wretched by the continual grumbling of a very irritable husband.

Cases of this kind might be multiplied indefinitely, but I only desire to illustrate the type. These patients come to the doctor complaining simply of indigestion, and a careful and tactful search has to be made to discover the cause in the shape of some depressing circumstance of environment. Their cases stubbornly resist the ordinary medicinal and dietetic treatment, but respond to a well-directed attempt to remove the cause. If the environment can be modified—that is, if the circumstances themselves can be reached and altered (in some cases, perhaps, by plain speaking to relatives)—well and good; if not, the patient can perhaps be removed from them for a time, or, better still, may by a strong and encouraging effort be induced to take a different attitude towards them and gain a brighter view of life. A difficult undertaking this may be in some conditions, but the result will often repay the attempt, and sometimes has an effect that appears to be almost miraculous. At any rate, neither drugs nor diet, but a change in some life-circumstance, gives the clue to the successful treatment of very many cases of dyspepsia.

As further illustrating the success attending the discovery of the cause of an attack of dyspepsia and its removal, I may mention a few examples. A gentleman whose dyspeptic symptoms had lasted two or three months, and were apparently the outcome of a long period of anxiety on account of his wife's illness, went to see a surgeon, who, taking the case to be probably malignant and suitable for exploration, hedged over the diagnosis and yet left a very unfavourable impression upon the patient's mind, with the consequence that the symptoms grew worse. A consultation was held and a definite decision arrived at against organic disease and against operation, with the most happy results. A very similar case was that of a medical man who suffered occasionally for years from indigestion. He consulted a brother practitioner, telling him he thought he had a pyloric or a duodenal ulcer, and asked him to advise him on the question of operation, as he felt that a posterior gastro-enterostomy might cure him. They decided to come to me, and I felt justified in regarding the case as functional, dismissed the question of operation, and spoke very encouragingly. Within ten days or a fortnight I had letters from both my friends, the doctor and his patient (for they lived at some distance) conveying the intelligence that the symptoms had quite passed off and ordinary food could be taken.

Another phase of the nervous side of indigestion is to be met with in people who exhaust their nervous energy; and the result is the same whether the exertion be physical or mental, whilst not infrequently the candle is burnt at both ends. Practice amongst all classes of society furnishes many examples which belong to this group, and the fact will at once occur to your mind that one of the most useful of therapeutic measures in stomach cases is *rest in bed*. To this we ascribe the great majority of cures in cases of chronic functional dyspepsia in our hospital patients. That physical exertion, if excessive, will derange the digestive functions to the extent of producing a trying illness cannot be denied; here are some instances. A lady entertaining in her country house a party of friends fatigued herself by a long walk, and in consequence suffered, as she had often suffered before, from indigestion. She was unable to rest, and sought relief in careful diet and stomachic mixtures without success, but the attack soon yielded to rest after the departure of her guests. The wife of a member of Parliament, who was most energetic in furthering her husband's interests at the time of the election, developed a group of symptoms referable to her stomach. These she neglected, as she had suffered from indigestion before, and declined to forego any of her engagements, but sought relief in mixtures and diet, so far as she could exercise care, but with little result. I induced her to diet herself very carefully, and to lie in bed for three weeks, which she did with complete success; the symptoms, which had lasted twelve months, entirely disappeared.

Another example of nervous indigestion cured by rest in bed is the case of a lady who experienced a severe shock when travelling with her husband in an express train. The dress of a fellow passenger, a lady sitting

beside the door, was found to be caught in the door. The train was travelling at a high rate of speed, and my patient's husband attempted to release the dress by opening the door. It at once swung open, and could not be closed on account of the wind. He struggled with it for upwards of half an hour, until the next stop, and seemed all the time in imminent danger of falling out of the carriage. Weeks of indigestion followed the fright—flatulence with discomfort after food, depression, giddiness, etc.—and there was little or no improvement until she was induced to rest. And it is not alone cases that have an obvious nervous origin that are benefited by rest, for many chronic cases, the cause of which is not easy to determine, that prove most obstinate under dietetic and medicinal treatment, will yield to rest, and it must not be forgotten that a large number of the neurasthenic cases will respond only to rest with isolation from home influences, as treated by Weir Mitchell.

The limits of my paper prevent more than a very sketchy dealing with the subject, but my desire is to put a familiar subject in a somewhat novel light that may help to explain why we so often fail to effect a cure. I am myself so convinced of the practical importance of hunting out the inducing cause in each case of indigestion with a view to its removal, that I regard investigation of the secretory activity of the stomach, followed by prescription of appropriate diet and acid or antacid remedies, as being valuable, no doubt, for giving relief, but only too often insufficient for a cure; and foremost amongst these perplexing and often highly elusive causes stands mental and nervous disturbance.

An Address

ON

REFLEX PAIN IN DISEASES OF THE ABDOMINAL VISCERA.

