ABSTRACT OF

The Hunterian Lectures

ON

SOME POINTS IN THE ANATOMY AND
PATHOLOGY OF THE VERMIFORM
APPENDIX.

*Delivered before the Royal College of Surgeons of England on
Feb. 9th, 11th, and 13th, 1903,*

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LECTURE I.

Delivered on Feb. 9th.

MR. PRESIDENT AND GENTLEMEN,—I almost owe you an apology for bringing to your notice a few points, hardly any of which, I fear, are very novel, on the subject of the vermiform appendix. In spite of the widespread attention which has of recent years been given to this lymphoid appendage there is still a very considerable difference of opinion on many points connected with its anatomy and physiology, to say nothing of the pathological conditions associated with it. By so much has our knowledge of the organ and its lesions been increased that it would seem that there is but little left to be added to the sum, yet it is perhaps at just such a stage of experience that it is well to gather together some of the important facts in lectures such as these. I shall not allude in detail to all the well-known statements concerning its gross anatomy but only to some which, however simple and apparently obvious, are sometimes lost sight of.

GROSS ANATOMY OF THE APPENDIX.

First, let it be remembered that the vermiform appendix is wholly an intra-peritoneal organ, using this term in the sense in which it is generally employed—that is to say, it is always suspended by a fold of peritoneum—the meso-appendix—in a manner similar to a loop of intestine, while its extreme tip is usually quite free. The obvious deduction from this elementary fact is that the appendix cannot be approached by any route whatever which does not transgress the peritoneal cavity—in other words, one in which the parietal layer of peritoneum is always incised.

Dr. R. J. A. Berry¹ has very carefully worked out the varieties of the attachment, form, and relations of the meso-appendix. Briefly he summarises the differences in the descriptions given by various authors as follows: "These are, first, the shape of the meso-appendix, whether triangular or quadrilateral; and secondly, its relations to the vermiform appendix, whether a complete or an incomplete investment for that organ." From a careful review of the fold in 100 cases he comes to the following conclusions: "The meso-appendix is a double fold of peritoneum which entirely surrounds the vermiform appendix, constituting its mesentery. Though generally of a triangular aspect it is always quadrilateral in outline—that is to say, four borders can always be described, though one border may be so short as to give one the impression that the structure is triangular. In most cases the mesentery can be demonstrated to the naked eye extending along the whole length of the appendix, and in those cases where the meso-appendix appears only to extend midway along the appendix microscopic examination will conclusively prove that a peritoneal covering is investing the whole length of the appendix." While from a personal examination of over 50 normal appendices I can fully indorse all that Dr. Berry affirms, I think that he partly loses sight of the pathological and, therefore, surgical, significance of the fact that the breadth of the fold constituting the meso-appendix may vary very much. Thus undoubtedly in a large number of cases the meso-appendix as a distinctly

quadrilateral fold extends the whole length, or nearly the whole length, of the appendix, but, on the other hand, there is no inconsiderable minority of instances in which it does not reach as such a fold to the termination of the tube. It is because of this shortened attachment of an actual fold that the appendix is so frequently curved or bent upon itself and it is by no means unusual for a division of the meso-appendix to be required in order to straighten out the tube. Away then must go all the statements of operating upon the appendix extra-peritoneally.

A second fact is the direct communication with the cæcum proper. This connexion is merely, as it were, a safety-valve against explosion and not in the vast majority of cases the entrance through which an irritant foreign body passes into the tube. It is frequently after this communicating aperture has become abnormally closed that trouble ensues rather than when it is unusually patent. The calibre of this aperture, while amply sufficient in its natural state to allow the free evacuation of secretion from the mucous membrane of the tube itself, is not great enough to permit the entrance into the lumen of the appendix of bodies of considerably smaller dimensions than those which have been said to have passed through it.

