkably little is known of its mechanism. The vagal fibres are not truly parasympathetic, but are analogous to the motor fibres of the vagus innervating the larynx. They occupy a special position in the nerve. There is little evidence of the role of the sympathetic fibres, all of which have been cut without disturbing deglutition, but irritation of them causes transitory increase of tone in the cardia. Recent work by Ellis (1962) employing *in vitro* muscle strip examination indicates that there are two sorts of receptors in oesophageal muscle, one producing contraction and one relaxation. The main motor receptor field is cholinergic, but an adrenergic mechanism is also present chiefly associated with relaxation of circular muscle fibres at the lower end.

Mucous membrane

Most of the oesophagus is lined by stratified squamous epithelium lubricated by numerous racemose mucous glands, many of which penetrate the muscularis. The whole lies loosely in areolar tissue and is easily separated from the muscle coats. At rest it is disposed in longitudinal folds, pink in the upper third, paler lower down, until 1 or 2 cm above the oesophago-gastric junction there is an abrupt dentate line where it changes to a reddish rugose lining macroscopically (but not anatomically or functionally) identical with that of the stomach. It is mobile and consists of columnar epithelium containing simple tubular mucous glands confined to the mucosa and nowhere piercing the muscularis. The squamous epithelium of the remainder of the oesophagus is highly susceptible to peptic digestion; this zone, although it secretes no enzymes but only mucus, is not. Hayward (1961) suggested (since it forms a buffer zone between gastric and squamous mucosa and is distinct from either) that it should be renamed 'junctional epithelium'. When peptic digestion of the squamous-lined oesophagus occurs (and is followed by healing) columnar celled mucosa extends upwards to cover the ulcerated area. Thus, when patients who have had oesophagitis are found to have columnar celled mucosa high in the gullet it by no means follows that they have 'congenital short oesophagus'.

Occasional islands (as opposed to complete lining) of columnar celled mucosa are also found in serial sections of the upper third of the oesophagus.

PHYSIOLOGY

The oesophagus is the only section of the alimentary tract from which nothing is absorbed and into which no enzyme is secreted; its function is solely one of onward transmission. As for most of its length it lies within the thorax, it is subjected to the ebb and flow of negative pressures resulting from the respiratory excursion, but these contribute little to the machinery of swallowing. Below the diaphragm there is a sudden change to a positive pressure, and this plays an important part in keeping the oesophageal lumen closed and preventing gastric reflux—an influence at once removed when the cardia slides up through the hiatus as a hernia.

Swallowing begins as a voluntary act when the masticated food in the mouth is passed backwards by the tongue into the pharynx. Contact with the pharyngeal wall at once triggers off a complicated involuntary reflex whose afferent path is the glossopharyngeal nerve, the efferent being the vagus. First, all other egress from the pharynx is blocked; the tongue moves upwards and backwards against the hard palate; the levator, tensor palati and palatopharyngeus muscles combine to close the nasopharynx with the soft palate; the epiglottis (together with the whole larynx) rises and closes forward to seal off the airway. As this happens the pharyngeal constrictors grasp the bolus and there is a momentary peak of positive pressure before it is passed onwards.

The cricopharyngeus muscle constitutes the sphincter of access into the upper end of the oesophagus, keeping the gullet closed against the entry of air during respiration, and opening only to deliver food into the lumen. As the upper pharyngeal muscles contract, the cricopharyngeus relaxes sharply, so that the bolus is propelled downwards with a force estimated at the equivalent of a column of water 2½ ft high, and in itself sufficient to deliver semi-solids to the stomach. It is, however, augmented and completed by a series of reflex peristaltic waves initiated in the oesophageal walls by the act of swallowing.

Liquids pass down the oesophagus without help from these, the initial pharyngeal thrust and gravity itself being all that is required when the subject is erect. Peristalsis is inhibited when there is a quick succession of swallows, the wave then following down to clear the lumen. If fluids are swallowed from a head-down position, they are dealt with by peristalsis in the same manner as are solids.

