stance; we can even make an estimate of the number of molecules of acetylcholine released by a single impulse at a single ganglionic synapse; but we are no nearer to a conception of the meaning of a specific sensitiveness to a substance having that structure, or as to why its presence should augment the activity of one type of cell and inhibit that of another. The complex changes accompanying a muscular contraction are known in much greater detail than those of any other kind of functional metabolism; but there is yet no knowledge clearly relating these changes, or any part of them, to the mechanical event of the contraction.

Are we witnessing the early stages of a major advance in which a finer physical conception of the structure of living matter will ultimately give order and meaning

to the knowledge, now so rapidly accumulating, of the chemical changes which accompany vital activities, and of the chemical substances which so mysteriously condition or control their occurrence? Or will physiology find itself brought early to a halt in the line of its present advance, baffled by a complexity which its methods have revealed, but which they cannot yet begin to resolve? None of us, I think, can answer such questions. We must be content to follow patiently what clues we find, and to go forward in the faith of Harvey, that

"Nature herself is to be addressed; the paths she shows us are to be boldly trodden; for thus, and whilst we consult our proper senses, from lower advancing to higher levels, shall we penetrate at length into the heart of her mystery."

OESOPHAGEAL OBSTRUCTION*

BY

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Obstruction of the oesophagus is one of the most distressing conditions by which any individual can be afflicted. It is true that it is only a symptom, but it is a symptom of such gravity that the problem of its relief entirely overshadows that of the removal of its underlying cause, and it is well that one should recognize that this is the case, since if relief is difficult cure is only too often impossible.

Of the many causes of obstruction we shall only deal with two—carcinoma and cardiospasm—since in frequency and in surgical interest they far exceed all other sources of dysphagia. Moreover, these two conditions may present a nice problem in diagnosis, their treatment is altogether different, and the results are in equal contrast.

Carcinoma of the Oesophagus

Carcinoma of the oesophagus is essentially a disease of elderly men, 90 per cent. of the male cases occurring after 50, and the maximum incidence lying between 65 and 70. In women it is much less common, one woman being affected for every three men, and in women it occurs more or less uniformly at any age after 40. Moreover, in men it is commonly a disease of the lower oesophagus, 80 per cent. of the cases occurring below the tracheal bifurcation, while in women it occurs in any situation, and a large proportion arise from post-cricoid growths.

The first symptom is almost invariably a steadily increasing dysphagia, although occasionally the onset is so abrupt as to give the impression that a foreign body has become impacted. At first there is difficulty in swallowing solid food, then liquids only pass down slowly, and, finally, food may be regurgitated in unaltered form. Inability to swallow saliva is a very serious inconvenience, and this is increased by the secretion of a stringy mucus, so that the oesophagus becomes filled by a tenacious froth, which further impedes swallowing. We regard this froth as a diagnostic sign of the first importance. At first it is white and odourless, but in the later stages it becomes blood-stained and foul, indicating a fungating and ulcerated growth, and producing a marked fetor.

At a still later stage involvement of the respiratory passages gives rise to an important group of secondary symptoms. The secretion of mucus is increased and is accompanied by a constant irritable cough. Finally, the growth perforates the trachea, or bronchus, or the lung itself, a fistula is formed, and a septic pneumonia develops. Yet the tolerance of the lung is remarkable, and we have

seen a stream of barium emulsion cascading through a fistula into the whole of the lower lobe with no apparent inconvenience to the patient, who ultimately coughed it up. Occasionally a large vessel is opened up, and haemorrhage quickly closes the scene.

The pathological features correspond to the advanced clinical picture, and indicate one of the most malignant and remorseless growths with which surgery ever has to deal. Operative exposures and post-mortem examinations agree in revealing growths which have invaded surrounding structures at an early stage, and it is rarely that a

Fig. 1.—The oesophagus in carcinoma and in cardiospasm.

growth will be found which even the most optimistic surgeon could regard as operable. One soon realizes that dysphagia is a later development, and that in the great majority of cases the growth is far advanced before it gives rise to this, the earliest indication of its presence.

