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ON

PAIN IN THE ILIAC FOSSA.

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BY

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I DARE say that to some it may seem that a discussion on pain in the iliac fossa is a somewhat barren and uninteresting subject; for myself I confess that there are few problems in abdominal diagnosis which cause me greater anxiety or difficulty.

Let us suppose that we have to deal with a patient who presents as the principal theme of the history the complaint of chronic pain in one or other of the lower quadrants of the abdomen. I would say that in a surgical outpatient clinic this type of case is one of the most common of abdominal disorders, and often one of the most difficult to unravel. Too often, it seems to me, we arrive at what we regard as a diagnosis upon evidence which is superficial and incomplete, and, where right-sided pain is concerned, we are inclined to attach the blame to an organ which has borne so much of the heat and burden of the surgical day—the vermiform appendix. It is my intention to analyse a problem of this description, and to attempt to show that there are many possible explanations of chronic iliac pain.

The importance of a critical analysis and a reasoned diagnosis is obvious. In many instances, it is true, the case history and the physical signs are sufficiently distinctive to establish a correct diagnosis, but such is not the class which I have in my mind; it is rather the indefinite and more elusive type of case, in which an ambiguity of symptoms may lead us to take refuge in operative intervention—a course which too often, instead of clearing up the mystery and affording relief, results in a persistence of symptoms and an obscuring of the issues, and perhaps the introduction of complicating features of a most regrettable character.

Let me illustrate what is in my mind by quoting to you the following abstract of a case history.

Mrs. A. B. had complained for three years of chronic pain in the lower abdomen. It was referred to an area a handbreadth below the umbilicus; it was bilateral, but somewhat more severe on the right side. It was not an acute pain, but of a dull, aching character. It was relieved by lying down, and it was sometimes referred to the lower part of the lumbar spine. The symptom made its appearance soon after the birth of the first and only child three years before. It was sometimes accompanied by a sensation of nausea.

I need not elaborate the symptoms—what concerns us now is the fact that a diagnosis of chronic appendicitis was made, the appendix was removed, and for a time there was relief from symptoms. There was then a recurrence of the original complaint, and some months later a laparotomy was carried out and the right ovary removed. Again there was a period of relief, and again a recurrence of symptoms. A ventral fixation of the uterus was performed, but on this occasion there was no relief, and four months later a complete hysterectomy was recommended and accepted. Some months later the low abdominal pain and the backache reappeared, and on this occasion permanent relief was secured by the fitting of an efficient sacro-iliac belt. Someone recollected that a lax sacro-iliac joint may be responsible for low abdominal pain.

Perhaps there is something to be said for diagnosis by the method of radical exclusion practised in this case; it certainly eliminated possibilities until there was little left to consider, but from the patient's point of view it must be regarded as a *via dolorosa* which need never have been travelled. I have made no call on my imagination in the recitation of this case; it is an accurate record of events, and it has left me with an impression of the importance of a most rigid analysis of the clinical features of every case of chronic low abdominal pain.

THE ANALYSIS.

The Index of Pain.

The major symptom in the history of the case which we propose to analyse is pain, and therefore this feature focuses our attention, and we discuss it first from a general standpoint. It is a symptom so variable in quantity and quality that a concise definition and conception of it is always difficult and sometimes impossible. No one has succeeded in establishing its index, and, there being no constancy in its concept, we have no means of scientifically measuring or recording its degree. We have no choice but to place our dependence upon the statement of each individual, and, as we do so, we register one of the weakest points in our system of clinical investigation, for we are at the mercy of such unscientific elements as the power of description, the influence of imagination, it may be the utter materialism of "an axe to grind." Someone has said that to carry out an investigation of any case in which the pain syndrome exists four considerations must be taken into account: (1) the personality equation, (2) the history, (3) the examination, and (4) the interpretation. The first of these is the most difficult, for it entails the consideration of what our legal friends term "the competency of the witness." Is actual pain being suffered? Is there a subjective sensation which is not pain, but which is confused or exaggerated or distorted, and presented to the examiner as pain, or is the error a psychological one, so that the more general disturbances of anxiety or fear are made manifest in the local guise of a pain which is purely imaginary? The first and often the most difficult part of the problem is to assure ourselves that pain exists, and that it is reasonably constant in situation and in character.