The primary wave begins in the striated upper third of the gullet and sweeps down to the cardia preceded by a phase of muscular relaxation. At rest the cardia is closed, but as the primary peristaltic wave reaches it, it too relaxes to allow the passage of food. The presence of a solid food bolus within the oesophageal lumen stimulates (by actual distention) a secondary, supplementary wave in the smooth muscle of the lower two-thirds, helping to complete onward delivery. In addition localized, uncoordinated tertiary contractions of the circular muscle fibres occur particularly in older subjects. During swallowing the gullet shortens, snake-like, as the longitudinal coat contracts.

Pressure recordings within the oesophageal lumen reflect the negative intrathoracic pressures (-5 to -15 cm of water), fluctuating with the phases of respiration, and being lowest on full inspiration. Pressure in the stomach is slightly positive ($+5$ cm of water), but this is sharply increased by certain postural changes such as bending, and fluctuates reversely with respiration, being highest on full inspiration.

At the level of the cricopharyngeal sphincter the resting intraluminal pressure is some 40 cm of water higher than in the rest of the oesophagus or in the pharynx, but as the muscles of the latter contract (producing a pressure of 50–100 cm) the sudden relaxation already described takes place and food is, as it were, shot through into the oesophageal lumen. Relaxation of cricopharyngeus occurs 0·2–0·3 sec after deglutition begins; food reaches the cardia in 1·5–2·5 sec (according to consistency), that is, at the rate of 10–20 cm/sec.

The zone of increased pressure marking the cardia is much less well defined than is that at the upper end, but is about 10 cm of water above

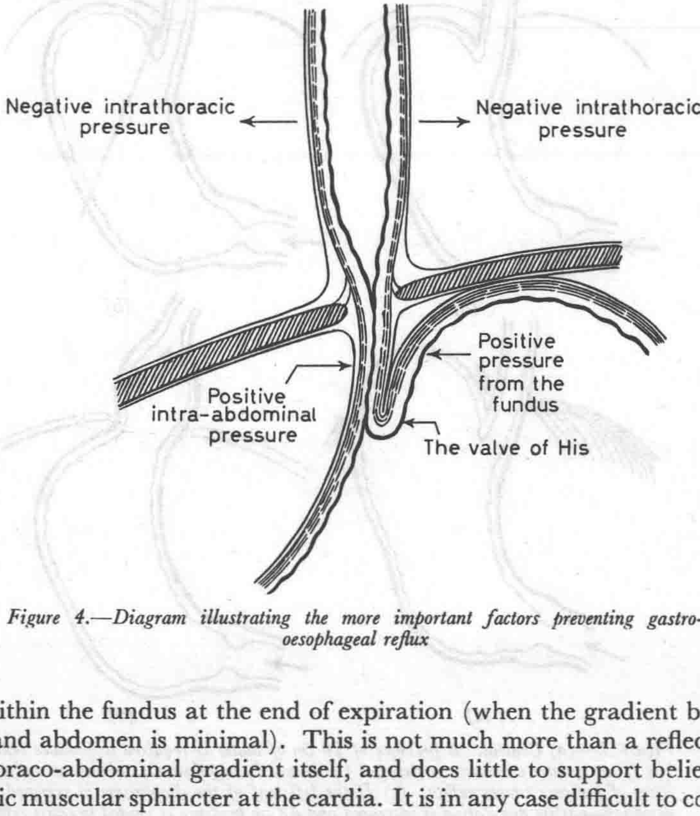

Figure 4.—Diagram illustrating the more important factors preventing gastro-oesophageal reflux

that within the fundus at the end of expiration (when the gradient between chest and abdomen is minimal). This is not much more than a reflection of the thoraco-abdominal gradient itself, and does little to support belief in an intrinsic muscular sphincter at the cardia. It is in any case difficult to conceive of such a sphincter acting when the oesophago-gastric junction lies normally in the abdomen, but ceasing to do so when displaced into the chest. In fact, no satisfactory evidence, either anatomical or physiological, exists in support of a true, intrinsic sphincter at the cardia.

