splint was applied to the limb still in the elevated position, and the same attitude was maintained as the patient was removed to the ward, and continued by attaching the end of the splint to a rope connected with the tripod and pulley used in applying Sayre's plaster of Paris jacket. This position of the limb did not cause the patient material inconvenience, and after two or three days the rope was slackened a little so as to allow the end of the splint to come down an inch or two, and the same thing was repeated every two days or so, till the limb could be placed quite horizontal.

This preliminary operation has taken a long time to describe; but in execution it is of the simplest character, no paring of the broken surfaces being done at this stage, and there being almost no bleeding and no shock. The wound having healed (I need hardly say without suppuration), the patient was allowed to leave her bed, and left the hospital soon after to practise using the limb.

Before long she was readmitted, and the second operation was performed. The lower cicatrix was opened and the wire removed, and two interrupted wire sutures placed in the tracks of the previous continued one; the fragments, of course, being this time pared to clear them of fibrous tissue of new formation, and produce smooth surfaces for coaptation. This was all satisfactorily effected, though not without the use of the powerful hook and the vertical position of the limb. The result was restoration of the use of the joint in a manner so satisfactory that I determined to try the same procedure in the other limb. The only difference which I made in this case was that, as the upper fragment was too small to bear drilling, I passed the ends of the wire, in dealing with that fragment, through the tendon of the quadriceps just above the upper border of the bone, the lower fragment, which was, of course, very substantial, being drilled as in the other limb. By this means, aided by the vertical position of the limb and the hook, I was able to bring down the upper fragment very satisfactorily, so much so that I did not feel it needful to have the patient use the limb in walking before proceeding to the second operation, but did this before she left her bed, soon after the wound had healed. In the second operation I applied two interrupted sutures, passing them, as in the first operation, through the track in tendon and bone, which the first wire had occupied.

The continued wire suture, which was first used by Dr. Hector C. Cameron of Glasgow, has the great advantage, where much traction has to be made upon the fragments, that the pressure of the wire is distributed over the anterior surface of the bone instead of being concentrated upon the limited portion of tissue included in an interrupted stitch. And this is peculiarly valuable in old cases of fracture; in which, as a result of long disuse, the bone undergoes interstitial atrophy, that sometimes makes it very soft. But this suture has the disadvantage that it may tilt the fragments so that their anterior edges do not come well into contact with each other, as indicated in this diagram [Fig. 5.] :

Fig. 5.

This was my reason for preferring the interrupted suture in the second stage of the proceeding. In the first stage, in which the principal dragging probably takes place, this circumstance is a matter of no consequence, as accurate apposition of the fragments is not then aimed at; and in any case admitting of being dealt with by a single operation, though not without much traction, this defect of the continued suture might be readily got over by introducing a superficial central stitch of comparatively thin wire to ensure coaptation of the anterior margins of the fragments.

The effect of the second operation in the above case was such as would have surprised me if I had not seen in other cases how substantial and strong a patella may result from wiring after thorough paring of the surfaces, even when one of the fragments is of quite insignificant size. Without my notes I cannot say how long it is since the case was treated, but I think it must be about four

years. And I lately had the satisfaction of hearing from the patient that she could walk well, with strong and supple knee-joints.

In Miss —'s case I would suggest that you should, in the first instance, before making any incision, but after she has been placed under an anaesthetic, apply the strong sharp hook to the border of the upper fragment through the skin, and, with the limb vertical, ascertain to what extent the quadriceps will yield immediately. If the upper fragment came pretty well down, you would proceed to do all by one operation, but if there were the slightest doubt as to the feasibility of this, you would adopt the preliminary procedure as in the above case.

Supposing you to be doing all by one operation and that it seems desirable to employ Cameron's continued suture, as the wire will be left in permanently, it would be better to introduce its ends first into the lower fragment and fix them over the upper one, where the fixed ends could not cause inconvenience in kneeling. The strong hook would keep the upper fragment well down during the fixing process. If I had published this case, as I ought perhaps to have done, I should not have had to inflict upon you so large an amount of manuscript.