THE PHYSIOLOGY OF PAIN.

If we are satisfied of the existence of pain, we may review for a moment certain of the more commonly accepted facts in relation to the anatomy and the physiology of the disturbance.

The Pathway.

What is perhaps the simplest conception of pain arises in connexion with cutaneous sensibility. If I prick the skin on the back of my hand, and if in doing so I disturb one of the nerve endings which lie in the Malpighian layer, I am conscious of the sensation of pain. The stimulus has travelled along a well-defined route; it has been transmitted by a mixed nerve to the spinal cord, it has entered that organ through the medium of the posterior route, it has terminated for the time being in the synapse of the grey matter of the posterior horn. Picked up at this point by the synapse of the second axone, it passes to the opposite side of the cord, and then, by way of the spinothalamic tract and the fillet, it ends as a synapse in the outer part of the optic thalamus. A third and last axone proceeds from this point in the posterior part of the internal capsule to end in the sensory area of the cortex which lies behind the fissure of Rolando. It is there that the actual consciousness of the peripheral stimulus is recorded.

The Sites of Origin.

Such is the conception of pain sensibility in relation to the skin, but in our consideration we must recognize that the stimulus which induces pain may arise from areas other than the skin. Many of you may have noticed that, when employing local anaesthesia, pressure on a blood vessel causes pain when the surrounding structures have been rendered insensitive. When you made this observation you were confirming an experience which Foerster recorded many years ago in connexion with an avulsion injury of the brachial plexus. Blood vessels, more especially the smaller arteries and the arterioles, are sites from which painful stimuli originate, but there is this distinction, that the tract which the stimulus follows is along the line of the larger blood vessels and thence by way of the sympathetic system through the anterior nerve roots into

the spinal cord. Subcutaneous fat is apparently insensitive, but fascial planes and septa are plentifully supplied with sensory nerve endings which react to painful stimuli. Muscular tissue is presumed to be insensitive to pain, but the fascial interseptal are highly sensitive, and periosteum is so well supplied with sensory nerve endings that painful stimuli readily arise from it.

There remain to be considered the viscera and the serous surfaces. Both are areas from which pain may originate, the impulses travelling by the line of the splanchnic nerves and ganglia, by the rami communicantes into the mixed spinal nerves, from which point they enter the spinal cord through either the anterior or the posterior nerve roots.

I have recorded these facts so that I may be in a position to say that when Mrs. A. B. complains of chronic pain in the iliac fossa, the individual tissues from which the painful stimuli may originate are the skin, the fascial planes and septa, the blood vessels, the periosteum, the serous membranes, the viscera, and of course any point in the nerve tract which pain impulses follow.

Nature of the Stimulus.

Continuing my study, I am anxious to know something of the manner in which the pain may originate, something of the influences which, when exerted, result in the sensation of pain. This point is evident—that the stimulus may be applied either to an end-organ or to any portion of the nerve fibres throughout the course of the first axone and probably of the second; but here comes a distinction, for, if the stimulus is applied to an end-organ, it would seem to be a necessity that it shall be distinctive in character and relatively intense in degree, while, where the nerve fibre is concerned, the question of the specificity of the stimulus would appear to be less important. The stimuli which affect the nerve endings of skin, fascia, and periosteum are those of prick, temperature, and tension. Where the blood vessels are concerned the origin is somewhat different; tension is probably one of the influences, and it is most likely responsible for the pain which accompanies conditions of extreme vascular spasm or of undue dilatation. In the case of the blood vessels, however, we have reason to believe that the stimulus of the nerve endings may be chemical in character and arising from such influences as an excess of CO_2 or the products of imperfect tissue metabolism.

The nature of the stimulus which induces visceral pain is still a matter of controversy, but it is evident that hollow viscera are peculiarly sensitive to stimuli which arise in association with undue contraction or undue relaxation of the muscular walls. From observations which we have made we believe that the explanation may lie in a whorl-like arrangement of the nerve fibres around the spindle-shaped muscle cell. Tension on the encircling fibre may result from excessive contraction and foreshortening of the cell or from undue relaxation and stretching.