DELIVERED BEFORE THE GREENOCK AND DISTRICT
FACULTY OF MEDICINE.

BY

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THERE is nothing actually new in the symptom of reflex visceral pain; what is really of importance in connexion with it is that we have come to know more definitely about its origin, and much more clearly about its clinical significance. This has arisen largely from the enormous strides which surgery has made within recent years. Previously, it was only through the accidental light thrown upon the subject by a necropsy that a certain symptom during life received its correct explanation after death. So that much depended upon the ever doubtful possibility of a necropsy whether or no a particular symptom would receive its right interpretation. Since, however, the surgeon has found it possible to operate with such impunity upon almost every region of the body, any obscure or persistent symptom is never allowed to pursue an uninterrupted course without an effort to afford relief by direct inspection. Thus, then, many a pain which hitherto had been recognized only as a probable indication of a particular disease, has, as the result of operation, come to receive a degree of certainty which renders it a valuable and positive factor in the chain of symptoms that collectively contribute to a correct diagnosis. I shall limit my remarks to reflex pains as they are manifested in affections of the viscera within the abdomen.

In order properly to appreciate the significance of a pain and the reason for its occurrence, I must outline briefly the normal anatomical and physiological factors which necessarily enter into all considerations of the subject. Pain in itself we must regard as Nature's peculiar and special way of indicating that her normal functions are being prejudicially or injuriously disturbed. That, at least, is its significance; but whether we are to look upon it as a separate and distinct manifestation of a newly awakened sense evoked through a special system

of nerves, or simply as the result of an exaggerated stimulus acting upon ordinary sensory fibres, is matter which enters into the sphere of the physiologist rather than into the domain of the clinician. But whatever be the true explanation, it is certain that the association of pain with the sensory nerves is in many, if not in most, cases a very close one. As regards reflex pain more particularly, we must consider it Nature's way of affording a diseased organ protection against external injury; for, as we shall see later, it renders so sensitive to functional activity both the skin and muscles, that immediately there is danger from any mechanical agents the skin becomes painful to touch and the muscles as rigid as a board.

What may be taken as the normal disposition of the parts in their nerve relation to each other is shown diagrammatically in Fig. 1, representing the brain and spinal cord. From the organ, *o*, afferent nerve fibres, *a*, pass to certain nerve cells, *c*, in the spinal cord; to other nerve cells in close proximity to these, afferent fibres, *a*, come from the skin, *s*, and from other cells efferent fibres pass to the muscles, *m*. Now, under normal circumstances

Fig. 1.—Diagrammatic scheme of reflex pain. Br., Brain; Sp., spinal cord; *m*, muscle; *s*, skin; *o*, organ; *c*, nerve cells in spinal cord; *a* and *a'*, afferent nerve fibres; *e*, efferent nerve fibres.

the influences from either the organ or the skin probably remain quite distinct on their arrival at their respective cells in the cord. But supposing from some cause the afferent impulses of the organ are abnormally exaggerated, then the stimulus overleaps the boundary of its own cells, and acts upon neighbouring ones—that is to say, upon those cells to which the afferent sensory fibres come from the skin. Now we know that if any part of a sensory nerve is excited, whether at its termination in the cord or in its transit to the periphery, a sensation results similar to that produced by the actual excitation of the special receptive nerve endings. So, then, if some powerful and exaggerated stimulus arises from the organ, not only are the cells specifically connected with the sympathetic in the cord greatly excited, but also those neighbouring ones associated with the sensory nerves. The result of the over-excitation of the sensory cells is the production of pain; and hence it comes about that pain is often felt in the area of the abdominal parietes over the region of the affected organ. But I must go a little further, and indicate that the stimulus may not only affect the cells in immediate continuity to those directly receiving the afferent nerves from the organ, but it may excite into abnormal activity other cells more remote, so

that instead of the pain being limited, as just indicated, to the sensory nerves arising from the region more or less directly over the affected organ, its distribution becomes more diffuse and distant, and pain is felt over a much wider area. Now this wider diffusion is not only dependent upon the intensity of the local stimulus, but it may be, and indeed very frequently is, materially affected by the sensitiveness of the cells themselves. This hypersensitiveness may be due to natural causes within the cells themselves—what we understand by the functional idiosyncrasy of the patient—or to influences exercised upon them through certain conditions of the blood. It must be remembered that while we are reasoning on the assumption that the variations wrought in the production and extension of certain changes are due to influences exercised in the nerve cells of the cord, the real receptive centres for the sense of pain are, of course, in the brain; and that these influences are just as likely to have their origin in the brain as in the cord. In other words, that the same hypersensitiveness which we have assumed to

Fig. 2.—Diagrammatic representation of seats of maximum reflex pain in diseases of abdominal viscera. A, Stomach and pancreas; B, small intestine and vermiform appendix; C, large intestine, rectum, uterus, and bladder; D, vermiform appendix, right ovary and tube; E, vermiform appendix, both ovaries and tubes; F, gall bladder, cystic and common ducts, and duodenum; R, kidney and ureters. 1, Gastric ulcer towards cardiac end; 2, gastric ulcer mid-way between cardiac and pyloric ends; 3, gastric ulcer at pyloric end; 4, large intestine down to splenic flexure; 5, large intestine from splenic flexure to anus (Mackenzie).

exist under certain conditions in the cells of the cord may, under the same conditions, be in the cells of the brain.

