• SUMMARY

(1) The main indication for operation in cases of cardiospasm is the failure of medical treatment and periodical dilatations.

(2) The operation of choice is extramucous oesophagocardiomyotomy, the technical details of which are given.

(3) Notes of four personal cases are recorded together with end-results of operation.

(4) The operation described is one of such technical simplicity that, in the writer's opinion, it should be more widely practised in the future for the intractable type of cardiospasm.

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REFERENCES

- 1) BARLOW, D., *Brit. Jl. Surg.* (1942), **29**, 4.
- 2) OCHSNER, A. and DE BAKEY, M., *Arch Surg.* (1940), **41**, 1146.
- 3) HELLER, E., *Mitt. a. d. Grenzgeb. d. Med. U. Chir.* (1913), **27**, 141.
- 4) HELLER, E., *Verhandl. d. deut. Gesellschaft f. chir.* (1921), **45**, 144.
- 5) ZAAIGER, J. H., *Ann. Surg.* (1923), **77**, 615.
- 6) LAMBERT, A. V. S., *Ann. Surg.* (1913), **58**, 415.

RADIOLOGY IN DISEASES OF THE OESOPHAGUS

By G. T. CALTHROP, M.D., (Cantab.), D.M.R.E., Camb.

(From the X-ray Department, Royal Free Hospital)

The radiological examination of the oesophagus can determine:—

1. The position of the oesophagus.
2. The size of its lumen.
3. The contour of the lumen.
4. The presence of any obstruction, its site and the degree.

The oesophagus is a tube whose walls, during the greater part of life, are collapsed, so that there is only a potential lumen. Consisting of muscular and connective tissue, it cannot be differentiated by X-rays from the surrounding tissues, but the lumen may be made visible by filling it with a substance which is of lesser or of greater density. Even if air, or other medium of lesser density could be used, it would be impossible to see details in the intra-thoracic portion because of the over-lying shadows and translucencies of the lungs and other structures. A medium of greater density, i.e. more opaque to X-rays, must be used, and a suspension of barium sulphate is now universally employed.

When it is required only to depict the course of the oesophagus, no previous preparation of the patient is necessary, but in all other cases no solids or even fluids should have been taken by mouth for at least four, and preferably more, hours before the examination.

The passage of the opaque medium through the oesophagus is observed in the usual manner on the fluoroscopic screen, and a radiographic record is made to permit study at leisure and a comparison in the future.

The demonstration of mucosal relief of the oesophagus can be made. Its value, as so often in the alimentary tract, is greatest when it is normal, and it gives greater confidence in the report that there is no abnormality. The details of the technique need not be described here.

The Course of the Oesophagus.

In discussing diseases of the oesophagus, there is no need to describe the normal position more than has already been done by Monro, nor is there need to enter in detail into all the variations due to congenital anomalies, such as dextro-cardia or dextro-aorta.

It is more important that the oesophagus may be displaced by intra-thoracic diseases, which rarely produce obstruction, or other symptoms directly referred to the gullet. These are:—

1. Intra-thoracic goitre.
2. Tumours of the mediastinum and bronchi.
3. Fibrosis of the lungs, secondary to pulmonary tuberculosis, bronchiectasis, abscess of the lung.
4. Pleural effusion, including empyaema and, later, pleural thickening.
5. Cardiac and vascular lesions in addition to the congenital anomalies already mentioned. Of these, the most important is aortic aneurysm: an enlarged left auricle displaces the oesophagus, and may cause dysphagia, which is relieved if the auricle decreases in size as a result of treatment.
6. Kypho-scoliosis: the displacement varies according to the deformity, but dysphagia rarely results.

In view of the many causes which may distort the oesophagus, it is obvious that an unnecessary risk is taken if any instrument is passed, before the route has been mapped out by a preliminary radiological investigation.

TUMOURS OF THE OESOPHAGUS

Benign.

Fibroma, myoma, fibro-myoma, lipoma, polypoid tumours, and cysts, are but very rarely found. They have no particular individual appearances, and their presence can only be suspected by the radiologist if he meets something that radiographically and clinically is difficult to fit into any other group.

Carcinoma.

This is the most common disease to find in the oesophagus, or if it is not, it is most definitely the disease which must always be kept in the front of the mind whenever a radiologist examines the oesophagus for any reason whatever.

Carcinoma produces effects in the oesophagus which are to be expected and can be deduced from its behaviour in other hollow organs.