The position of the aperture is interesting and so is also its relation to the axis of the tube. Too little attention has perhaps been paid to the fact that the passage from the cæcum into the appendicular canal is, as it were, hidden away under the loose folds of mucous membrane which surround it; indeed, in some instances it is difficult to determine its position. This is obviously very different from the character of the larger adjacent opening—the ileo-cæcal—which guarded rather than obscured by the folds constituting the ileo-cæcal valve, is very apparent, for the ileo-cæcal junction appears prominent as if somewhat telescoped into the cavity of the large intestine, while that of the appendix is depressed and may have to be searched for. As a general rule the relative position of these two apertures is that the orifice of the vermiform appendix is some 2.5 to 3.5 centimetres inferior and posterior to the ileo-cæcal. Then, again, in at least two of the fairly common positions of the appendix—namely, when lying upwards and inwards or directly upwards—its orifice is in reality, at any rate, in the upright position, at the most dependent part of the tube, and this facilitates the exit of secretion and hinders the entrance of extraneous material. But it must be here remarked that the foregoing meets with an exception in the case of bacteria which, as it were, creep along the surface of the mucous membrane lining the entrance to the tube, and also of intestinal worms, which occasionally glide over the surface into the tube. It is wonderful how the various pointed foreign bodies found within the lumen of the tube have discovered the narrow aperture, cast around as it is with everything that would seem to block their way.

A third subject of extreme interest and importance is the position of the appendix within the abdomen. To guess correctly where the tip of the appendix lies in any given case, without exposing it, is well-nigh impossible. To state that such-and-such a position is the *normal* one for the appendix is only to make oneself liable to have the statement completely overthrown by the next observer. The cæcum with its vermiform appendage only reaches its common habitat in the right iliac region after a considerable route of migration, and this fact is quite sufficient in itself to lead to very different relations of the organ. It is probable that in a small number of instances the cæcum has not fully reached the right iliac region even at birth and may continue its journey for some months after intra-uterine life. Thus there are on record instances in which the vermiform appendix has been discovered lying close beneath the liver and even behind the right lobe of the same gland (Fig. 1).

With regard to what may be conveniently termed the normal positions there are three in which the appendix generally lies:—1. Pointing upwards and inwards towards the region of the spleen. This may be described as being the north-east position. 2. Pointing downwards and inwards over the brim of the true pelvis. This may be described as being the south-east position. 3. Pointing directly upwards behind the cæcum. This may be described as being the due north position. Various authors state differently as to which of these three is the most usual position. Personally, from the observation of nearly 200 cases in the dissecting-room and post-mortem room, I am convinced that a direction upwards and inwards behind the inner part of the cæcum,

¹ The Cæcal Folds and Fossæ, 1897, p. 25.

or the junction of the ileum and the cæcum, is that assumed by the appendix in more than half of the cases, while that in which it lies over the brim of the pelvis, generally with an inclination distinctly inwards as well as downwards, is the next most common. Lying directly upwards behind the cæcum is not so very uncommon and in this site pus, if

FIG. 1.

Diagram to illustrate the common positions of the appendix.

present, is difficult to reach by the usual anterior incision and the propriety of lumbar drainage arises. It must be well known to all who are in the habit of palpating the right iliac fossa, particularly when the cæcum is nearly empty, that it is common to detect an elongated body, not unlike an enlarged appendix, felt through the thickness of the abdominal wall. This may not infrequently be felt when there is no suspicion of disease of the appendix and in such instances it cannot be attributed to the tube itself. In nearly every case in which I have personally palpated this structure, and have asked others to confirm its presence, it has been felt running obliquely downwards and inwards and could be made to roll under the tips of the examining fingers.

Like so many other conditions in connexion with abdominal palpation, the question arises as to whether the structure felt lies in the abdominal wall or within the abdominal cavity. Sir Frederick Treves when discussing the fact gives it as his opinion that it is produced by a portion of contracted muscle, probably rectus, stating as an argument in favour of it that the muscle and the deeper, possibly diseased, parts which are irritated by the palpation, are both supplied by the same spinal nerves. I am inclined, however, to think that, in some cases at least, it is the anterior longitudinal muscular band of the cæcum contracting under the stimulating effect of the pressure of the examining fingers.

MICROSCOPIC ANATOMY OF THE APPENDIX.

A great deal has been written on this subject, but even now there are several disputed points to be cleared up.