If barium is watched passing down the oesophagus it is seen to pause just above the hiatus, especially if the patient breaths in. This is the moment when the pressure differential is greatest between the chest and abdomen and when the right crus is fully contracted. On expiration the barium flows through. The transitory dilatation of the lower end of the oesophagus visible during this pause is known to radiologists as the 'phrenic ampulla', but this does not represent a recognizable anatomical vestibule. As the last few centimetres of the oesophagus lie in the abdomen and are therefore subjected to a positive pressure, the effect is similar to that of a flap valve, thus helping materially to prevent reflux. Clearly, when the cardia is displaced into the thorax and the positive is replaced by a negative pressure, this mechanism ceases to function. As food passes from oesophagus to stomach the mucosal lining of the cardia pouts into the stomach like an anus

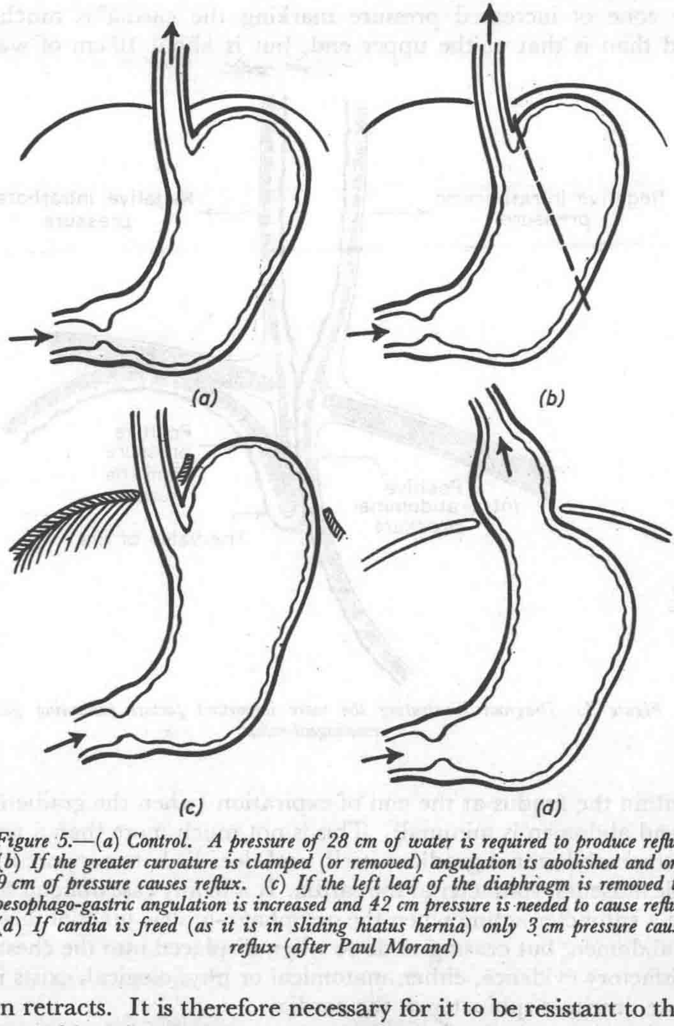

Figure 5.—(a) Control. A pressure of 28 cm of water is required to produce reflux. (b) If the greater curvature is clamped (or removed) angulation is abolished and only 9 cm of pressure causes reflux. (c) If the left leaf of the diaphragm is removed the oesophago-gastric angulation is increased and 42 cm pressure is needed to cause reflux. (d) If cardia is freed (as it is in sliding hiatus hernia) only 3 cm pressure causes reflux (after Paul Morand)

and then retracts. It is therefore necessary for it to be resistant to the gastric enzymes at this point.