It arises in, what is to the radiologist, the wall of the oesophagus. From its point of origin it must spread inwards, upwards or outwards, or in all three directions in varying degree. As it grows inwards, it fills the potential space of the lumen. When the barium meal passes through the oesophagus, there are filling defects, and the lumen is narrowed. The latter effect is enhanced by an additional component of muscular spasm. Eventually there is a complete stoppage to the passage of the opaque medium. The shadow then finishes, not with a smooth contour as in cardiospasm, but with an irregular outline, and a "rat-tail" extension. In other cases, the growth seems to be mainly lengthwise and an area of irregular contour is found. The radiological picture may seem to show the actual outline of the growth as it develops backwards.

Should the site of the obstruction be one where *cardio-spasm* is often found, it is sometimes difficult to be certain whether the condition is simple or malignant. If there is the least doubt, oesophagoscopy should be carried out and a piece removed for histological examination. One type of case may be particularly difficult: when there is a carcinoma of the fundus of the stomach, with extension upwards into the oesophagus.

If the carcinoma does not produce complete obstruction at the time of examination it should be possible to demonstrate the length of the growth, and by examination of an antero-posterior view, taken with the direct ray passing through the centre of the growth, to estimate its position in relation to the bodies of the dorsal vertebrae. These details of location are of great importance to the radio-therapist who has to plan his fields so carefully and accurately, and also to a surgeon who may be contemplating any direct methods of approach.

If the lesion is the so-called **post-cricoid carcinoma**, the passage of the opaque meal is

retarded in the neck, and it is possible to make a radiograph showing the irregular, narrowed, tortuous channel. In this region, the normal passage rate of the meal is so rapid that, without special apparatus, it is not possible intentionally to make a record of the opaque meal in the upper oesophagus.

The mere demonstration of the barium-filled oesophagus, therefore, is almost pathognomic. Almost, but not quite, for occasionally a partial spasm occurs.

Where there is a carcinoma there is a soft tissue mass or swelling, and this can be seen in a suitably prepared radiograph of the neck. If the lumen of the oesophagus, though narrow, is smooth, and there is no variation from the normal in the soft tissues, a post-cricoid carcinoma is probably not present, and spasm only is the cause of the dysphagia.

DIVERTICULA

Zenker's Diverticulum, or **pharyngeal pouch**, occurs in adults of over fifty years of age. It has been claimed that it is associated with lipping of the bodies of the cervical vertebrae, but this latter condition is seen in radiographs of the neck in so many people over fifty, that it is felt that this is an incidental finding, and not a condition directly related to the formation of the pouch. Patients are said to be able to swallow solids more easily than liquids. Radiologically, however, there seems little difficulty in filling the pouch with the usual barium meal. The diagnosis is rarely difficult. When seen from the front of the patient, there is a sac-like shadow with well-defined convex lower border at about the level of the clavicles. When the patient is turned into either oblique position, this pouch is found to lie behind the oesophagus, and the connecting stalk should be seen. On pressure at the side of the neck, or in the Trendelenberg position, the opaque medium flows always from the upper and never the lower end of the sac.

Filling defects may be seen in such a pouch, and carcinoma is known to occur. A second examination after longer fasting, and after pressure on the side of the neck to expel any retained food or fluid should confirm or dispel any doubt.

Other so-called diverticula are found in the thoracic oesophagus, and are called **pulsion, traction, or pulsion-traction diverticula**. They do not have the narrow neck or stalk seen in Zenker's pouch, or in diverticula of the stomach, or of the small or large intestines. They appear radiologically, at any rate, to be incidental findings: sometimes calcified hilar or mediastinal glands can be shown to lie in near relation to them, and are said to be causative.