That the histology of the tube differs considerably at various periods of life is a well-recognised fact. First note the presence of the lymphoid tissue in the submucosa, or, as I prefer to term it, the lympho-mucosa. It has been shown by Dr. Berry that the apex of the cæcum of those animals which do not possess an appendix contains a quantity of lymphoid tissue and this he believes to be the homologue of the appendix vermiformis of the higher apes and man. This is probably true and while bearing upon the comparative anatomy of the organ it also gives a hint as to its function. From the comparatively enormous development of the lymphoid tissue in the submucosa of the appendix some have deemed it justifiable to term this little appendage the "intestinal tonsil." As lymphoid tissue in all parts of the body is most pronounced and active in the young, so the same holds good for the lymphoid masses in the appendix. In the infant they form almost a continuous layer outside the muscularis mucosæ, while their globular or ovoid shape, their deep staining, and their number and size make them the most marked objects when a stained transverse section of the appendix from a young subject is examined by the naked eye. (Fig. 2.)

As a rule a distinct difference may be noted between the

central and the peripheral parts of these follicles. The centre, which usually stains less deeply, appears to be composed of looser adenoid tissue than the outer portion, which latter stains very markedly. Not infrequently in sections made from perfectly normal appendices a distinct space may be found around the outer part of the follicle. At first on observing this I was inclined to consider it merely as a cleavage the result of faulty preparation, but I have met with it now in such a considerable number of sections that I consider that it truly represents a normal lymph channel. In a few instances, under a high power, I have made out a distinct endothelial lining which puts the question at rest. Lockwood, Clado, and others have demonstrated the same spaces and also look upon them as lymph sinuses.

Although these masses of lymphoid tissue persist throughout life yet they proportionately certainly become less as age advances and where the appendix has been the seat of inflammatory changes they may be very much lessened in size and in some instances may have almost completely disappeared. During an acute inflammation of the tube the lymphoid tissue is much involved and the various lymph spaces are greatly dilated.

CHARACTERS OF A NORMAL APPENDIX.

The question not infrequently arises as to what constitutes clinically a normal appendix. This is a question of great importance when the appendix is exposed in an operation undertaken for abdominal symptoms the origin of which is not fully evident. I believe that it is impossible to say that an appendix is absolutely "normal" without a microscopic examination of the tube, for what appears to be a "normal" organ on the outside may show evidence of disease if its interior and its mucous membrane be submitted to a closer examination. But it is possible to say whether or not an appendix is sufficiently healthy not to be excised. A

FIG. 2.

Transverse section of the appendix of an infant showing the ring of well-marked lymphoid follicles.

"normal" appendix should present the following characteristics:—

1. *Axis*.—There should be little, if any, actual twisting in the length of the organ. There is probably always some curving of the organ, but this should only be a gradual bend in the healthy tube, brought about probably by the attachment of the meso-appendix and the distribution of the appendicular artery. Any sharp kinking or any distinct coiling probably always indicates an abnormal condition.

2. *Colour*.—This should be yellow but with a pinkish tinge. The degree of yellowness depends upon the amount of subperitoneal fatty tissue, while the pink colouration is due to fine blood-vessels. No actual blood-vessels of any size should be noticeable. The appearance of such denotes their dilatation and therefore probably the presence of an inflammatory process. This is especially likely to be the case if vessels are seen in the form of enlarged venules tending to pass round the circumference of the tube.

3. *Consistence*.—A normal living appendix when first touched after exposure has an extremely significant feel. There is no suspicion of any hardness or stiffness, but it is soft and velvety. A little handling, particularly if this happens to be otherwise than gentle, or even the mere contact with cool air, causes an excitation of the muscular tissue and a corresponding hardening and shortening of the tube. It is important not to mistake this for true inflammatory induration. General or local undoubted hardness

present when the appendix is first fingered is indicative of a pathological condition.

4. *Surface*.—The surface of the serous covering of the appendix should normally be perfectly smooth and regular and there should be no adhesions other than those of a natural character. The whole length of the tube should be uniform in circumference except for a slight tapering at the distal extremity. Any sudden bulgings or enlargements suggest disease.

PHYSIOLOGY OF THE VERMIFORM APPENDIX.

Practically little or nothing is known concerning the physiology of the tube and it may be that its physiological functions are in reality insignificant, though they may have some bearing upon its pathology. There are two conflicting ideas as to its primary functions, one that it is entirely an absorptive organ, the other that it is purely an excretive gland. Probably the real truth lies in the statement that it is in part absorptive and in part excretive.