And yet another consideration must not be left out of count—the part which the ganglia on the posterior roots of the spinal nerves possibly play in reflex phenomena. Inasmuch as the sensory fibres of the skin, as well as the sympathetic fibres of the viscera, pass into these ganglia, one can quite well understand how in some cases the cells in these ganglia may be the true reflecting media, and not the cells in the spinal cord. However, reflex muscular contraction, such a common concomitant of hyperalgesia of the skin, cannot be explained in any such way, for the efferent nerves of the muscles pass from the cord by way of the anterior primary roots; and so the transmission must take place among the cells of the spinal cord.

I must not pursue this aspect of the question further, for I fear it is carrying me a little out of my depth, and leading me more into the speculative realms of physio-

logical hypothesis than along the surer paths of clinical fact. To return, then, to safer ground, this transmission of symptoms from a viscus deeply seated to a certain area on the surface of the body calling forth sensory manifestations constitutes what is understood by "referred" or "reflex" pain; and is brought about on the one hand by the autonomic or sympathetic nerves, and on the other by the cerebro-spinal nerves. Head, in his investigations, sought to map out the surface of the body into definite areas, which corresponded to equally definite segments in the spinal cord, so that when disease of a given viscus over-excited the cells in a spinal segment a well defined area on the body surface gave the sensation of pain; and that it was often possible to fix on one particular point in that area—known as the "maximum" point—where the pain was acutest and where the skin was most sensitive. I am not going to discuss the truth or not of this investigation. Personally I agree with Mackenzie that the distribution of pain to the surface of the body is dependent more upon the distribution of individual cerebro-spinal nerves than upon any special limited segmentation of the cord; that, as he puts it, "The spread" (of hyperalgesia) "is from one definite portion of a nerve area to another, without completely affecting the whole of one segmental area."

It will have been noted that in the reflexion of pain there is, in addition to the involuntary manifestation, a voluntary exhibition. It is possible to cause pain by certain methods of investigation which is as significant as the unevoked manifestation of it. Both skin and muscles may be hyperalgesic, and this hypersensitiveness is in itself an equally sure indication of a deep-seated lesion. Thus, the patient may not at the time feel pain at a certain place, but any physical measures, such as pin-pricking, pinching, or pressing, will at once cause discomfort. That this condition of both skin and muscle is reflex is almost without doubt, and yet it has been largely the cause of the assumption that where skin and muscle overlie directly the diseased viscus the pain has really been in the viscus itself. This opens up the interesting question, Are the viscera themselves the direct source of pain? Ross, as the result of his investigations, believed they were, and used the name "splanchnic" for visceral pain, as distinguished from "somatic" for pain felt on the body surface. There is this certainty, at least, about the question, that the same stimuli which cause pain to be felt through the medium of the cerebro-spinal nerves fail to evoke the same manifestation in the viscera; if, therefore, a viscus can itself become a positive pain producer, it probably arises from a source peculiar to the organ in which it has its origin. I have said enough, I think, to indicate wherein the difficulty arises, because, when from without we attempt to manipulate a part, we are bound, in the first place, to influence the terminals of the sensory nerves of the cerebro-spinal nerve system before we can exercise any effect upon the organ which is situated more deeply; and but for the elucidation which the direct exposure of a viscus has admitted, it would certainly have been difficult in many cases to have effected a differentiation. In, however, our operations we frequently have the opportunity of demonstrating that ordinary mechanical irritation of a viscus in a patient whose nerve system is not benumbed by an anaesthetic fails to call forth any sense of pain. As I have said, however, this shows no more than that pain cannot be evoked by the usual methods of producing it in the sensory nerves of the cerebro-spinal system, and by no means negatives the possibility of pain arising in a viscus from a stimulus peculiar to itself.

Again, I must not allow myself to be carried away by considerations of this kind, but come to the essentially practical side of the subject, which concerns the clinical significance of reflex pain in its relation to diseases of the abdominal viscera; and in each instance I shall seek to elucidate the symptom by a reference to those nerve connexions which in a diagrammatic and general way I indicated at an earlier stage in my remarks.

The Stomach.