Captions

- FIG. 1.—Carcinoma of the post-cricoid region of the oesophagus.
 FIG. 2.—The same case as Fig. 1, showing the swelling of the soft tissues with their typical projection into the trachea.
 FIG. 3.—Spasm at the upper end of the oesophagus: there is no soft tissue swelling. No carcinoma was found by oesophagoscopy.
 FIG. 4.—Carcinoma: the mass projects lengthwise, forwards, and backwards and distends the oesophagus.
 FIG. 5.—Short oesophagus with cardiospasm and thoracic stomach in an infant of 9 months.
 FIG. 6.—Short oesophagus with hiatus insufficiency, i.e., this amount of stomach is only seen to pass through the diaphragmatic opening when the patient is in the Trendelenberg position.
 FIG. 7.—Short oesophagus: the cardia is above the diaphragm. Note the continuation of the gastric mucosal relief.
 FIG. 8.—A short oesophagus, showing that the cardia—the junction of the oesophagus and the stomach—is above the level of the diaphragm.
 FIG. 9.—Para-oesophageal hernia of the stomach.
 FIG. 10.—Diaphragmatic hernia through an opening in the diaphragm secondary to an operation for empyema. Although practically the whole of the stomach is above the diaphragm the cardia and lower end of the oesophagus are below it.
 FIG. 11.—Cardiospasm: but a piece removed by oesophagoscopy was reported to show malignant changes. Deep X-ray treatment.
 FIG. 12.—Zenker's Diverticulum as seen from in front. The lower contour is smooth.
 FIG. 13.—Carcinoma of the middle third of the oesophagus. There is some dilatation above the malignant stricture.
 FIG. 14.—Carcinoma: the growth is extending lengthwise rather than projecting into the lumen.
 FIG. 15.—Traction diverticulum of the lower third of the oesophagus.
 FIG. 16.—Carcinoma of the oesophagus involving the lower and part of the middle third.
 FIG. 17.—Pharyngeal Pouch of Zenker. The oesophagus is seen as a thin line anterior to the Pouch.
 FIG. 18.—Zenker's Diverticulum examined in the Trendelenberg position. The opaque medium is seen running out of the upper end of the diverticulum into the pharynx.

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DIAPHRAGMATIC HERNIA

When considering diseases of the oesophagus, one cannot properly include a full discussion of herniation through the various portions of the diaphragm. Some reference must, however, be made, if, in some cases, only for differential diagnosis.

The most common deviation from the normal, and one much more common than often thought, is the congenital anomaly of a **short oesophagus**. Its termination may be at any point between the half-way mark and the ordinary intra-abdominal site. In the majority of cases, the cardia is seen as an area in which the column of barium varies in width, reminiscent of an intermittent spasm of mild degree. The barium meal then appears to continue in the lumen of the gullet. Careful observation with the patient in the horizontal position or with his pelvis raised, will show the mucosal folds of the stomach continuing upwards through the diaphragm, as far as the cardia. Spasm may occur at this point. Emphasis has been laid on the apparent continuation of the gullet. It is but rarely that any large proportion of the stomach passes through the hiatus. Of necessity, the short oesophagus is complemented by a thoracic stomach, but the use of the phrase should not encourage the building up of a misleading mental image.

Careful fluoroscopic observation and the making of aimed exposures will permit the recognition of **para-oesophageal herniae** in which the abdominal portion of the gullet remains in the usual situation.

Insufficiency of the hiatus is a phrase used to describe those cases in which some part of the stomach passes through the oesophageal hiatus when the patient is in the horizontal position, or with his pelvis raised, especially if pressure is applied to the abdominal wall, or if he bends forward as in gardening. In the upright position, however, the stomach returns to its normal situation. Usually only a small part of the stomach is involved. It is to be looked for especially in elderly people, who have put on weight.

Almost the whole of the stomach may pass through an unusual opening in the diaphragm, whether congenital, or acquired by trauma, surgical or otherwise. The cardia then usually retains its normal position.

FUNCTIONAL DISTURBANCES

When a mouthful of barium meal is swallowed, it passes rapidly over the back of the tongue through the pharynx and the upper oesophagus, and no residue is left. Occasionally remnants are to be seen in the valleculae and the piriform sinuses, or some may spill over through the larynx into the trachea, and then make a modified bronchogram. In such a case, attention should be given to the possibility of some organic nervous disease, such as tabes, progressive muscular atrophy, toxic lesions of nerves, e.g. diphtheritic palsy of the recurrent laryngeal nerve, or involvement of the vagus by an aneurysm or mediastinal growth. In some cases, especially in elderly people, no lesion is found, and the cause cannot be given. In younger patients, hysterical manifestations can simulate many organic disorders.

The thoracic oesophagus retains some barium meal as a coating for a varying time, depending on a multitude of factors, such as the moistness of the mucous membrane, whether washed with saliva or coated with mucus, the consistency and composition of the bolus. Providing the lumen is normal, this small retention is of no significance.

Spasm may occur in any portion of the oesophagus, the most common sites being at the upper and lower ends.