Further, it has been thought that it has to do with the production of sulphuretted hydrogen to aid in the antiseptics of the large intestine. There can be no doubt that the highly lymphatic character of the appendix seems to point to its absorptive function. The extremely well-marked lymphoid follicles and the large lymphatic spaces and channels both tend to make the assumption feasible that the appendix is chiefly concerned with absorption. Yet, on the other hand, there are some strong arguments against such a theory. Its absorbing surface is practically infinitesimal compared with that of the adjacent small and large intestine. Then, again, what is it to absorb? It is a very significant fact that it is well-nigh impossible even under pressure to distend the lumen of the appendix by distending the cæcum with fluid, exactly in the same way as it is not usual to be able to fill the lower end of the ileum from the colon. This conclusion is also corroborated by the fact that it is seldom or never the case that the lumen of the vermiform process is affected in those instances in which the cæcum has given way under the strain of distension arising from constriction of the large intestine on the distal side of the cæcum. Further, the lumen of the appendix is never a receptacle for meconium, so that it would not appear likely that the appendix often has any liquid contents, other than what it has itself secreted, to absorb.

Again, it is a point of interest that the action of the muscular fibres forming one of the coats of the tube tends, when they contract, to force its contents towards and into the cavity of the cæcum. That the mucus is here of assistance in lubricating hardened fæces and helping in their onward passage is past believing, for the contents of the normal cæcum, although designated "fæces," are not even semi-solid and therefore require no such help. I do not consider that there is evidence to justify the belief that the appendix produces sulphuretted hydrogen; in fact, the knowledge that the mucus contained within it is often entirely inodorous is greatly against the theory. Until, however, there is an accurate chemical analysis of the secretion it is impossible to be sure as to whether it may not have some function in the economy.

LECTURE II.

Delivered on Feb. 11th.

ETIOLOGY OF INFLAMMATION.

MR. PRESIDENT AND GENTLEMEN,—Can an inflammation of the appendix sufficient to excite symptoms ever be of a non-bacterial nature? I would venture to answer this question decidedly in the negative. It is my firm belief that every instance of so-called appendicular colic, slight appendicitis, catarrh of the appendix, and a number of other conditions designated by like somewhat vague terms, is in truth dependent upon an actual inflammation of the appendix and that with a bacterial origin.

I am perfectly willing to admit that in some, perhaps many, instances in which an appendix is examined after removal, where symptoms pointing to it have been in existence, bacteria may not be found. But it is to be remembered that most of these are excised after the symptoms have nearly or completely disappeared—in fact, during the quiescent stage. It is therefore quite possible that since the inflammation has passed, the bacteria which induced it may have vanished. On the other hand, an examination of the increasing number of appendices removed

during an attack, and some of these attacks of only a slightly greater severity than a "mild" preceding one, show not only the presence of bacteria but an abundance of infective micro-organisms. It is open for an objector to say that these organisms are present in every appendix, whether it be the site of inflammation or not, and that the bacteria must therefore play little or no part in the inflammatory process when in progress. Granted that the constant presence of bacteria in greater or fewer numbers is true, this fact only tends to strengthen further the supposition that parasites are the essential cause of the inflammation. They are present, they can incite inflammatory processes, and if some starting cause ensues they will produce the condition of distinct inflammation with symptoms.

If it be conceded that all cases of inflammation of the appendix with symptoms are the outcome of bacterial infection, what deductions should be drawn therefrom? First, that it is impossible to say what will be the limits of any given attack, merely a few days' malaise with slight colicky pain referred to the right iliac fossa, or death from septic peritonitis or septicaemia. Secondly, that should the sufferer apparently recover from the attack, there will probably remain, in a now more than ever damaged appendix, bacteria always ready to light up a fresh inflammation on the least provocation. (Fig. 3.)

FIG. 3.

Section of appendix with calculus *in situ* ($\times 25$).

BACTERIOLOGY.

