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Abstract
Based on a Dissertation read before the Royal Medical Society on Friday, 30th January 1959.
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ABDOMINAL PAIN

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" Every pain has its distinct and frequent signification if we will but carefully search for it; pain the monitor is a starting point for contemplation which should ever be present to the mind of the surgeon in his reference to treatment."

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Pain is the only visceral sensation which man can appreciate. William Harvey remarked on the insensitivity of viscera in these words—" I carried the young man to the king that His Majesty might with his own hand behold this wonderful case—that in a man alive and well, he might, without detriment to the individual, observe the movement of the heart, and with his proper hand even touch the ventricles as they contracted. And His Most Excellent Majesty, as well as myself, acknowledged that the heart was without sense of touch, for the youth never knew when we touched his heart." This remarkable experiment has been repeated on other viscera in operations under local anaesthetic and in cases of external fistulae. It raises the question of the mechanism of the production of pain. Perhaps it is fortunate that space does not permit a discussion of this searching question.

There is a wide variation in man's response to the stimulus of pain. Age may play a part in this, for infants, adolescents and adults sometimes appear to vary in their susceptibility to pain; we seem to harden ourselves to it with the addition of years. Again, individuals obviously vary in their tolerance of pain. We read of the disarticulation of the foot of a wounded Cossack (and of three fingers and their metacarpals of his comrade) without any anaesthetic. The surgeon tells us that the Cossacks were less perturbed by the operation than he was himself. The Indian fakirs on their beds of nails and those unusual cases of people refusing operative anaesthesia for moral and other reasons, recall the phenomenal demonstrations of hypnotism in a class of psychiatry or in the music-hall. Even to look at a picture depicting an early operation makes one shudder. However, with the advance of civilisation and the advent of pain-relieving drugs, we have perhaps become more pain-sensitive. Well indeed might the purist, replying to the question " Where do you feel the pain? ", reply " In the sensorium."

The understanding of abdominal pain requires its subdivision into visceral (or splanchnic) and parietal components. Each component depends on an effective stimulus if pain is to be felt. We cannot be sure of the precise nature of the effective stimulus, but evidence suggests the compression of a sufficient number of nerve elements, and this is enhanced by the accumulation of tissue metabolites in a relatively ischaemic field.

Visceral pain is the pain of colic, of muscular spasm in a hollow viscus. This is the type of pain felt in acute intestinal obstruction, when its coming and going is associated with a wave of peristalsis passing along the gut. The patient is often more aware of its coming than of its going. It is also the pain of labour as the contractions pass through the myometrium. In the form of biliary and renal colic it is cited as one of the most severe pains

known. The biliary passages and the ureter are both small-bore tubes and the colic is usually due to the pressure of a relatively solid object. Sir David Wilkie, who suffered both, considered renal colic to be the more severe. As a symptom, colicky abdominal pain is extremely important, for it may be an early symptom of a serious condition and therefore of great diagnostic value. A residual soreness or tenderness (after the acute attack has receded) appears in many instances.

The region of the abdomen in which visceral pain is felt is dependent on the embryonic formation of the gut, with its bilateral innervation. It has been stated that pain produced in the appendix, stomach, or the rest of the gut is invariably situated centrally in a definite and constant site for the simple reason that the related innervation was acquired, and the reference map in the cerebrum completed, while the gut was a short midline tube. Future migration of certain parts of the later elongated and tortuous intestine alters neither the reference map nor the local sign. The registered address remains constant. The embryological divisions of foregut, midgut and hindgut can conveniently be transferred to the anterior abdominal wall, where they are represented, roughly speaking, by the epigastric, hypogastric and umbilical regions. It is deep to these regions that splanchnic pain originating in the appropriate viscus is felt. It is there that the initial pain of visceral disorder is located by the patient, and, by taking careful note of what he says and where he points, the surgeon can learn much that will help him to make the diagnosis.

There is in the reference map a tendency for a constant error of draughtsmanship in one direction. The map always indicates that the pain is felt higher in the abdomen than the anatomical site of the viscus in which it originates. This rule of superior localisation has been explained by the adoption of the upright posture, all the abdominal contents shifting caudally under the influence of gravity. It appears that the quadripeds used for experiments in this field keep their viscera relatively nearer the cranium than we do.