In one or other of these different ways—by stimuli of prick, of pressure, of temperature, of stretching, and of chemical influence—the pain impulse may arise.

The Manner of its Conduction.

I conclude these physiological questions with a query: The stimulus having arisen, what is the manner of its conduction?

You will recall that the transmission is not a continuous one, but one which is repeated at a rate which varies from five to one hundred impulses per second, each period being accurately spaced, for the phase of transmission is followed by one of refraction, during which conduction is interrupted, and this phase must pass before the succeeding transmission can be assumed. Learmonth has expressed nerve conduction figuratively by saying that it is not a long-drawn-out Hey, but a Hey-hey-hey.

These are the general facts, and I think it has been of interest and importance to notice them, for we are able to appreciate in a physiological sense the situation from which the painful stimuli may have originated, the type of stimuli, the paths which they follow, and the nature of their progress.

ANATOMICAL ASPECTS.

One of the reasons why there may be difficulty in the diagnosis of chronic low abdominal pain is that these regions are intimately related to a variety of anatomical structures which, if affected by changes which produce pain stimuli, may refer the pain to one or other of the lower quadrants of the abdominal area. Let me indicate what these structures are.

The Sacro-iliac Joint.

If I indicate an outline on the anterior abdominal wall which extends from a handbreadth below the umbilicus downwards towards the pubic spine, and is some two inches from the mid-line, I have outlined the position of the sacro-iliac joint in relation to the anterior abdominal wall. This joint is a synarthrosis of supreme significance in the system of body mechanics. Through it the bulk of the body weight is transmitted to the lower limbs; its statics and dynamics are not above suspicion, for the joint is the contact of two parallel surfaces, and, though it lies in relation to an inverted dovetail, is a central one, and thus liable to forces which rotate and loosen until fixation is insecure. If for any reason there is imperfect fixation oedema may result, and if such develops it is chiefly evidenced in an area where the ligamentous arrangements permit it to occur—the anterior portion of the joint. Oedema means increased tension, a stimulation of nerve endings in fascia, and the production of pain stimuli, which may be referred to the lower quadrants of the abdomen, and which may be associated with local tenderness when pressure is exerted on the anterior abdominal wall in the line of the sacro-iliac joint.

The Lumbar and Sacral Nerves.

Passing in close relationship to the sacro-iliac joint are the nerve plexuses, which are motor and sensory to the lower limbs. The third and the fourth lumbar nerves unite to form the femoral or crural nerve at a point which corresponds to the upper portion of the sacro-iliac joint. The fifth lumbar and the upper four sacral nerves unite in the formation of the lumbosacral cord, and the area of union is roughly over the lower third of the sacro-iliac joint.

Now the points of exit of the individual nerves are either through rigid bony foramina, or, as in the case of the fifth lumbar nerve, beneath a bony traverse and an equally rigid ligament, while there is the interesting but somewhat paradoxical position that, though the nerves are probably the largest in the body from the point of view of girth, the foramina through which they pass are not proportionately arranged for their accommodation—aperture and content are curiously close-fitting in their adjustment one to another (Putti). There are thus abundant possibilities for nerve irritation. The underlying joint itself may be none too secure, and the nerve tracks are so arranged that pressure upon them readily occurs—a state of affairs which results in oedema of the nerve sheaths and pain, which is both local and referred to the lower quadrants of the abdominal wall.

The Psoas Muscle.

Overlying the sacro-iliac joint and the related nerve tracks is the muscle mass of the psoas major. There are conditions under which this muscle becomes tender and oedematous, and on such an occasion I have seen pain in the iliac fossa so definite and distinct that a diagnosis of appendicitis was seriously considered.

The Viscera.

The anatomical sources of iliac pain, however, which bulk most largely in our minds are in relation to the viscera. In a visceral disturbance associated with pain two types or varieties of pain may arise. One is local—that is to say, its evidence is in a situation corresponding to and immediately overlying the organ affected; the other is referred through the medium of nerve tracts so that the surface manifestations are evidenced in parts of the body remote from the original and primary area of the disturbance, an example of the latter being the shoulder pain

which develops in association with inflammation affecting the under surface of the diaphragm.