In our opinion, then, the practical problem of carcinoma of the oesophagus is to enable the patient to swallow, and, fortunately, it is usually possible to achieve this by comparatively simple means. It is only rarely that the question of radical removal can even be raised, and, in spite of a few brilliant results, it seems to us most unlikely, from pathological considerations alone, that it can ever become a practical method. The depth at which

* A special clinical lecture given by request at the Melbourne Meeting of the British Medical Association, September, 1935.

the oesophagus lies, the fragile nature of its wall, which possesses neither a submucous nor a peritoneal coat, the complexity of the structures by which it is surrounded, and the age at which the disease occurs, are all opposed to a direct attack, and one may be sufficiently grateful if one can relieve the dysphagia.

The diagnosis will rarely be in doubt, and it can be settled at once by an *x*-ray examination. On the fluorescent screen the barium emulsion is seen to reach the obstruction and to fill up the lumen of the oesophagus above it. Except in the rare cases in which the obstruction is absolute, it will now be seen to trickle slowly through it and to fill up beyond it the longitudinal folds in which the mucous membrane of the empty oesophagus normally lies. In the case of a malignant stricture a moderate degree of dilatation may be observed above, the shadow will terminate in a cone pointing downwards, and from the apex of the cone a firm, twisted stream of barium will be seen making its way through the tortuous vagaries of the growth.

Intubation for Cancerous Dysphagia

The most direct and simple means of relieving the dysphagia is intubation, and the method which I propose to describe is one which I have been using for the last ten years with increasing success. The tube which I employ is a flexible spiral formed of German silver wire and gilded. The tube has an expanded upper end and a twisted oval section, which prevents displacement. From its complete flexibility the tube is well tolerated, the patient being quite unconscious of its presence, whilst the lumen is so large that he can swallow ordinary food without difficulty.

The introduction of these tubes requires the use of an oesophagoscope of larger dimensions than those usually employed. The one which I most frequently use has a slightly oval section and is 20 x 18 millimetres in outside diameter. In most instances there is not the slightest difficulty in passing this large instrument, and it gives a facility which makes manipulations much safer than with one of smaller size. Three lengths of tube, 10, 14 and 18 inches, enable one to reach any stricture under the most advantageous conditions. Smaller tubes, 18 x 16 and 16 x 14 millimetres in diameter, enable one to deal with cases where the larger tubes cannot be passed.

With the patient lying flat on his back the head is extended at the occipito-atlantal joint, but is lifted forward so as to straighten the cervical spine. No greater mistake can be made than forcibly to extend the neck. The head, supported by an assistant, is now slightly deflected to one side, and the operator inserts his instrument at the angle of the mouth, thus avoiding the prominent central incisors, if they are present, and entering at a point much nearer the pharynx.

Under the control of vision the epiglottis is now lifted forwards on the beak of the instrument, which enters the pyriform fossa of the opposite side. From this it is deflected to the middle line, where it is probably brought abruptly to rest by spasmodic closure of the cricopharyngeus, the passage of which is the most difficult part of the operation. Gently pressing the tip of his instrument against the sphincter, the operator waits until with a deep inspiration it opens, disclosing the lumen of the cervical oesophagus, into which the instrument glides. After advancing an inch further the wider lumen of the thoracic oesophagus opens up, expanding with each inspiration and closing on expiration to a transverse slit. The assistant now slightly raises the head, and the instrument glides easily through the thoracic oesophagus, following the natural concavity of the thoracic spine. As the lip of the instrument, guided by the vertebral column, again turns forwards, the head, neck, and shoulders must be

depressed. The lumen now assumes the appearance of a vertical slit, where the oesophagus passes through the diaphragm. At this point extreme care must be taken, for not only is the oesophagus itself here very fragile, but its fixation to the diaphragm renders it peculiarly liable to trauma. Beyond this the cardia will be seen as a puckered opening, to which folds of mucosa converge. Entry into the stomach is announced by a gush of fluid and the appearance of heavy folds of dark pink mucous membrane.