Many varieties of bacteria may be found within the lumen of the appendix, in the walls of the tube, in the lymph formed on its serous surface, in the adherent portions of omentum, in the peritoneal fluid, in consecutive abscess cavities, in distant collections of pus, and even in the blood and remote organs. They may be classified as follows: 1. *Bacilli*.—(a) *Bacillus coli communis* in its various forms; (b) *bacillus pyocyaneus*; (c) *bacillus prodigiosus*; and (d) *bacillus tuberculosis*. 2. *Cocci*.—(a) *Staphylococcus pyogenes aureus*; (b) *staphylococcus pyogenes albus*; (c) *streptococcus pyogenes citreus*; and (d) *diplococcus pneumoniae*. (Fig. 4.)

As to the frequency with which the more common individual organisms are found the following may be taken as a fairly accurate estimate based, as it is, upon the combined results of the investigations of many authorities: (1) varieties of the *bacillus coli communis*, 94.0 per cent.; (2) *bacillus pyocyaneus*, 0.5 per cent.; (3) *bacillus prodigiosus*, 0.5 per cent.; (4) *bacillus tuberculosis*, 2.0 per cent.; (5) *staphylococci*, 1.5 per cent.; and (6) *streptococci*, 1.5 per cent. The *bacillus coli communis* is the only organism which is commonly found alone in cases of appendicitis. Cocci are but rarely present by themselves, though they are more often found in association with the colon bacillus. (Figs. 5 and 6.)

Tuberculosis of the appendix may be primary or merely

part of a general infection of the alimentary tract. In its primary form, which is decidedly rare, it is apt to be very chronic, producing signs and symptoms of a chronic appendicitis. In these instances the mucosa and the submucosa will ordinarily be the parts involved, the serous membrane

FIG. 4.

Calculus from the same appendix as in Fig. 3 showing colon bacilli ($\frac{1}{2}$ oil immersion).

frequently remaining free. Now and then there are seen instances in which connective tissue hyperplasia is the predominant anatomical feature of the lesion, giving rise to a mass which to the naked eye is very difficult to distinguish from a new growth. This hyperplasia is probably the

FIG. 5.

Section of inflamed appendix showing great infiltration of the mucosa and pus in the lumen ($\times 25$).

outcome of a low virulence of the bacillus and a consequent disinclination to caseation and a great increase of newly formed connective tissue in place of it.

Secondary tuberculosis of the appendix is by no means rare and as a rule presents no marked signs or symptoms of its own presence, these being masked by those of the more extensive infection.

CALCULI AND CONCRETIONS.

It may be stated at the outset that these are always formed *in situ* within the lumen of the appendix. Although it is possible that their nucleus may have found its way from the cæcum into the appendix, yet the bulk of the material of the calculus has been laid down within the tube itself. Concretions or calculi may occur in almost any part of the alimentary tract and they may produce no signs or symptoms or they may give rise to most serious consequences in the way of irritation, inflammation, ulceration, perforation, or obstruction. The calculi of the appendix may behave in precisely the same manner as calculi elsewhere in connexion with the intestines. The malignity of calculi, and particularly of appendicular calculi, would seem to depend on one of two conditions, first the presence of virulent micro-organisms within or upon them, and secondly, their movement. If it were possible to have a stationary and non-septic calculus but little harm would result, but as soon as such a concretion is infected with organisms or changes its position, it is liable to produce dire consequences.

The surface of the calculi is usually fairly smooth and they are frequently rounded or elongated in form, occasionally

FIG. 6.

Pus from the lumen of the same inflamed appendix as in Fig. 5 showing colonies of staphylococci ($\frac{1}{2}$ oil immersion)

presenting facets. These three facts would seem to me to indicate that the calculi have been subjected to a certain amount of movement, perhaps caused by ineffectual efforts on the part of the appendix to rid itself of its undesirable contents. But, on the other hand, a calculus may be markedly tuberculated on the surface. This latter condition is associated with a crystalline deposit and is usually observed in those calculi which are stationary and which are found within a distinct cavity in the appendix.

An interesting point in connexion with the formation of appendicular calculi is the question as to whether they can arise without the walls of the tube being separated from them by a distinct space. There can be no doubt, I think, from the observation of fresh specimens, that is before any process of hardening has been employed, that the walls may closely embrace the calculus and that the actual enlargement of the lumen of the tube has occurred in consequence of the growing calculus within it, rather than that the increase in size existed prior to the formation of the concretion.

ACTINOMYCOSIS OF THE APPENDIX.