Temporary or fleeting spastic contractions are seen in the mid-thoracic portion and are nervous in origin.

Plummer and Vinson have described a condition of anaemia, enlarged spleen, and an unusual appearance of the tongue and pharyngeal mucosa, associated with the complaint of dysphagia. They look on the latter as hysterical in origin, and the other symptoms and signs as secondary to the poor nutrition. Often no definite signs are seen by X-rays. If an area of spasm is shown, there will be no swelling of the soft tissues of the neck, thus differing from cases of carcinoma. It has been thought, though not claimed by Vinson, that post-cricoid carcinoma is apt to be a secondary complication of such cases.

Cardiospasm occurs usually in adults, but it is seen in young children and even in infants of a few weeks, the radiological appearances being the same at all ages, except, of course, that the more developed stages have not had time to occur in the very young.

The actual site of the spasm or achalasia varies from case to case, and Barsony has described a case in which recurrence took place at a different spot. The usual site is not, at the cardia but higher up, at the diaphragmatic hiatus, or even just above it. If the oesophagus is short, the site of the spasm will of course be at, or near, the true cardia.

The degree of the spasm varies, as is shown by the "head" of the column of barium meal, which piles up before the spasm gives way. It may be only an inch or so, with no secondary dilatation of the oesophagus. Such a slight spasm is often reflex and associated with a gastric or duodenal ulcer. If the usual quantity of barium meal is taken in order to fill the stomach, there will always be left this head in the lower end of the oesophagus for quite a little time after the last mouthful has been taken. From this minimal degree of spasm, all degrees are found, until, if the condition lasts for some time, the gullet distends more and more, and becomes tortuous at its lower end—a danger to anyone who wishes to pass any instrument into the stomach.

Once the oesophagus has dilated, it appears that although the obstruction which has produced the dilatation has been overcome, the gullet never shrinks back to its normal size. This may result in some unexpected radiological adventures. Recently a lady was referred for examination of the chest on account of a severe cough. During the routine fluoroscopic examination, a peculiar shadow was noted in the right lung field. There was no obvious explanation. Although she was seventy-six years of age and gave a history of vague dyspepsia all her life, but not of dysphagia, a mouthful of barium suspension showed an air-containing oesophagus so grossly dilated that its right wall showed in the lung field. The barium swallow passed into the stomach without delay, and the appearance was that of a dilated tortuous oesophagus; obviously due to a former cardiospasm.

The differential diagnosis is always from carcinoma. In the latter there is rarely time for much dilatation; there may be some, but it is not comparable with the degree of obstruction. Other causes of obstruction can usually be deduced from the history.

The radiologist may be called upon to assist in the passage of an instrument, whether a bougie or a Sterck's dilator, to advise when the area of spasm has been reached or passed as the case may be.

Congenital Stricture.

A narrowing, partial or complete, which occurs in the new-born. It may be fatal, either because inanition results, or because pulmonary complications occur. However, some cases occur in which symptoms are not produced until later, perhaps not until adult age is reached. The barium swallow will demonstrate the site and degree of the obstruction. In making a diagnosis, the occurrence of cardiospasm in a short oesophagus must not be forgotten.

Acute Obstruction.

This follows the swallowing of a foreign body. If the latter is opaque to X-rays, the cause of the symptoms is easily found and localised—radiographs in the sagittal, coronal and oblique planes may be necessary. If the foreign body is not opaque, a barium swallow should be given. The stream may stop, divide, or some may adhere to the foreign body.

Oesophagitis, whether mild, ulcerative or phlegmonous, may be a cause of acute or sub-acute obstruction. Such cases are not usually examined radiologically, for though it may be due to the swallowing of a foreign body, oesophagitis more often follows the taking of caustic fluids. It is obvious that such cases are radiologically more important when the chronic stage has been reached, and a stricture formed.

Oesophageal varices can be demonstrated by means of X-rays. They occur, of course, in cases of portal circulation back-pressure, e.g. cirrhosis of the liver. They need careful hunting for, and show as irregular shadows in the oesophageal lumen, somewhat reminiscent of retained food products.

Peptic ulceration of the oesophagus is often described, but is rarely found in routine examinations. It shows the same characteristics as elsewhere, an ulcer niche projecting out from the lumen of the oesophagus.

Considering this brief summary, it must be agreed that very few diseases of the oesophagus cannot be demonstrated by means of X-rays, and that very few can be found in the first place without their help.