Where a carcinoma is present the appearances are very characteristic. On entering the oesophagus its lumen will be seen to be occupied by a thick, white, frothy mucus, which entirely blocks the view. On advancing further, variable quantities of liquid and of food remains appear, and if these are excessive the simplest plan for their removal is to tip up the table and to allow them to flow down the instrument by gravity. As the stricture is approached it will be seen that the walls of the oesophagus, thickened by infiltration, no longer open and close with respiration, whilst slight dilatation of the lumen is usual. The stricture itself may appear as a mere constriction of the mucosa or as a fungating mass of vascular growth, which bleeds readily on contact, or we may see a deep ulcer in the oesophageal wall. In any event, it must be remembered that all we see is the upper margin of the growth, and that from the appearances alone we can form no idea of its extent.

Passage of Bougie

An attempt must now be made to pass a bougie through the stricture, and for this purpose I use a modification of Jackson's bougie, a flexible sound attached to the end of a steel wire, which does not interfere with vision. Under the guidance of the eye the end of the bougie is manipulated until it engages in the lumen of the stricture, through which, in most cases, it will then pass without difficulty. Not the least force must be used, for the wall at this point may be formed by soft growth, through which, with the slightest violence, the bougie may penetrate. Once the stricture has been successfully passed the bougie is pushed on until the wire occupies the stricture and forms a guide over which the dilators may be passed.

These dilators are of a novel type, which I devised specially for this purpose. They are formed of short cylindrical rods of aluminium with an axial hole to slide freely over the wire guide. Each is attached to a long rigid steel wire, and the sizes rise by millimetres from 4 mm., the smallest, to 11 mm., the largest, in diameter. By passing these in turn completely through the stricture it can usually be dilated with great facility up to the full size. At the same time, as each dilator passes through and clears the constriction, an accurate measurement of its length may be obtained. The method appears to be devoid of risk, but there is one circumstance in which I have always felt it necessary to exercise great caution. If, on dilating a dense stricture offering considerable resistance, it is noted that the resistance has suddenly disappeared, dilatation should proceed no further, as obviously there is a distinct risk of tearing the oesophageal wall if it is continued.

The stricture once dilated the introduction of the flexible tube is achieved by a simple device. The tube is mounted by its proximal end on a holder which just fits it, whilst into its distal end is inserted a small cone of gelatin. The latter enables the tube to glide through the stricture with facility, and it is dissolved in a few minutes. The tube is advanced until it is just clear of the oesophagoscope, the end of which can now be used to detach it from the holder, which is then withdrawn, leaving the tube in position, with its expanded upper end resting on the face of the stricture.

No further precautions are necessary, beyond reasonable care in the choice of food. If the patient is edentulous he can of course only take soft foods, but if his teeth are sound he can deal with any ordinary meal, and within two days most of these patients can be placed on an ordinary diet. They must be careful to wash down any remains of food, to eat slowly, and to avoid fibrous substances such as orange pulp or stringy meat, or such solids as orange pips or raw onions, which might become impacted in the tube.

As regards the tube itself the patient is entirely unaware of its presence, and, so far as we have been able to observe, it never gives rise to ulceration. We have actually verified tubes in position after eighteen months canalizing a large mass of carcinoma. This, however, could only happen with a dense scirrhus. With soft growths the tube is often passed after a few weeks, leaving, however, a canal which functions perfectly. The tube passes freely through the intestine, and only once have we seen one impacted.

Cardiospasm

Except for the one feature of dysphagia, cardiospasm contrasts with carcinoma of the oesophagus in almost every feature. It occurs in younger people, occasionally as early as 20, most often in women, and frequently in persons of a nervous disposition. Its relation to the nervous system is sometimes stressed by its appearance after a severe shock, or as a sequel to some illness.