The actinomyces may attack any portion of the alimentary tract, or the fungus may infect the adjacent organs or distant parts through dissemination from the intestines. That actinomycosis may be a primary lesion of the appendix is now an established fact, though the condition is necessarily a rare one.

A recently recorded case² illustrates the condition as it is usually seen. The patient had for some time been employed as a stable-boy in a hotel and had previously been a farm labourer. He had been the subject of hydrarthrosis of the right knee-joint at the age of 15 years but had made a rapid and complete recovery under treatment. He had lost three or four molar teeth during the past three years. He had long been in the habit of chewing blades of grass, grains of wheat, &c., when not quite ripe. His symptoms began with acute pain in the right iliac fossa, with recurring rigors, frequent nausea, and progressive malaise and debility. On several occasions there was a rise of temperature. The symptoms at first improved under treatment by rest, careful diet, and inguinal compresses moistened with tincture of opium. This improvement was succeeded by lassitude, persistent anorexia, and slight constipation, together with some loss of flesh. On palpation there was no tenderness in the region of the appendix but a small tumour above Poupart's ligament on the right side; it was about from three to four fingers' breadth in the vertical direction and was very hard to the touch. The appendix was removed and on microscopical examination typical actinomycosis was revealed.

One important point in the prognosis of actinomycotic inflammation of the appendix is the fact that there is a great liability for the wounds made, either to drain an abscess or even to remove a non-suppurating appendix, to have a marked tendency to become the seat of secondary infection with the fungus. It is therefore well to bear in mind the possibility of this infection in those instances in which a series of sinuses form after a lesion occurring primarily in the region of the right iliac fossa. In one case under my care these sinuses tracked upwards in the sheath of the rectus abdominis muscle almost to the thorax and downwards behind Poupart's ligament into the thigh and outwards into the lumbar region.

EFFECTS OF INFLAMMATION.

One effect of inflammation is obliteration of the lumen of the appendix. This is entirely an opposite condition to that of perforation. It is in this manner that nature may bring about what is sometimes termed a "spontaneous cure."

FIG. 7.

Section of sclerosed appendix, proximal end, lumen obliterated ($\times 25$).

There is also a natural tendency for the appendix to become obliterated in its lumen as age advances and it is for this reason that acute inflammations of the tube are less common in later life. In order, however, to bring about complete immunity to a recurrent appendicitis it is necessary that the whole of the lumen of the tube should be obliterated. (Fig. 7.) This result is not so very usual, for from attacks of inflammation there

may be obliteration only of a small part of the tube. If this is at the distal portion it leaves the proximal part still in communication with the cæcum and still liable to the invasion of bacteria. If it is at the proximal end it shuts the rest of the lumen off from that of the cæcum and opens the door for the formation of a cyst of the appendix. If bacteria are shut up in the portion of the lumen which lies on the distal side of the obliteration an empyema may result. But take those instances in which, on a series of sections being cut from many parts of the length of the organ and all showing complete obliteration of its lumen, it is somewhat difficult to explain the undoubted attacks of pain, and of severe pain, that some of the possessors of such an altered tube have suffered from. (Fig. 8) A possible explanation

FIG. 8.

Section of the same appendix as in Fig. 7, distal end, a trace of lumen remains ($\times 25$).

exists, however, in the fact that the majority of these appendices are found when exposed to be very closely bound down by adhesions to the surrounding parts and it may be that tension on these peritoneal bands induced by peristalsis or movements of the psoas muscle gives rise to the pain and discomfort. Whatever may be the actual explanation the fact remains that a removal of the altered appendix relieves the sufferer of all his troubles.

The histological appearances of these appendices in which the lumen has become completely obliterated varies considerably in different instances. In most the elements of the lympho-mucosa are to all intents destroyed and their place is taken by a mass of cicatricial tissue. In some sections here and there may be seen remnants of the glands or of the lymphoid follicles. In many the muscular layers seem to be a good deal hypertrophied.

SECONDARY ABSCESES.