The afferent nerves of the stomach, consisting of fibres of the sympathetic, enter the spinal cord—as judged by clinical considerations—in the dorsal region at that particular part of it from whence the fifth, sixth, seventh,

and eighth spinal nerves proceed. Hence we may look for the production of reflex pains in connexion with diseases of this viscus at the peripheral distribution of these nerves; in other words, pain is felt usually in the middle line between the xiphoid and the umbilicus; and inasmuch as the thoracic branches send off posterior branches to the back we may expect to find occasionally that pain is felt there also. So that you will understand how, when the gastric disease is of a diffuse nature, the pain experienced will be spread over an area which may embrace the whole epigastrium, the back between the shoulder blades, and sometimes the left side. But not only through the sympathetic but through the vagus also we may get reflex pains, and in these instances it is through the sensory fibres of the trigeminal, for pain in some cases of gastric disease is felt in the jaw or in the neck. When we come to a localized lesion like an ulcer, there is some clinical significance in the exact situation where the pain is felt most acutely. Mackenzie has pointed out, and I have verified the correctness of his observation, that an ulcer situated near the cardiac end of the stomach causes pain in the upper part of the mid-epigastric line; and that an ulcer situated at or near the pylorus causes pain in the lower part of the same line; while ulcers situated between these two seats occupy similarly a position midway between the xiphoid and the umbilicus.

While, then, it may be said that the situation of the pain on the body surface is useful as a diagnostic sign of the viscus involved—the stomach in the present instance—and sometimes helpful in determining the particular lesion, it is doubtful if we are yet in a position to derive much from the special character of the pain. We hear complaints of sensations described as "burning," "boring," "gnawing," "aching," etc., but they fail to help any further than to indicate that the patient does suffer pain, though from what exact cause it may be impossible to say.

So far I have only alluded to pain which the patient himself is the sole producer of. But it is within our power under certain conditions to evoke pain, and this in itself is of equal importance from a diagnostic point of view. As can well be understood, if the sensory centres in the cord are under the influence of undue excitation from disease of a viscus, they will be doubly susceptible to any stimuli conveyed to them from their own peculiar peripheral terminals; hence we may find both a cutaneous hyperalgesia and a muscle hyperalgesia in those parietal areas of the abdomen where the patient at times complains of pain. Palpation of the epigastrium at particular parts of it will materially support the diagnosis in the presence of other symptoms similarly suggestive. This mechanical method of irritation may be effected by pricking or gently scratching the skin, when any undue sensitiveness indicates a superficial cutaneous hyperalgesia; this may fail, and soreness be induced by pinching the skin, which constitutes a deeper cutaneous hyperalgesia; or, still further, these two symptoms may be absent, and we may find that it is only by deep pressure upon the muscles that pain is produced, and we have what is termed "muscle hyperalgesia." This latter symptom is manifested by a rigid, board-like contraction of the muscle. One form of hyperalgesia is probably as symptomatic as the other, and any form indicates a reflex condition dependent upon deep-seated disease.

Before dealing with such an acute crisis as perforation of a gastric ulcer, I shall discuss reflex pain in connexion with affections of other parts of the gastro-intestinal canal, for perforation of a gastric ulcer is, in its direct manifestations, indistinguishable from perforations of other viscera where a sudden communication is established with the general peritoneal cavity.

Duodenum.

With regard to the duodenum, I may for all practical purposes limit my remarks to chronic ulcer of the canal. As in the case of the similar ulcer in the stomach, the pain is referred to the middle line, but somewhat lower down, nearer the umbilicus. In addition, however, pain is felt to the right of the middle line below the ribs in what is usually termed the gall-bladder region. One must assume that in all cases where a viscus is laterally placed within the abdomen the sensory terminals in the skin, muscle, and peritoneum immediately over the viscus are

those most likely to manifest the greatest excitation; this is but natural, if our original conception of the whole intent of reflex pain be correct. We find in duodenal ulcer precisely the same expressions used by the patient to describe the character of the pain as in the case of gastric ulcer; but, as a differential distinction, the pain after the ingestion of food takes place proportionately later—that is to say, instead of coming on shortly after food is taken, it does not appear for two, three, or four hours. It has these further peculiarities about it, that it often occurs at night, and, when present, is relieved by the consumption of food; this latter peculiarity has earned for it the name of "hunger pain."

Small and Large Intestine.