Some extra-abdominal lesions cause pain to be felt in the abdomen, and some intra-abdominal pathology brings about pain in other sites. In the first category, a neglected source may be the fashionable prolapsed intervertebral disc lesion although there are many others more common. Surgeons have operated on cases of what they thought to be intra-abdominal disease when a spinal tumour turned out to be the underlying pathology. This might be even more uncommon than it is if careful history-taking and a full examination of the patient in pain were to take place instead of the spot diagnosis based on faulty intuition. The often-cited example of irritation of the diaphragm (in the course of a disease process or else experimentally) causing what is called " shoulder-tip " pain, complies with the statement quoted above in relation to the acquisition of nerve supply at an early embryonic stage. The diaphragm has its embryological origins in the tissues of what is later to become the neck, and in its migration to the anatomical site which it eventually occupies, it does not acquire an additional nerve supply. Although the precise region is of little importance clinically, it should be pointed out that the shoulder-tip may extend in the mind of the subject from the root of the neck to the greater tuberosity of the humerus. The pain is not so variable as the term " shoulder-tip." In patients undergoing phrenic nerve crush operations for pulmonary tuberculosis under local anaesthesia, it was found that the pain was always felt, at the moment of crushing, two inches above the mid-point of the clavicle. The term " referred pain " is applied to this phenomenon.

Irritation of the parietal layer of the peritoneum by chemical or infective agents causes continuous abdominal pain which is not relieved except by removal of the cause by surgical intervention, or by one of the natural pro-

cesses—localisation; abscess formation and discharge; or absorption. Peritoneum is extremely thin tissue, and it appears that, while it is not itself sensitive, the sub-serous layers are extremely sensitive, and an inflamed organ lying in contact with the parietal layer can induce reaction and oedema in the sub-serous layers in a very short time. The pain is then felt in the abdominal wall where the process is acting. The character of this pain is quite different from that of visceral pain, being continuous and of a burning, stabbing or tearing nature. It is this sort of condition involving the diaphragmatic peritoneum which causes the supraclavicular pain mentioned above. Parietal pain does not appear if the parietal peritoneum is not involved in the pathological process as, for example, in certain cases of appendicitis and in some perforated peptic ulcers. It should not be confused with tenderness.

Cutaneous hyperalgesia has been estimated to be present in about one case in three of parietal peritoneal involvement. The best method of testing for it is to draw the sharp point of a long pin across the abdominal wall, exerting an even pressure throughout. The factors determining the presence of hyperalgesia are two in number—emotion and local tissue reaction. The emotional one is described as a tuning-up of the nervous system in severe pain. It may or may not be manifest as a state of apprehension on the part of the patient. It can be likened to a simple stimulus such as a tap on the shoulder in the company of friends—perhaps after a good dinner—when the response is like that of the normal subject on testing for cutaneous hyperalgesia: nothing happens. If pain is present, the picture is like that of a man walking alone down a quiet dark road, when a tap on the shoulder may cause considerable alarm. Abdominal rigidity is generally agreed to be due to a spinal reflex. The afferent limb may be either or both the visceral or parietal nerves. It seems that the parietal nerves usually predominate, for the rigidity may follow injury to the abdominal muscles or an intra-abdominal accident, and be more pronounced on one side than on the other. Rigidity due to biliary colic can be abolished by splanchnic nerve block or induced by distension of the biliary tract—for example, when there is a tube in the bile duct post operatively.

Deep tenderness can be distinguished by the sufferer from parietal pain, and is found on palpation over the affected site. The pain is described as being felt deep to the area of palpation rather than in the superficial layers. This has been called the " borrowed local sign." The impulses must originate in the viscera themselves for deep tenderness is found early in appendicitis before the inflammation has spread to the outer layers, and therefore before the parietes can be involved. It is also found in peptic ulcer where there can be demonstrably no contact between the affected part and the parietal wall. In cases of pelvic appendicitis, palpation through the rectal wall may be the only time when the patient complains of tenderness.

The borrowed local sign is explained as a single sensation caused by the correlation of deep tenderness with skin sensibility to the examining hand. As viscera have a bilateral innervation there does not appear to be any other explanation. Normally no sensation arises from viscera, but when pain deep to the abdominal wall and touch and pressure from the abdominal wall arise simultaneously, they can easily become inextricably linked in the patient's mind. It can be roughly compared to Aristotle's experiment of crossing two adjacent fingers and feeling an object placed between the two in the groove they thus form. Because we do not usually feel one single object with these two surfaces at the same time, we find it hard to believe that we are not feeling two separate objects.

Many questions are left unanswered, many topics remain untouched. As our knowledge advances and our experience widens, we may be able to find the key which will open the door and even to answer the age-old question " What is pain? "