I remain,
Ever truly yours,
(Signed) JOSEPH LISTER.

Remarks

ON THE

RATIONAL TREATMENT OF FUNCTIONAL DYSPESIA.

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The first step towards a rational treatment of functional dyspepsia—a consummation, it will be admitted, devoutly to be wished—must be a more scientific classification of its forms. The rough clinical division of cases, according to symptoms, into the "atonic," "acid," "flatulent," and other groups commonly adopted is unsatisfactory, because the same symptoms may be produced by totally different disorders of function which demand quite different treatment. Now, the physiological functions of the stomach as an organ are these: (1) secretory, (2) motor, (3) sensory, (4) absorptive; and any case of functional dyspepsia must be due to disorder in the normal discharge of one or more of these functions. It follows from this that a rational classification of cases of dyspepsia must be based upon an accurate discrimination of the function or functions affected, and this, with a proper use of modern methods of investigation, should not be very difficult.

Investigation shows that the alterations in the functions of the stomach which produce the symptoms spoken of as "dyspepsia" tend to be in the direction of either excess or defect. This tendency may be discussed in the case of each function separately.

1. *Secretory Functions.*—An excess of secretion may be manifested by a total increase in the amount of gastric juice secreted (hypersecretion, gastro-succorrhoea, Reichmann's disease), or it may affect the hydrochloric acid alone (hyperchlorhydria). Conversely there may be a deficiency in the total amount of juice (hypochylia), or it may even be absent altogether (achylia), or the hydrochloric acid may alone be deficient (hypochlorhydria).

2. *Motor Functions.*—In considering the disorders of the musculature of the stomach it is necessary to distinguish between its more passive function of "tonicity" and its active "motility." Defect of these results in "hypotonicity" and "defective motility" respectively. Mere want of tone is responsible for many cases of "splashing stomach"; if the active movements are also in defect there is delay in the passage of the food onwards, but no actual stagnation such as occurs when the pyloric outlet is blocked. Increase of the motor functions is less important in the production of dyspepsia than their defect, but "pyloric spasm" may be regarded as an increased manifestation of the active movements, usually,

however, induced by the presence of an ulcer or fissure; of a mere increase of tone we know nothing.

3. *Sensory Functions.*—An exaggerated sensibility of the stomach (hyperaesthesia) is apparently a common cause of pain during digestion. Its existence can only be proved indirectly, but one is entitled to assume it when the secretion is normal, and there is no evidence of the presence of organic disease. Of a defective sensibility or anaesthesia of the stomach we have no knowledge, as the mucous membrane is normally insensitive to the ordinary processes of digestion, but it is possible that some profound cases of anorexia are due to a *minus* degree of sensibility in the gastric nerves or nerve centres.

4. *Absorptive Functions.*—The absorptive power of the stomach is at best but a limited function, and, so far as is known at present, alterations in it play no part in the production of functional dyspepsia.

We may therefore classify the disorders of gastric function which give rise to the symptoms of functional dyspepsia as follows:

1. Secretory { Excess=hyperchlorhydria and hypersecretion.
Defect=hypochlorhydria and achylia.
2. Motor { Excess=pyloric spasm.
Defect=atony and motor insufficiency.
3. Sensory { Excess=hyperaesthesia.
Defect=? anorexia and achoria.

Any one of these disorders may occur alone, but frequently one finds two or more coexisting and giving rise to a group of symptoms characteristic of certain clinical types of dyspepsia. It is common, for instance, for an excess of secretion to occur along with some hyperaesthesia of the stomach in some forms of so-called "acid dyspepsia," and to these there may be superadded some excess of motility in the form of pyloric spasm; or there may be a greater or less degree of motor insufficiency with or without some disorder of secretion in what is commonly spoken of as "atonic dyspepsia." This, at least, is certain—that, did our knowledge only permit of it, every case of dyspepsia could be analysed into a disorder of one or more of the above functions of the stomach, and that accurate treatment depends upon the degree to which such an analysis can be carried out.