As we pass down the canal to the small and large intestine we encounter difficulties which render both the explanation and the clinical significance of reflex pain a source of much perplexity. So far as we know, the cause of pain in the intestinal canal is exaggerated or abnormal peristalsis; in other words, undue contraction of the muscle forming part of the bowel wall. This may be brought about either by the irritating effects of the contents of the canal, by excessive nerve stimulation from more distant parts, or by obstruction to the onward progress of the faeces. The character of the pain may be the same whatever the nature of the cause producing it; its variation is rather one of degree than of kind. The middle line of the abdomen still remains the seat where the pain is most markedly reflected, but it is very frequently diffused over a much more extended area on both sides. We have this distinguishing feature about intestinal pain—that, unlike all other intra-abdominal viscera, with the exception of the kidney and ureter, it tends to travel, and may often be felt passing from one point of the abdomen to another. The extent, however, of the migration is largely dependent upon the length of the bowel through which a peristaltic wave passes. Now, the question of most clinical interest is, Does the disease in any part of the bowel manifest itself by pain which will enable us to localize its situation? Yes and No. Yes, to this extent, that a pain which arises in affections of the small intestine is limited almost entirely to the umbilical region, whereas in involvement of the large bowel pain is felt in some part of the hypogastrium. Further, in cases of a well-defined and distinct seat of obstruction, the pain will travel to a certain spot and there remain, indicating that the peristaltic wave has been brought to a point beyond which it does not, or perhaps cannot, extend. In noticing more particularly the spot up to which the pain works, Mackenzie considers it possible to distinguish between obstruction above and below the splenic flexure; thus, he says: "In obstruction at the splenic flexure the pain did not descend below the middle of the hypogastric area; while the pain due to peristalsis below the splenic flexure was felt about and below the middle of the hypogastric area." The negative answer to my question concerns chiefly the small intestine, for, so far as our present knowledge goes, we are unable, by the simple manifestation of pain, to localize the seat of disease in any particular part of it.

There is one rather striking feature about abdominal pain in connexion with bowel disease to which I must draw attention, because I have always felt that it is one very weak link in, if indeed it does not break, the chain of argument which seeks to explain all pain connected with visceral disease within the bounds of reflex pains. My chief reason for thinking that in bowel disease we have to deal with really a splanchnic pain is that one usually fails to obtain any evidence of a cutaneous or muscle hyperalgesia. Now a pain so acute as is sometimes intestinal colic from obstruction ought to excite an excessive irritability of the cells in the spinal cord which should render the sensory terminals in the skin, muscle, and peritoneum peculiarly sensitive to external stimuli; but we often find that a patient is relieved by pressure or rubbing of the abdominal parietes. Perhaps one ought not to include muscle tissue, and therefore viscera which are essentially muscular in function and formation, in the category of abdominal viscera proper. Nature certainly seems to make an exception in her method of dealing with

the bowel when implicated in obstructive conditions as compared with her protective measures in certain diseases of other parts. Instead of rendering the abdomen rigid and the skin tender, which would effectually forbid the application of any external stimuli, it admits of deep pressure and massage being exercised, and thus relief afforded in a way which could not otherwise be. That colonic affections do quite possibly evoke reflex pains seems supported by the fact that patients who suffer from chronic constipation resulting in overloading of the colon sometimes complain of a dull heavy aching pain across the lower dorsal region. The only explanation of this can be that the pain is reflexed through the posterior primary divisions of the lower dorsal spinal nerves which distribute sensory branches to the back.

Before leaving this point, I might add in further support of the existence of splanchnic pain that I think there is something reasonable in the assumption that undue contraction of involuntary muscle tissue should always in itself be a direct source of pain from analogy to the cramp-like pains of hypercontracted voluntary muscle. To discuss this particular aspect of the subject properly, I feel one ought to embrace considerations of such a disease as angina pectoris; but this would carry me without the limits of my object this evening, which is to deal solely with the abdominal viscera.

The Vermiform Appendix.

Diseases of the vermiform appendix are usually considered after those of the large intestine, although strictly, both pathologically and clinically, they ought to be regarded as midway between affections of the small and large gut, for the viscus itself is really a remnant of that which originally formed the commencement of the large bowel. In both nerve and blood supply the appendix is intimately associated with the lower end of the ileum, and herein will at once be seen the reason for the reflex pain associated with diseases of the organ becoming manifested in the same region as pain arising from affections of the small gut—that is to say, in the umbilical region. But for reasons it is difficult to explain, the pain is sometimes limited from beginning to end to the right iliac region. There is no doubt as to the reflex character of the umbilical pain when it arises; and there seems little doubt that, in most instances at the early stage of the disease, the iliac pain is also reflex. In further support of the latter opinion is the fact that the pain is sometimes felt in the left iliac region. This latter manifestation is of special interest, and will be referred to later in connexion with the consideration of the ovarian and renal reflexes. It indicates the intimate association which must exist in the spinal cord between the cells which control one half of the body with those that control the other. But why the cells on the opposite side of the cord should in certain cases be more readily excited than those on the side on which the disease exists is decidedly puzzling. It is easier of explanation in the case of bilaterally disposed viscera. The only possible explanation seems to be that, the organ being originally a part of the large intestine, the tendency is for the pain to be referred, as in cases of disease of that particular segment of the gut, across the hypogastric region, and, not being complete in its development, it is only at the two sides that it is felt. The skin over the iliac fossa is supplied with sensory branches from the last dorsal nerve. It can be understood, therefore, why it occasionally happens that pain or stiffness is experienced in the lower portions of the erector spinae muscle, for branches of the posterior primary divisions of the spinal nerves supply the part. Subject as the appendix is to inflammatory changes and to obstruction, there is the possibility of distinguishing, through the character of the pain manifested, the one kind of lesion from the other. Obstruction from whatever cause—whether from stricture, from kinking, or from a concretion—produces pain of the colicky, cramp-like type felt mostly in the region of the appendix itself. The similarity is precisely that of obstruction in the large or small intestine, and due to a like cause—the effort of muscle contraction to overcome an obstacle. If unassociated with any inflammatory changes, neither cutaneous nor muscle hyperalgesia may be present over the area occupied by the appendix; but appendicular colic, when of any severity and duration, is more frequently than not