Appreciating these points, we ask ourselves: What are the viscera which directly or by reference are associated with iliac pain? The answer is not difficult. The organs which occupy the iliac fossae come first to our minds—the lower loops of the small intestine, the caecum and the ascending colon, the vermiform appendix, the iliac and the pelvic colons, in the female the tubes and the ovaries. There are others which we are more apt to forget; I allude to the ureters and the kidneys. The line of the lower third of the ureter is roughly that of the sacro-iliac joint, and a disturbance of this portion is associated with local tenderness and subjective pain referred to the iliac fossae. In the case of the kidney and the upper end of the ureter, though local pain is evidenced at a level above the iliac regions, it is not unusual to find the reference of pain to the abdominal surface at a considerably lower level. Included in the visceral group we must recognize the associated lymphatic glands, and particularly those which occupy the ileo-caecal angle.

The Superficial Nerve Distribution.

There is yet one more distinction which I would mention, and it is in relation to the nerve elements which pass through or are distributed in the parietes of this region. I need not elaborate them in detail; it is sufficient to say that in this area there gathers a complexity of nerve elements which extends from the distribution of the tenth thoracic to the third lumbar. It is an extensive summation of nerve tissue in a comparatively small area, and clinically it may be regarded as indicating a wide potential source from any point of which there may be an ultimate superficial reference of iliac pain.

CLINICAL CONSIDERATIONS.

Hitherto I have spoken in terms of anatomy and physiology; let me now put the matter in the clinical sense. We have seen that where individual tissue is concerned the pain stimuli may originate in skin, fascia, peritoneum, blood vessels, nerve trunks, viscera, or serous membrane. Judged anatomically, the common site origins of iliac pain are the sacro-iliac joints, the lower nerve trunks of the lumbar plexus, the sacral plexus, the psoas muscle, the various viscera which occupy the iliac region, the viscera of a higher level which may refer pain to the iliac region, the associated groups of lymphatic glandular tissue, and, related to these various sites, the complex distribution of nerve elements in the parietes of the region. I shall devote the remainder of this address to a consideration of some of the clinical characteristics which distinguish different types and origins of iliac pain.

The Visceral Aspects of Iliac Pain.

1. The Appendix.

I consider this aspect of this problem first because it is still a common conception that pain in the right iliac fossa is appendicular in its source. It is one of those dogmatisms which possess a half-measure of truth, and yet possess also a great background of potential error. Many writers and observers have striven to clarify the position. Sherren, for example, has expressed in so many words the almost startling paradox that when pain develops *ab initio* in the right iliac fossa the chances are that, whatever the clinical condition may be, the one it is most unlikely to be is appendicitis. Others have made the same declaration, but, in spite of these and similar statements, the impression remains, with the result that untold numbers of cases have undergone the operation for appendicitis when, whatever may have been the explanation, it was certainly not the appendix which was at fault.

When an individual develops appendicitis three processes are presumed to be responsible for the production of pain, and the events may follow one another in sequence or may occur in combination. The processes are:

- (a) Severe spasmodic contraction of the related hollow viscera, the lowest coils of the ileum, the caecum, and the pyloric portion of the stomach.
- (b) Increased tension within the appendix.
- (c) An infection of the related peritoneum.

The first of these, by undue contraction of the fibres of the involuntary muscle, stimulates nerve endings which communicate their disturbance to overlying parts, usually to the body mid-line in the supra-umbilical and umbilical regions. As the more local appendicular tension increases, afferent stimuli are transmitted through the medium of the tenth and eleventh dorsal nerves, which results in a diffuse pain in the subumbilical region on one side of the mid-line. With the third stage of the development of the disease—the infection of the related peritoneum—there is localized tenderness, both subjective and objective, which delimits itself at the situation which the appendix occupies, and, as this in some 85 per cent. of cases is at McBurney's point, there is local pain in the right iliac fossa.