TREATMENT.

Seeing that disorder of the functions of the stomach is in most cases and in the last resort the expression of a disturbance of the nervous mechanism of the organ—that is, that dyspepsia is really only one way in which functional disease of the nervous system manifests itself—it will be obvious that treatment directed to the nervous system is applicable in all cases. It is in this way that such therapeutic agents as rest, liberation from worry and mental work, change of air and scene, and many of the "hydrotherapeutic" measures exert their beneficial influence, and the use of such agents is in the strictest sense rational. Putting these aside, however, we may now consider briefly the methods at our disposal for correcting disorder in each function of the stomach separately and more directly.

1. SECRETORY DISORDERS.

(a) Excess of Secretion.

1. *Dietetic Treatment.*—The rational use of dietetic means in the treatment of excessive production of hydrochloric acid or gastric juice must include, in the first place, the avoidance of those articles which are known to act as stimulants of secretion. These embrace such things as common salt, meat extracts, soups made from meat, alcohol, and all spices and condiments. Physiological research has also shown that less gastric juice tends to be secreted on some diets than on others. Milk, for instance, makes comparatively small demands upon the secretory activity. It would therefore be rational to adopt such a diet in cases of excessive secretion, and in bad cases such a plan may be adopted at the outset of treatment with undoubted advantage. In the majority of cases, however, it will be found better not to attempt to restrain the secretion, but to content oneself with prescribing such articles of food as will best tend to neutralize the excess of secretion if it appear, and the diet most adapted to fulfil this purpose is one in which the animal ingredients predominate. Such a diet has the further advantage of being comparatively rich in fat, and fat, as

the researches of Pawlow have shown, inhibits gastric secretion. In practice, therefore, the dietetic indications in cases of over-secretion will be met by a regimen into which milk, eggs, meat, and fish enter freely, whilst the starchy foods are kept within strict limits.

2. *Medicinal Treatment.*—The most rational way of using drugs to counteract a tendency to over-secretion would be to select those, if there be such, which tend to inhibit the function of the gastric glands. Belladonna has been recommended for this purpose, and there seems no reason to doubt that it does tend to check gastric secretion just as it does that of the sweat glands. Its power in this direction, however, is feeble, and in practice it will be found to be disappointing unless given in such doses that its toxic effects make themselves felt. Nitrate of silver and vegetable astringents are also credited with some power of diminishing secretion; but, like belladonna, they are open to objection on other grounds. On the other hand, the bromides are undoubtedly useful, probably owing to their power of lessening the activity of reflex processes, and in many cases of hypersecretion in neurotic individuals they are very helpful.

Experimental observations seem to show that the administration of bicarbonate of soda has a restraining influence upon gastric secretion, and its exhibition before meals would seem to be indicated where it is desired to bring about this result. Clinical experience, however, does not seem to bear this out, and the prevailing opinion amongst physicians is that if bicarbonate of soda be given before meals it tends to increase secretion rather than to check it. Instead of using drugs to lessen secretion, it is simpler and quite rational to employ them to neutralize the secretion once it is formed. For this purpose the earthy are to be preferred to the soluble carbonates, as one can give them freely without the risk of over-neutralization of the stomach contents, and, if one wishes to avoid a copious ebullition of CO₂, the corresponding oxides (for example, magnesia usta) may be used instead. The neutralizing drug, whatever it be, should be given freely and at a time when the acidity of the stomach contents is beginning to reach its maximum—that is, about two hours after meals.

(b) Defect of Secretion.

1. *Dietetic Treatment.*—In this disorder such articles of diet may reasonably be given as are known to stimulate secretion. Amongst these are meat extract, soups prepared from meat, condiments of all sorts, and alcohol. It is of great importance that the food should be palatable and attractively served so as to excite as far as possible a flow of "psychical" gastric juice. On the other hand, there is no need to adapt the diet in its chemical composition to the diminished secretion. It might seem reasonable, for instance, to reduce the amount of protein—or, in practice, the animal constituents—because it is this ingredient which the gastric juice has chiefly to deal with. Fortunately, however, so long as the motor power of the stomach is not defective and the food is well chewed, diminution or even total absence of the gastric juice does not affect its length of stay in the stomach; its digestion is carried out in the intestine. The actual composition of the diet, therefore, is a matter of indifference provided it be presented to the stomach in a suitable mechanical form.