accompanied with a certain amount of inflammation, and then before the inflammation may have extended to the parietal peritoneum there may, and probably will, be reflex hyperalgesia of the skin and muscle. Much diagnostic importance was at one time attached to the elicitation of pain by pressure over what is known as McBurney's point. In the majority of cases, where the appendix is normally placed, this is doubtlessly the point of maximum acuteness; but it would be wrong to rely upon it in all cases, and, with a wider knowledge of the subject and the extreme vagaries in the situation of the organ, the sign is not much relied upon at the present day. Pain which arises from a localized peritonitis—where, for instance, the inflammation extends to the parietal peritoneum—does not come within the scope of our consideration, for the sensory terminals are then themselves engaged in the inflammatory process, and become a direct source of pain. Reflex pain in connexion with perforation of the appendix I shall refer to later, when discussing the subject of perforations generally.

Cholelithiasis.

Gall-stone disease affords some very interesting examples of reflex pains; and if we consider, in the first place, the nerve connexions of the gall bladder, cystic and common ducts, the reason for these will become at once apparent. The afferent branches of these parts pass into the hepatic sympathetic plexus. Now this plexus has entering into it filaments from the right phrenic nerve and from the left vagus, and, indirectly through the solar plexus, it is in connexion with the great and small splanchnics. The phrenic is connected with the fifth and sixth spinal nerves which go to form part of the right brachial plexus; the vagus has connexions with the left trigeminal; and the two splanchnics connect with the fifth, sixth, seventh, eighth, ninth, and sometimes tenth spinal nerves. Thus, then, to express more clearly and succinctly the relation of these particular viscera to the body surface, we may say that affections of the gall bladder and ducts will produce (1) symptoms referable to the back, side, and front of the abdomen, due to the peripheral distribution of the lower spinal dorsal nerves; (2) symptoms referable to the right shoulder and outer side of the right arm, due to the peripheral distribution of branches of the fifth and sixth spinal nerves of the brachial plexus; and (3) symptoms referable to the head and face through connexions of the vagus with the trigeminal. But these anatomical considerations and expressions must be further reduced to terms of simple practical clinical significance. In gall-stone disease, then, we have pain referred to the middle line in the epigastrium, to the anterior right subcostal region below the ninth costal cartilage, to the back between the shoulder blades, and to the right shoulder. But the areas over which pain may be felt are often much more extended; indeed, gall-stone disease affords a very good illustration of the theory propounded at an early stage of my remarks, where, if you remember, I stated that the stimulus which, arriving by the autonomous fibres, excited the receptive cells in the cord, might overleap its own proper bounds and excite neighbouring cells, so that the sensation produced would be that a much wider area on the surface of the body was involved in pain. For we not infrequently find that pain may be felt in the left shoulder or in the left hypochondriac region at a point where it is correspondingly felt in the right. From the epigastrium, also, it may be diffused over the whole abdomen, and sometimes pain reaches as high as the neck and as low as the loins. The peculiar acute colicky or cramp-like character of the pain, sometimes lasting for hours, is probably due to the powerful contraction of the muscle fibres in the parietes of the gall bladder and ducts striving to rid the part of a gall stone. In many instances it is possible to form a tolerably correct diagnosis, from the situation of the pain, of the seat of the stones, whether they are in the gall bladder, in the cystic duct, or in the common duct. In connexion with this differentiation I cannot do better than quote such a good authority as Mayo Robson. When the stones are in the common duct he says

The frequent attacks of pain are usually less severe than when they are in the cystic duct. . . . The pain also is in the epigastric rather than in the right hypochondriac region, and passes through to the right dorsal lumbar rather than to the

right infrascapular region, and the tender point is found between the umbilicus and ensiform cartilage rather than between the ninth costal cartilage and umbilicus, as in ordinary cholelithiasis.

Reflex cutaneous and muscle hyperalgesias are often readily demonstrated by any attempt to irritate or press upon the skin in the right hypochondriac or epigastric regions. The value of these symptoms lies in the fact that they—the symptoms—may be present when otherwise the patient is free from any involuntary exhibition of reflex pain.