What has been the sequence of events? There has been an epigastric or umbilical pain followed by a diffuse subumbilical pain, and only with the third stage is there localized right iliac pain. The sequence is of great importance in the matter of differential diagnosis, and as far as my experience goes I am in agreement with the statement which Sherren and others have made—that, if pain *begins* and remains in the right iliac fossa, the chances are that the case is not one of appendicitis.

I have said that the appendix occupies the right iliac fossa in some 85 per cent. of cases; in the remaining 15 per cent. it is accommodated elsewhere in the pelvis—beneath the mesentery of the small intestine, below the pylorus with an undescended caecum, or in the cellular tissue of the retrocaecal region. In all these instances, which may be termed anomalies of position, there may be no pain in the right iliac fossa, it is supra-pubic or subumbilical, or subcostal, or in the loin, according to the position which the organ occupies. My point is this, that right iliac pain as an evidence of appendicitis depends upon the organ occupying what is supposed to be its normal anatomical position, and, moreover, that its appearance is an evidence of a stage in the local pathology which bespeaks an established infection of the organ with peritoneal involvement.

2. The Ileo-caecal Junction.

If the appendix as a source of right iliac pain has to be accepted with a certain measure of qualification, there is another structure in the right iliac fossa which is responsible for the symptoms, and that with a considerable measure of constancy. Let me quote from one of many similar records.

Miss C. D., aged 30, complains of pain in the right iliac fossa. The attacks are intermittent, they come and go at different periods of the day, and they vary in intensity. If at all severe a sense of nausea is present. The symptom is often relieved by lying down, and there is usually complete comfort during the resting hours. The appetite is indifferent, and there is obstinate constipation. Miss C. D. is a spare woman, observant to the degree of introspection, and of a highly strung and nervous temperament. The abdominal wall is thin, and the site of the pain is characteristically indicated by laying the palm of the hand obliquely downwards and inwards over the right iliac fossa. On palpation no local rigidity can be demonstrated, but on deep palpation a sensation of discomfort, scarcely amounting to pain, may be elicited slightly below and to the inner side of McBurney's point. As the hand rises from the abdominal wall there may be a gurgling sensation produced by the expanding caecum. On x-ray barium investigation it is evident that there is some degree of stasis of contents in the caecum and lower part of the ascending colon.

It may be that I am injudicious enough to operate on Miss C. D., and if I do I shall certainly remove her appendix. Then I shall don a convenient pair of pathological spectacles and shall describe to my friends suggestive evidences of an existing pathology. Miss C. D. will make an early and a good recovery, I have no doubt, and for some weeks or months there will be no return of symptoms; but presently, and with a most disconcerting certainty, she will return to tell me with some measure of satisfaction that her symptoms have recurred. I shall not be unduly surprised (though in my wisdom I shall give Miss C. D. no indication of the fact) because her symptoms have been proceeding from spasm of the lowest loop of the ileum, the caecum, and the ileo-caecal valve.

Let me for a moment elaborate the points which this case illustrates. Certain types of individuals are liable to unusual degrees of spasm at what may be termed junctional points in the alimentary tract. These points correspond to segments in which sphincteric action normally occurs—the pylorus, the ileo-caecal valve, the mid-colic sphincter, and the pelvi-rectal sphincter. In subjects who are liable to disorders of these areas there are probably peculiarities of innervation and, more evidently, of structural arrangement. The condition of the ileo-caecal region is characteristic; the caecum is thin-walled, blue, and distended, an injected veil of peritoneum may cross its surface, but, most distinctive of all, there is a meso-caecal attachment which permits of considerable mobility of the structure. For some reason which we do not fully understand, the sphincteric portions of such an arrangement are liable to spasmodic disturbances of considerable intensity, and these are evidenced by pain in the related area. Superficially it may suggest appendicitis, but the sequence of events, the distribution of the pain, the absence of rigidity, and the associated findings will establish the true explanation. Ileo-caecal spasm is a common visceral explanation of right iliac pain, while a similar disturbance of the sphincteric arrangements of the pelvic colon gives rise to left iliac pain.