Once food has entered the stomach a further effective mechanism comes into play to prevent its regurgitation either during gastric peristalsis or by the effect of gravity. As has already been mentioned (page 5), the oesophagus joins the stomach wall obliquely, the fundus rising beside it to form the cardiac angle. This angle is not only encircled by the oblique smooth fibres of the gastric musculature, but by the far more potent muscle sling formed mainly by the right diaphragmatic crus, the contractions of which accentuate the angulation not only from before backwards but also laterally, and are maximal on full inspiration when the pressure gradient between chest and abdomen is greatest. Within the stomach this angle is formed by the mucosal flap of the valve of His, closing the cardiac orifice so that even in the cadaver it is not immediately visible. A pressure of something like 28 cm of water is required to overcome it. Botha (1958) has shown that these mucosal folds at the cardia have independent tone due to their muscularis mucosae (*Figure 4*).

Distention of the fundus tends passively to compress the cardia. As was shown by Marchand (1955), if the fundus is clamped (or excised altogether in dogs) a pressure of only 9 cm of water within the stomach is sufficient to produce reflux; whereas if the left diaphragmatic dome is removed, allowing the fundus to balloon upwards beside the oesophagus, increasing the angle considerably, 42 cm of water (that is, nearly twice the pressure required when the fundus is normally situated) must be exerted before reflux occurs (*Figure 5*). When the cardia is freed from the hiatus altogether and is allowed to slide up into the thorax so that all angulation is abolished, a pressure of only 3 cm of water causes reflux. This is exactly what happens in a hiatus hernia. It is notable that in many para-oesophageal hernias (*see* page 33) the cardia is displaced into the chest, thus eliminating the flap valve effect due to intra-abdominal positive pressure. Such patients do not, however, suffer from reflux because cardio-oesophageal angulation is retained.

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2—Investigation of Oesophageal Disease

A careful and detailed history is of prime importance. Sometimes the first symptom of oesophageal disorder is a cough. This may be irritative and unproductive due to vague discomfort or to the presence of a mediastinal mass; or productive of purulent sputum because of inhalation pneumonitis, or spill-over from an obstructed oesophagus.

Much more commonly the presenting symptom is dysphagia. This should never be attributed initially to psychological causes, but always demands serious and complete investigation. It is, on the other hand, true that emotional stress is likely to aggravate difficulties in swallowing that are of organic origin.

Dysphagia is classified as painful, paralytic or obstructive. Painful swallowing is associated with inflammatory lesions of the mouth and pharynx. Obstruction is intrinsic or extrinsic, the commonest intrinsic causes being carcinoma and fibrous stricture. In some patients history of a previous injury with corrosives or a foreign body may be elicited; in many others a long period of dyspepsia, heart burn and acid brash precedes the development of oesophagitis, ulceration and stricture formation. In older age-groups dysphagia always arouses fear of carcinoma and this diagnosis is presumed until disproved. As a rule dysphagia in such cases is of brief duration, but sometimes carcinoma supervenes upon a long-standing lesion such as chronic oesophagitis.

Extrinsic pressure comes most often from lung cancer and its metastases, lymphadenopathies and retrosternal goitre.

Patients are often able to indicate with fair accuracy the level at which obstruction takes place. Most people with dysphagia tend to lose weight through inanition, but those suffering from achalasia usually do not do so; and it is surprising how well nourished some remain with quite severe simple strictures through which little would seem able to pass.

Detailed physical examination of patients with oesophageal symptoms always precedes special investigations, and include direct oral and laryngeal and rectal inspection. Finger clubbing is common in achalasia. Wasting may be the only finding; but a malignant lymph gland behind the head of the left clavicle, epigastric masses, or an enlarged liver are sought for. The subject is asked to eat and drink in the presence of the clinician so that the timing and character of his difficulty may be observed.

Plain postero-anterior and lateral chest radiographs are indispensable for not only is oesophageal obstruction likely to result in pulmonary infection due to spill-over and aspiration, but the mediastinal spread of bronchial carcinoma is one of the commonest causes of dysphagia in men over the age of 50 years. In addition, aneurysms, anomalous vessels, mediastinal cysts and tumours, or the enlarged left atrium of mitral stenosis may all compress the oesophagus. Absence of a gastric air bubble strongly suggests oesophageal obstruction. Sometimes growth at the cardia is directly visible as an encroachment on the translucent bubble (*Figure 6*).