I only draw attention to these because I wish to emphasise the possibility of their occurrence at quite late periods after the complete removal of the appendix. I have myself had one case in which no less than five years after the removal of the appendix in the usual manner a secondary abscess formed close to the cæcum at the site of the stump of the appendix. These collections may be due to several causes. One is that a few bacteria are left behind which remaining latent may at a remote period light up a fresh suppuration. Another is that a silk ligature or suture has remained and has been the source of the irritation. A third is that a small portion of gauze has been accidentally left behind in a case in which drainage was required in spite of the removal of the appendix. All these causes are quite apart from those instances in which secondary suppuration occurs as the result of an incomplete operation in which too long a stump of the appendix is left or in which a peri-appendicular abscess has been drained and no attempt has been made to excise the appendix. Cullen³ has recently described an interesting

² Dr. Leon Thevenot: Medical Press and Circular, December, 1902, p. 722.

³ New York Medical Journal, Dec. 27th, 1902, p. 1111.

case in which a retrocæcal abscess developed three years after the complete removal of the appendix and has well illustrated the condition.

EXAMINATION OF THE BLOOD IN APPENDICITIS.

Recently a considerable amount of attention has been given to the examination of the blood as an aid in the diagnosis of appendicitis. While admitting that the hæmatological examination and significance may be carried too far, yet there can be no doubt of its usefulness as a help in diagnosis when employed with due consideration of other signs and symptoms. There are two distinct changes in the blood associated with appendicitis, both of which are very obvious and both have a recognised bearing upon treatment and prognosis. These two alterations are (1) anæmia and (2) leucocytosis.

1. *Anæmia*.—One has been often struck with the intensely anæmic appearance of some patients who have been suffering from toxæmia for many days. Not only is this anæmia apparent in the face of the person, but it is very evident when the blood is minutely examined. In several instances in which poisoning was due to absorption from the products of an infective appendicitis I have found a very marked diminution both in the actual number of erythrocytes and the percentage of hæmoglobin. The suddenness with which these changes may occur is a necessary factor in the importance with which they are to be viewed. There are, of course, conditions causing rapid loss of blood, as ruptured ectopic gestation, which must be carefully excluded. If the lessening of the erythrocytes is very great the proportionate loss in the percentage of hæmoglobin is tremendous, for while the average decrease in the oxygen carriers in instances of appendicitis of any form is about 15 per cent., according to the most recent statistics, that of the corresponding loss of hæmoglobin is no less than 25 per cent. Supposing, then, the fall in the hæmoglobin is between 35 and 50 per cent., whether or no the red corpuscles are correspondingly diminished in number, the question of operative interference becomes an anxious one for the surgeon. In some instances of the repeated attacks of the so-called catarrhal appendicitis there is a certain degree of anæmia, especially in young women and in those where there is chronic constipation. When the blood is examined there is a diminution in the red cells and hæmoglobin but without leucocytosis. I consider that in these cases probably both the anæmia and the appendicitis are dependent upon a disordered state of the alimentary tract and if the condition does not rapidly improve under careful dieting and good hygienic surroundings I am convinced that the removal of the appendix is indicated, as the continued anæmia may really be due to slight toxæmia by absorption from the appendix. It is remarkable how rapid is the return to health in certain of the cases after the removal of the source of poisoning is carried out. I would venture to suggest that more attention be paid to the anæmia arising in cases of chronic appendicitis or at least in those of chronic digestive trouble with suspicion of distinct local lesions of the appendix.

2. *Leucocytosis*.—Of recent years the question of leucocytosis in association with appendicitis has been engaging a considerable amount of attention, and although there are very divergent views as to the degree of importance that can be placed upon the condition yet taken in conjunction with other signs and symptoms the determination of its presence may be of the greatest assistance (1) in the diagnosis of suppuration before operation; (2) in the diagnosis of secondary suppuration after operation for abscess; and (3) in the differential diagnosis of appendicitis from other affections. It is often a matter of extreme difficulty to say in any given case of inflammation of the appendix whether or not a focus of suppuration has formed. It is equally true that in the vast majority of instances in which pus is being produced in the tissues there is an increase in the number and an alteration in the characteristics of the white corpuscles circulating in the blood. It would seem therefore that given a case of appendicitis in which leucocytosis is obvious the surgeon may safely assume that suppuration is in evidence or that the case is one that demands operative interference.