3. The Tubes and Ovaries.

Pain in the iliac fossa arising from affections of the tubes and ovaries is a common source of confusion, and I may say that surgery has made a confession of the difficulty by employing the paramedian or Battle's incision in the doubtful female case.

The source of the confusion is partly attributable to the fact that the segmental spinal areas, and therefore the areas of superficial pain reference, are very similar in the two instances—the appendicular being the tenth and eleventh thoracic, the ovarian the tenth thoracic, the tubal the eleventh and twelfth. It is easy to see, therefore, how confusion may arise. It is not within the scope of this paper to enter into details of differential diagnosis, but I would remind you of one feature by which ovarian and tubal disease may be distinguished from appendicitis: it is by the demonstration of a point of maximum local tenderness at the position of the internal abdominal ring. The explanation is an anatomical one: arising from the hilum of the ovary and the under surface of the tube is the infundibulo-pelvic ligament, its superficial attachment corresponding to the position of the internal abdominal ring. It would seem that irritation or infection of the visceral connexion is transmitted to the peripheral area and is there manifested by pain on pressure.

4. The Kidney and the Ureter.

The association of kidney disease with iliac pain is apparent in the following case history.

Miss M. W., a girl of 18, recently suffered from an attack of tonsillitis. During convalescence she complained of a sudden attack of pain in the right side. It was partly in the back, but it extended over the right iliac region. Soon after the onset of the illness there was a shiver scarcely amounting to a rigor, and the temperature was found to be 101°. There was a leucocytosis. In some way the complaint of iliac pain, accompanied as it was by fever and sickness, aroused suspicions of appendicitis, and once the impression had taken root the common sequence—an operation—followed. The appendix was normal; the explanation, as later results showed, was an acute pyelonephritis, secondary, no doubt, to the pre-existing tonsillitis.

In this instance the confusion arose from the combination of features (fever, vomiting, and leucocytosis), but the essential symptom productive of the error was the right iliac pain referred from a kidney undergoing increasing tension, and distributed to the right iliac fossa along the ilio-hypogastric and ilio-inguinal nerves.

Where ureteral conditions are concerned the problem is somewhat different. There may be some degree of referred pain along the distribution of the eleventh and twelfth thoracic and the first lumbar nerves, but in this instance the demonstration of local tenderness arises. In a ureteral irritation, particularly if it is such as to involve the lower end of the organ, pain is elicited on pressure at the brim of the pelvis, an inch and a half on either side of the

promontory of the sacrum. I can recall several cases in which recurrent right iliac pain, ureteral in origin, formed a problem of diagnosis closely resembling appendicular infection. I illustrate one of an unusual character.

Mrs. R. W. complained of recurring attacks of right abdominal pain, which was referred widely over the subumbilical region, the attacks being accompanied by nausea and vomiting. Local examination revealed tenderness of the inner portion of the right iliac region. In this instance there was reason to suspect that the pain had a ureteric origin, and a ureterogram revealed a distorted and kinked organ (injured, as it transpired, in a former operation for hysterectomy).

In this case the pathology was obvious and distinct, but there are others of a more subtle type, and particularly I have in my mind the milder degrees of ureteral stricture, errors which are only appreciated objectively in a ureterogram, or by the sense of obstruction which there may be to the passage of a ureteral bougie. There are innumerable instances of confusion of this condition with appendicitis.

5. The Mesenteric Glands.

That inflammatory affection of the mesenteric glands may be associated with iliac pain is a fully accepted fact. Unfortunately it is an additional source of confusion that intestinal catarrh is premonitory to the glandular disturbance, so that colic and diarrhoea may appear and further obscure the diagnosis. The inflamed glands are themselves tender to pressure, while there may be referred pain in the parietes of the overlying abdominal wall. It is true that there is usually an absence of muscular rigidity, because the parietal peritoneum is not involved, but the issue is so difficult that in most cases the relatively safe course of laparotomy is advised and preferred.

6. The Psoas Muscle.

If we consider the question, it is evident that affections of the psoas muscle may be associated with pain and tenderness referred to the region of the iliac fossae, but it is a possibility which clinically we are apt to forget. The experience of a recent case impressed me with the confusion in diagnosis which may arise.