2. *Medicinal Treatment.*—When secretion is diminished drugs may rationally be employed, either (1) to stimulate the natural secretion or (2) to replace it artificially.

(1) The chief stimulants of secretion are the bitters. Seeing that their action is largely exerted reflexly through the nerves of taste, it is important that they should be given in solution and shortly before meals. This, indeed, has always been the traditional method of employing them. Whether or not the action of a bitter is increased by the administration along with it of small doses of bicarbonate of soda is a matter about which—as has already been pointed out—clinical observers and physiologists are not in agreement. Practical experience, on the whole, seems to favour the view that in small doses such an addition is of advantage.

(2) Both the chief constituents of the gastric juice—hydrochloric acid and pepsin—can be replaced artificially, and it seems most natural and rational to employ them for this purpose when the normal secretion is in defect. As a matter of experience, however, their use in this way

is disappointing. In the case of hydrochloric acid it is difficult to give enough to be of any real value in replacing the natural acidity, although if it be given in considerable doses (say half a drachm) after meals it is sometimes of service in restraining some of the secondary symptoms of defective secretion, such as "gastric" diarrhoea. In the case of pepsin, one is confronted by two obstacles: First, the difficulty of getting a really active preparation, and, secondly, the fact that its administration is useless unless the acidity of the gastric contents can be raised to the normal level at the same time. Ferment therapeutics, in fact, though rational in theory, is in practice almost worthless.

It would seem, however, that a diminution, or even total absence, of gastric juice is, in the majority of cases, of no serious consequence so long as the contents of the stomach are discharged normally into the duodenum; and, fortunately, this is usually the case. Drug treatment, therefore, resolves itself into the administration of bitters before meals, supplemented in some cases by the exhibition of full doses of dilute hydrochloric acid after meals.

2. MOTOR DISORDERS.

(a) Excess (Pyloric Spasm).

1. *Dietetic Treatment.*—As pyloric spasm is so often associated with the presence of an ulcer the diet suitable for it is the same as that for the latter condition—that is, it must be bland. In practice this means that it must consist mainly of milk, which may be supplemented by the use of soft farinaceous foods. Such a diet is not difficult to follow, inasmuch as patients who suffer from pyloric spasm are best treated in bed.

2. *Medicinal Treatment.*—The drugs which may reasonably be employed are those which lessen the acidity of the gastric contents (see above), and which diminish the sensibility of the mucous membrane (see hyperaesthesia). In addition to these there are grounds for administering the so-called "antispasmodic" remedies (for example, carminatives), and especially for the use of opium, which in small doses before meals certainly seems to restrain the tendency to spasmodic contraction.

3. *Hydrotherapeutic Treatment.*—Perhaps the most useful measure of all, however, is the local application of heat to the epigastrium in the form of fomentations or poultices, which seem to have a specific power of relaxing or preventing spasm and should always form part of the treatment in such cases.

(b) Motor Defect (Atony, Motor Insufficiency).

1. *Dietetic Treatment.*—In cases of simple atony, perhaps the most important rule of diet is to avoid burdening the stomach with a mass of heavy contents which tends to distend it by its weight. Fluids are particularly harmful in this way, and hence the chief characteristic of a suitable diet is that it should be dry, and that liquids should only be taken in small quantity and when the stomach is empty. Where there is defect of the active movements as well, the diet should be so constructed that its constituents will pass out of the stomach as easily as possible. In other words, its mechanical form is more important than its chemical composition. With this object in view, all tough, hard, and "indigestible" substances should be avoided, and the food should be thoroughly chewed, or, if there is any difficulty in this, its animal ingredients should be minced and the vegetable constituents sieved.