Renal Calculus.

I now pass from the subject of biliary calculi to that of renal calculi. The reflex pains connected with the kidney are, so far as we know, entirely limited to the existence of foreign material in the pelvis of the organ. Inasmuch as the parietes of the pelvis contain involuntary muscle fibres, it is probable that the pain is produced by an excessive contraction of this tissue in its effort to rid the cavity of such irritating material as pus, tuberculous debris, or calculi. The same reasoning applies to the ureters, the pain evoked being due to a powerful peristaltic wave striving to force out of the canal that which is foreign and detrimental to its normal function. The same interest attaches to the renal reflexes as to those just depicted in the case of the biliary, for we have pain felt in parts far removed from the actual seat of the cause. Without going into such minute detail with regard to nerve connexions, I may briefly indicate that in the cord centre, at which the autonomic nerves arrive from the kidney and ureter, there are the cells with which the afferent fibres of the eleventh and twelfth dorsal and first and second lumbar spinal nerves are connected. Hence, in accordance with the reasoning previously adopted, we shall expect to find the pains arising from calculous disease referred to the peripheral distribution of these nerves. Through, then, the last two dorsal nerves pain is felt in the loin and extending round to the iliac region; and through the genital branch of the genito-crural derived from the first two lumbar, pain is felt extending down the groin into the testicle. While these may be taken as the typical seats of reflex pain in renal calculus, the area of its distribution is often much more extended. We have, then, to assume, as was done in the case of biliary calculi, that neighbouring cells in the cord are irritated, and so pain felt as if coming from the sensory terminals of nerves supplying parts on the opposite of the body, or over the entire abdomen. The most puzzling feature, however, of pain so referred is that the affected side may remain free and the symptom be excited solely on the unaffected side. This reno-reflex, as it is termed, may unfortunately lead to error in diagnosis, and consequently to mistake in treatment. I have fully described in my book on *Abdominal Pain* a case that came under my own observation where an exploratory operation was performed on the supposed affected kidney. No stone was found; and unfortunately the patient died from suppression of urine. At the *post-mortem* examination a calculus was discovered in the opposite kidney—that is, on the side in which there had been no pain. It is very difficult to understand why pain should be more readily reflexed to the side of the body opposite to that on which the diseased organ is situated. It may be that the cells on one side of the cord are more easily excited than those on the other, so that the impression conveyed is that the pain is derived from the supposed morbid stimulation of the sensory nerves whose afferent fibres enter those particular cells. I shall refer to this particular point again when speaking of ovarian pain.

Pancreas.

I shall not occupy much time in discussing reflex pain as manifested in affections of the pancreas; and for this cogent reason, that it is not so much by pain as by other signs that we diagnose disease of this organ. The pain is usually felt in the middle line of the epigastrium, the most tender spot being about an inch above the umbilicus. It sometimes extends round to the left side, and sometimes passes backwards to the mid-scapular region. It will thus be seen that the situations of the pain correspond very closely to those experienced in diseases of the stomach.

Uterus, Ovaries, and Fallopian Tubes.

Affections of the female reproductive organs afford some very interesting examples of reflex pain, and possibly exhibit a wider distribution of such pains than any other abdominal viscera. This arises from the fact that the sympathetic plexuses—the ovarian, pelvic, and hypogastric—are connected with the eleventh and twelfth dorsal, the lumbar and sacral (particularly the third and fourth) spinal nerves. We therefore get pain referred to the lower part of the hypogastrium, the lumbar and sacral regions behind, and the iliac regions in front, with occasionally extensions down the legs. Now, of all situations for the most frequent exhibition of pain in affections of these organs, the left iliac region is the commonest, and in this region we may indicate as the *lieu d'élection* a point about 2 in. to the inner side of the superior iliac spine. Here pressure at once evokes pain, and both skin and muscle may be found hyperalgesic. It may be asked, Why should the left side be more frequently the seat of pain than the right in uterine disease and in affections, it may be, of the right ovary? We must assume, as was done in the case of the kidney, that the cells on one side of the cord are more susceptible to stimuli than those on the other; but that hardly gets over the difficulty of explaining the constancy of the pain on the left side unless we accept the assumption promulgated by Herman that the lesser strength of the left side of the body renders it capable of offering less resistance to sensory stimuli. In regard to the frequency with which female patients who suffer from affections of the reproductive organs have widely diffused referred pains, one must remember that these patients are often anaemic, neurasthenic, and generally wanting in body tone. As indicated in my introductory remarks, the sensitiveness of the receptive centres is greatly augmented by certain conditions of the blood, so that a stimulus arriving at one group of cells may readily extend to other groups, and so greatly widen the area over which reflex pains will be felt.