Mrs. M. was a sufferer from rheumatoid arthritis of the right hip-joint, and the limb had become somewhat adducted and flexed. It was suggested that manipulation of the limb under anaesthesia into a position of abduction was advisable, and this was carried out. Twenty-four hours later pain was complained of in the right iliac fossa. There was local tenderness below the umbilicus and to the right of the middle line; the temperature had risen; there was vomiting, though it was recognized that this feature might be ascribed to the influence of the anaesthetic. The picture suggested appendicitis, and this diagnosis was seriously debated, but an entire absence of muscular rigidity lent support to a simpler explanation, and as events turned out it was ultimately established that the symptom proceeded from an oedema of the psoas muscle, which had been stretched, or even torn, in the manipulation of the hip-joint.

7. The Lumbar and Sacral Nerves.

I dare say we pay insufficient attention to the influence which nerve cord irritation plays in the production of low abdominal pain. I have alluded to the relationship of the lumbo-sacral nerve trunks and the regions of the iliac fossae, and I have recounted the evidence to which Putti drew attention that the lumbar and sacral nerves, while among the largest in the body, are accommodated in vertebral foramina which are curiously close-fitting in their capacity. In the existence of an osteo-arthritis affecting the spinal column osteophytic outgrowths around the intervertebral foramina, with accompanying perineural oedema, are frequent evidences, and I can recall many cases in which low abdominal pain, right or left iliac, was attributable to such a source.

Mr. W. D., aged 62, complained of recurring discomfort and pain in the lower abdomen. The discomfort was intermittent, but he noticed that it was often troublesome at night after he retired to bed. He had previously suffered from rheumatism, and twelve years previously his teeth were removed on account of a diffuse pyorrhoea infection.

On examination it was demonstrated that there was local tenderness over the lower and inner parts of both iliac fossae, but the feature was somewhat more evident on the right side. His condition had been diagnosed as chronic appendicitis and the appendix had been removed, but his symptoms had continued.

A skiagram of his spinal column showed clear evidences of osteoarthritis. There was considerable outgrowth of new subperiosteal bone, and to some extent it was laid down around the neural openings. It is reasonable to suppose that pressure upon the nerves at their points of exit, with resulting oedema, played a considerable part in the collective group of symptoms.

The sacro-iliac joints as a source of iliac pain I have already referred to, and I need not repeat how important is the recognition of this association.

I might allude to other sources from which iliac pain may arise—the peritoneal and fascial stretching associated with an incipient inguinal hernia, for example—but I feel I have already drawn a complicated picture, and I do not wish to add to its complexity. It has been my desire to remind you of the importance of analysing in a more or less logical way any case of chronic iliac pain with which we may meet, and I have attempted to remind you of the physiological and anatomical considerations upon which such an analysis must be based.

NOTE ON THE ETIOLOGY OF PELLAGRA.

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SOME extremely interesting statistics of pellagra as it occurs in South Africa have recently appeared in a paper by Dr. E. H. Cluver.¹ Dr. Cluver describes an "outbreak" of pellagra in the Durban prison command, which comprises three groups of prisoners in separate institutions—the Central Gaol, the Point Prison, and the Congella Prison. In the first, for European and short term prisoners, 1.9 per cent. were affected; in the second and third, for long term hard-labour prisoners, 3.8 and 8.2 per cent. respectively.

It is of interest to consider whether the valuable tables of the rations supplied to the prisoners provide any evidence in support of either the vitamin deficiency or protein deficiency theories of the etiology of the disease. Four different ration scales are described—C and D, for short term (under three months) and long term coloured prisoners not natives of South Africa; E and F, for short and long term natives respectively. Prisoners receiving D and F do hard labour.

In a paper published in 1921² I drew attention to the fact that if the available protein (gross protein less loss in intestine) be reduced to the value of meat protein by the application of K. Thomas's figures for the "biological value" of protein from different sources, diets in which the value so obtained fell below 40 grams daily for non-labour communities and 45 grams for labour communities were likely to lead to pellagra in the consumers. There seem to be good reasons for doubting the validity of the method of determining the biological value employed by Thomas; nevertheless, the relationship of the value of protein in a diet so deduced to pellagra incidence is quite definite and cannot be accidental.