2. *Medicinal Treatment.*—We greatly need a drug which could be relied upon to increase the tonicity and muscular efficiency of the stomach in the same way as digitalis acts upon the heart or ergot upon the uterus. At present we do not possess any such agent. Strychnine, however, is believed—and perhaps with reason—to possess this power in some degree; alcohol, also, is undoubtedly a stimulant of the movements of the stomach, and so, perhaps, are mineral acids. Ipecacuanha used to be prescribed with the idea that it acted in this way, but it has fallen into disuse, probably because in effective doses it is apt to produce nausea.

The power of certain aperients, particularly aloes, to stimulate the gastric movements needs further investigation; it is certainly noteworthy that some of the most popular nostrums for stomachic affections contain this drug.

3. *Physical Treatment.*—Massage is commonly used in cases of "atony" of the stomach to increase the contractions of its wall; such a use is certainly rational if massage really has that effect. This, however, has not been proved. Undoubtedly it can increase the firmness of the abdominal wall, and therefore of the external support of the stomach, and it is perhaps to this that the benefit obtained from it in some cases is to be attributed.

The utility of electrical treatment is open to even greater doubt, but the sinusoidal current certainly gives promise of producing a greater degree of contraction of the muscular coat than any other form, and deserves a more extended trial.

Various hydrotherapeutic procedures, such as different forms of douching, may also be expected to produce benefit by acting upon the stomach directly, apart from their general tonic influence on the nervous system, and are always worth trying.

On the whole, defect of motility is the disorder of function which it is most difficult to treat directly, and in many cases one has to fall back upon indirect means which act by improving the general nutrition and raising the "tone" of the nervous system, for it is this function which is in most direct relation to the general health and vigour of the patient.

3. SENSORY DISORDERS.

The only sensory disorder which we have to deal with is, as we have already seen, an excess of sensibility or hyperaesthesia.

1. *Dietetic Treatment.*—The rational diet in this case would seem to be a bland one, such as is employed in the treatment of gastric ulcer, and that such a diet may relieve the patient's discomfort there is no doubt. It is, however, essentially palliative, and if one wishes to cure and not merely to relieve or conceal the excess of sensibility, it is often necessary to feed the patient up in spite of some pain until the general nutrition is so much improved that the hyperaesthesia disappears of itself. This, in short, is a case in which it may be necessary for a time to sacrifice the interests of the stomach to those of the organism as a whole.

2. *Medicinal Treatment.*—We are, fortunately, very well provided with drugs which act as gastric sedatives, and which may therefore be rationally employed in cases of hyperaesthesia. Of these, bismuth comes first in general utility, and its value is so well recognized that there is no need to dwell upon it. The bromides are also useful, and in severe cases opium may even need to be employed. Amongst other drugs which act as sedatives may be mentioned hydrocyanic acid, hyoscyamus, cannabis indica, chloral, and chloroform, all of which probably act directly upon the nerves of the mucous membrane.

3. *Physical Treatment.*—The local application of heat is, perhaps, the most potent of all methods of relieving oversensibility, and may be employed in the same mode as in the treatment of pyloric spasm.

In the above paragraphs the rational treatment of disorders of the separate functions of the stomach has been briefly sketched out, and it only remains to add that when more than one function is affected suitable combinations of these plans or compromises between them must be adopted according to the necessities of the case.

CONCLUSION.

It is not claimed that the treatment of functional dyspepsia on these lines will always be crowned with success, for sometimes the conditions of the patient's life are too adverse to be entirely counteracted; but it is asserted that this is the only way of approaching the treatment of the disorder which has any title to be regarded as rational and scientific.

A PROVINCIAL meeting of the Royal Sanitary Institute was held at Hull on April 4th, its interests centring in a discussion introduced by Dr. J. Wright Mason on diphtheria in elementary schools and its prevention. Evidence was brought forward that some of the educational authorities in the country make a practice of excluding children in whose homes cases of diphtheria have occurred until they have been proved by bacteriological examination not to be carriers. This course seems to have been accepted by the meeting as wise and desirable.