Acute Abdominal Crises.

Let me now refer to that most interesting exhibition of reflex pain which is manifested in almost all acute abdominal crises. I allude to the sudden, agonizing, and prostrating pain felt in the mid-line of the body as the result of a gross lesion associated with one or other of the abdominal viscera. It matters not where the viscus is situated within the abdomen nor where the lesion is located in the viscus, the initial acute seizure is most frequently felt in the mid-line, although variations will exist regarding the particular spot in this line. I have said enough not to need repetition of the nerve connexions between the various viscera and the spinal nerves. You will remember that in nearly every instance the pain was referred to the middle line, and that this was explained on the basis that the cells in the cord which received the afferent fibres of the sensory nerves contained in the lower six intercostals were abnormally irritated. The question, then, is really one of degree. These same cells receive a sudden and violent stimulus from an equally sudden and virulent lesion, and the clinical result is an unusually severe attack of pain proceeding as if from the terminals of the sensory nerves implicated. I believe that the acuteness of the initial seizure is largely affected by the relation of the lesion to the parietal peritoneum. This structure, as you know, is supplied by sensory fibres from the spinal nerves, and has within it many sensory nerve endings. Hence, when from the rupture of a viscus irritating material comes in contact with it, a very acute stimulating influence suddenly acts upon these sensory nerve endings; and, if it be not in itself a direct source of pain, one can well understand how it can indirectly augment the reflex symptoms evoked by the lesion in the way already explained. Without attempting to differentiate clinically between lesions causing pain in the same spot, I may give a sort of classified list of the diseases which may be expected to cause reflex pain in certain definite areas. Thus, (1) perforation of a gastric or duodenal ulcer, rupture of gall bladder, acute haemorrhagic pancreatitis, cause acute pain to be felt in the epigastrium; (2) perforation of the appendix vermiformis or of the small intestine, ruptures, strangulations and obstruction from various causes, embolism or thrombus of the mesenteric vessels, etc., cause acute pain to be felt

in the region of the umbilicus; and (3) rupture in tubal affections, including extrauterine pregnancy, causes acute pain to be felt in the hypogastrium.

In these few remarks, gentlemen, I can claim to have given you no more than a very cursory review of the subject of reflex pain as exhibited in certain affections of some of the abdominal viscera. I would like to interpose here and emphasize the fact, for the sake of making the drift of my remarks and conclusions quite clear, that while diseases of the abdominal viscera may give rise to reflex pain located in one or other of the anatomical regions into which the abdomen is artificially divided, all reflex pains experienced in these particular regions do not necessarily signify diseases of the abdominal viscera. Without bearing in mind this very important clinical fact, we may be led occasionally into committing egregious blunders both in the matter of diagnosis and, what will be still worse, in treatment.

The subject of reflex pain is one which is, as you will have already gathered from what I have said, fraught with innumerable difficulties—difficulties that involve intricate questions of anatomy, physiology, and pathology; and for want of exact answers to these questions it has often been necessary to base reasons on theories. If, however, even on the somewhat insecure basis of hypothesis, it is possible to formulate a few practical guides and derive some clinical assistance, we may legitimately feel that the ends are not altogether unjustified by the means; and that, until light shine out of darkness, our benighted path must be illumined by such artificial means as will best enable us to encounter and overcome, though it be ever so imperfectly, the many obstacles that at present beset our progress.

A Clinical Lecture

ON

HOW TO OPERATE FOR APPENDICITIS.*

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In a previous lecture¹ I gave my views about the choice of time for operation. I then submitted that:

1. It is wise to remove the appendix in the quiescent period after one definite attack of appendicitis.
2. The best treatment of acute appendicitis is an operation at the earliest possible moment.

In this lecture I propose to deal with some of the important points in the technique of the operation and after-treatment.

THE INCISION.

The same incision is not suitable for all cases. This could hardly be expected considering the varying conditions under which the operation has to be performed, and the varying position and abdominal relations of the appendix and caecum.

(a) *The Valvular or Gridiron Incision of McBurney.*

This incision has the advantages that hernia is very unlikely to follow it even when an abscess has to be drained, and none of the nerves or muscles of the abdominal wall need be divided, so that the abdominal wall is not weakened. It is particularly suitable for those interval cases in which the diagnosis is certain. It is also suitable for acute appendicitis in which an operation is performed before there is any suspicion of spreading peritonitis.

It is, I think, the best incision for appendicular abscess in the iliac fossa, but it is not a good one for pelvic abscess, on account of the difficulty of draining. When the position of the appendix is fairly well known, either by the presence of swelling or rigidity, or from the history of localizing signs in previous attacks, the gridiron incision can be made at the most suitable point. When the appendix is retrocaecal the incision is made unusually high up and far back, and when it is in the pelvis the opening is made low down and far in.

* Delivered at Guy's Hospital.