In Table I given below the protein content of Cluver's four diets has been investigated in this manner, the value of the mixed proteins expressed in grams of animal protein being shown in the line indicated by the letters B.V.

TABLE I.—The Protein Value of the Durban Prison Rations.

Ration Scale.	C.	D.	E.	F.
Gross calories	2,700	2,860	2,500	3,750
Gross protein	80	76	60	119
Protein from maize*	21	40	52	61
Protein from meat*	5	9.8	0	9.8
B.V. of protein	29.5	28.5	14	38
Cases of pellagra among recipients	2	7	10	44

* Gross amount; B.V. estimated from gross protein less 33 per cent.

The loss of protein in the intestine from a diet containing such indigestible materials as whole maize and beans is considerable. H. E. Roaf and I³ determined the average loss from the intestine on a somewhat similar diet supplied to the Turkish prisoners of war in Egypt in 1918. The observation was carried out on a squad of five men over a period of days. It was found that 33 per cent. of the protein intake failed to be absorbed. In estimating the available protein from the gross protein in the four diets one-third has therefore been deducted for non-absorption. The "biological value" is estimated from that figure.

It is evident that the value of the protein in all these four diets falls below the minimum safe value of 40. They are all, in fact, diets which would have been expected to result in pellagra among the recipients.

It seems scarcely justifiable to feed any type of prisoner for as long as three months on a diet so bad as E, issued to short term native prisoners. It consists entirely of maize with 450 grams daily of mixed vegetables. The general health of the recipients of this diet is not mentioned; the considerable daily amount of vegetables no doubt saved them from much. Although this diet is exactly adapted to produce pellagra, it is, even so, surprising that no fewer than 10 cases developed within less than three months from the time they commenced its consumption. The diet has a protein value almost identical with that used by Goldberger and Wheeler⁴ in the Rankin farm experiment; the calorie value is considerably less. In that experiment six out of eleven convicts forming the experimental squad developed the disease; it was not, however, until seven months after the beginning of the experiment that definite symptoms suggestive of pellagra were seen. The fact that two persons were admitted to the prison already suffering from the disease suggests that pellagra is less rare in South Africa than is supposed. It is also possible that individuals of the poorer class of natives, already sufficiently ill nourished, suddenly placed on such an exceptionally deficient diet as E, developed pellagra sooner than would otherwise have been the case. The still more perplexing fact that the disease had not been observed before in any of the three institutions, although the diets had been in force for some years, will be referred to later.

Unfortunately Dr. Cluver does not supply any information as to the percentage of pellagra cases among those receiving the four different ration scales. It may probably be assumed that the coloured foreign long term prisoners on ration scale D were very much fewer in numbers than the native long term prisoners on scale F. The conditions of labour appear to have been the same in the two cases; the incidence of pellagra among the coloured foreign prisoners, owing to the lower value of the diet (whichever of the two views of the etiology of the disease is adopted), should have been greater than among the native convicts.

That labour has an important influence in increasing the liability to pellagra is an undoubted fact to which I have drawn attention (loc. cit., p. 32), the apparent reason being that labour raises the need of the protein requirement (loc. cit., p. 54). The relatively large number of cases on diet F must be ascribed to the influence of labour on a community receiving a diet which, judged of by its protein value, would have been pellagrous even without that influence. It may be noted that of the 44 cases on diet F, 8 were originally on diet E, and were therefore probably non-labour.

From what has been said it is evident from the analysis of the four diets in regard to their protein value that the protein deficiency theory of pellagra provides a reasonable explanation of the result. Dr. Cluver very naturally accepts without comment Goldberger's view that the primary cause of pellagra is a deficiency in the P-P (B2) accessory factor in the diet. It is the purpose of this note to show that this theory is by no means conclusively proved, and that diets responsible for the Durban prison outbreak in fact supply strong evidence that the defect was not in the vitamin content but rather in the value of the protein.

In a paper⁵ read at the International Congress of Tropical Medicine in Cairo, which will be published shortly, I have endeavoured to analyse the data brought