The patient usually complains, not of inability to swallow, but of regurgitant vomiting, not recognizing that the food has never entered the stomach. An *x*-ray examination after swallowing barium emulsion shows a dilatation of the oesophagus, which may be enormous, terminating abruptly either at or a little above the cardia. In severe cases the obstruction may be absolute, but in most cases it yields to the pressure of a column of barium in the oesophagus when this has reached a certain height, the barium then running through until the pressure is insufficient to compel an opening. During this process the whole oesophagus may sometimes be seen to be in violent agitation with an irregular peristalsis which fails to advance the contents and only succeeds in rejecting them.

The oesophagus may be of such dimensions as to occupy a large portion of the thoracic cavity, and it may even be folded on itself so as to resemble the colon in Hirschsprung's disease. The wall is greatly thickened, rigid, and imperfectly contractile, whilst the lining mucosa may be ulcerated or covered by large patches of leucoplakia. Obviously such a structure can only return to normal by very slow degrees, even when all obstruction has been relieved.

Since the condition is generally progressive and may go on for many years, starvation and malnutrition may reduce the patient to an extreme degree of emaciation. As, however, the oesophagus has a great capacity, and as the respiratory tract is not affected, he is not troubled by the frothy mucus and the inability to swallow it which are an added misery in carcinoma.

The condition is primarily due to spasm of the circular fibres at the lower end of the oesophagus, and especially of the slightly condensed group which surrounds the cardiac orifice of the stomach. Whether the diaphragm ever plays a part is a matter of dispute, but it has now been shown conclusively by Knight's experiments that the condition is due to an over-action of the sympathetic fibres which control the whole region of the cardiac orifice. We have obtained confirmation of this control in a number of cases in which we have flooded the splanchnic area with novocain in the usual course of splanchnic

anaesthesia. In every instance there has been complete relaxation of the cardia, even where previous attempts at the passage of bougies had failed entirely.

Operations for Cardiospasm

Knight, however, showed that a large portion at least of the sympathetic supply is carried on the coronary artery, and he suggested that excision of this artery and of its gastric and oesophageal branches might relieve the condition. We have carried this out in two cases with satisfactory results, confirming the results already obtained in four cases by Adamson. Our patients are able to swallow satisfactorily, and state that they are greatly relieved. The *x*-ray picture, however, still shows some degree of spasm, and in view of the absolute relaxation produced by splanchnic anaesthesia we cannot believe that

FIG. 2.—Sympathectomy for cardiospasm (Knight's operation).

we know the whole story, and feel that this is still a field for research. The relief of the patient is, however, undoubted and the procedure is a practical success.

The alternative is to open the stomach and to dilate the cardiac orifice with the fingers. The results are good, but the operation is somewhat crude and not always easy to perform. It is greatly facilitated by splanchnic anaesthesia, which at once relaxes the spasm of the cardiac orifice, but if the results of the sympathectomy prove to be permanent forcible dilatation will, without doubt, be replaced by the more elegant and scientific procedure.

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On November 13th Mr. E. T. C. Milligan will give an epidiascope demonstration before the South-West London Medical Society on "Modern Methods and Treatment of Ano-rectal Diseases." Lectures will be given as follows: December 11th, Dr. H. W. Barber, "The Aetiology and Treatment of Eczema and Psoriasis"; January 8th, Dr. H. Crichton-Miller, "The Neurotic as the Practitioner's Bogy"; February 12th, Mr. C. D. Read, "The Problem of Abortion and Sterilization"; and April 8th, Mr. Hamilton Bailey, "Swellings in the Neck." On June 10th Sir George Lenthal Cheatle will deliver the Bolingbroke Lecture on "The Relationship of Experimental Pathology to Human Carcinoma." The meetings will be held at Bolingbroke Hospital, Bolingbroke Grove, Wandsworth Common, S.W., at 9 p.m.