I will cite two examples as types in which a blood count taken in conjunction with a general view of the case distinctly assisted in the diagnosis, and therefore in the treatment, of the lesion. Both are taken from Cabot's excellent review of the subject.⁴ The first case (Case 40, Cabot) is

one in which the blood count showed a progressively increasing leucocytosis which in the end decided the necessity for surgical interference. The age of the patient, a male, was 19 years, and the blood count showed 4,380,000 red cells. The white cells were as follows: on March 25th, at 9 P.M., 15,600, with vomiting, pain, and tenderness; on the 27th 19,500, the patient being comfortable, with no vomiting, and the signs more localised; on the 28th 22,900, there being slight tenderness only; on the 29th 35,300, the bowels moving well, with no symptoms; and on the 30th 32,800, when operation was performed, a large amount of pus being found. This is a typical case and one in which the other signs and symptoms present did not point to the formation of pus and the necessity for surgical interference. The second case (Case 20, Cabot) is one of exactly opposite nature. The patient in this case also was a male who had suffered from appendicitis for 24 hours with a resistant abdomen. On Oct. 23rd the white cells were 20,100; on the 24th at 9 A.M. 14,000, at 4 P.M. 12,000, and at 10 P.M. 13,250 (no operation); and on the 25th at 8 A.M. 8750 (the patient taking liquids every two hours) and at 3 P.M. 9600. Here, although there was a distinct leucocytosis on the first day of the affection, yet the signs and symptoms were but slight, and on the next day there was a rapid fall in the number of leucocytes which seemed to indicate—and that correctly, as the progress of the case proved—that there was no suppurative process in evidence. The number of leucocytes dropped to nearly normal on the third day of the attack.

As has been recently shown by Dr. C. J. N. Longridge,⁵ there is a tendency in those cases in which the infective inflammation of the appendix is so severe as to cause rapid gangrene of the tissues forming its walls for a very marked leucocytosis to be present. Thus, in his published table of 36 cases, in no less than six instances there was a leucocytosis of from 20 000 to over 30,000 and in all the appendix was found on exposure to be gangrenous but not surrounded with pus. I have observed the same in two cases in which on operation the appendix was found gangrenous within 48 hours of the onset of the symptoms and in both of which there was a considerable amount of non-purulent slightly irritating fluid in the peritoneal cavity. Both patients, in spite of washing out of the abdomen, intravenous saline injection, &c., succumbed to an intense toxæmia. One case was that of a strong and active young man, aged 20 years; the other that of a young married woman, aged 27 years, who was robust and healthy.

As to the causation of this condition there is much dispute. Purulent and gangrenous processes both cause a high count of white cells as a rule, that of purulent conditions being fairly easy of explanation, but that of gangrenous more difficult. Virulence of the toxin and the resisting power of the individual have much to do with the degree of leucocytosis. Generally speaking, the more intense the poison and the greater the resistance, the higher will be the leucocyte count.

In both cases mentioned above the subjects were young, apparently in the enjoyment of good health, singularly active, and robust. The onset of the infective process was sudden and the poisoning intense, but their resistance was great. Hence there was a rapid and surprisingly marked augmentation of leucocytes, the count in both exceeding 35,000 within 48 hours of the first indication of the trouble. I think that it is a fact that most of these cases of so-called "fulminating" appendicitis occur in young, active, robust persons who are therefore just those who conform to the conditions of marked inflammatory leucocytosis—namely, intense infection and great resistance.

Unfortunately, in a fair proportion of the cases in which inflammation of the appendix has reached the stage of suppuration and the case can only be treated by drainage there is a great liability for secondary abscesses to form either in the region of the primary mischief or at distant parts. It is in such cases that a blood count may again be of service. Another case taken from Cabot's series (Case 18) illustrates this very clearly. In this case, on Nov. 5th, the white cells were 21,700 (first operation); on the 10th, 21,400; on the 13th, 16,000; on the 15th, 24,400; on the 16th, 20,200; on the 19th, when the second operation was performed and a pus pocket was found, 47,700; on the 20th, 16,700; on the 21st, 13,000; on the 22nd, 10,700; on the 26th, when a third operation was performed, a pus pocket being again found, 30,200; on the 27th, 20,000; and on the 28th, 17,700; on Dec. 4th, 11,900; and on the 26th, 11,300.

⁴ Cabot: Clinical Examination of the Blood, 1901.

⁵ THE LANCET, July 12th, 1902, p. 74.