

APPENDICITIS

THE INFLUENCE OF PATHOLOGY ON SYMPTOMS AND TREATMENT

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WITH SOME OBSERVATIONS ON X-RAY DIAGNOSIS

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My excuse for writing on this hackneyed subject is a case I saw recently, and my reason is that in India the diagnosis of appendicitis has not reached the degree of accuracy found in countries where people live on a 'civilized' diet—and get appendicitis more frequently.

A few nights ago, I was called urgently to see a child. She had been under medical treatment for two and a half days, and as the parents were afraid of operation she had had sulphanilamide and 'Ochsner-Sherren' treatment. I found her showing much toxæmia with a running pulse of 160, a temperature of 102.2, and an acutely tender lump in the right iliac fossa, with general abdominal tenderness. I diagnosed an appendix about to burst and operated within the hour. I found an acutely inflamed appendix which had ruptured into a thin sac of omentum and was about to spread infection all over the peritoneum. I removed the appendix and drained the site and the child recovered, but how much easier and safer the operation would have been two and a half days earlier.

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vacuum taps, in one of which plasma or serum is kept and the other two chambers can be charged alternately with active silica gel during the process of desiccation. Temperatures in these chambers are controlled by circulation of hot or cold water and read by thermocouples. Vacuum is measured by a suitable vacuum gauge.

(c) An electrically heated oven for activating the inactive silica gel in vacuum with a pump.

5. The working of the plant consists of pre-freezing the serum or plasma, regeneration and charging of silica gel, and producing a high vacuum in the desiccator while maintaining thermal control over the frozen plasma or serum and the gel. The end point of desiccation is attained by the maintenance of a vacuum of the order of 200 microns or less for about 12 hours while the temperature of the dry product is raised and kept at 37°C. This produces a dry powder with moisture content of less than 1 per cent and high solubility. The process takes about 72 hours and can be shortened further with more frequent changes of silica gel.

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In the clinical part of my examination for the M.R.C.P. one of the Censors asked me 'What would this lady's lungs look like in a bottle'? I do not know what the lady thought, but I have often thought what a wise question that was, for it is only by visualizing the organs we are treating that we can give rational treatment, and it is with this idea in mind that the present article is written.

Etiology

Though this is generally considered obscure, there are certain facts which have a very direct bearing.

Diet.—This is the important factor. In Wilkie's famous experiments with isolated loops of cat's ileum, the loops full of protein became gangrenous in a few hours, those with carbohydrate developed an abscess or mucocele, and the empty loops became mucoceles.

Many others besides myself have observed the relative rarity of appendicitis among rural vegetarians in India and its frequency among city-dwellers eating a mixed diet, but the most striking evidence I have met was my own experience in Burma when I was surgical specialist there twenty years ago. I was in surgical charge of many more Burmese than British troops, but although in the course of my five years there I removed many an inflamed British appendix, I did not remove a single Burmese one. Main items in the Burmese diet were rice, atta and dâl, and in the British, meat, potatoes and bread. The latter forms of starch are more glutinous than the former and probably predispose to intestinal and appendicular constipation. The prophylaxis of appendicitis is therefore suggested, but I think that most Europeans would rather risk appendicitis than change their diet.

Over-eating.—As already remarked, appendicitis is far more common in the sedentary town-dweller, who does not need most of the rich food he eats, than in the countryman, who puts his more bulky diet to real use. Even if due allowance is made for shortage of civilian surgeons and hospital facilities, I think that after the present war it will be found there has been a decrease in appendicitis in the starved areas.

Constipation.—This depends largely on diet, exercise and sex, while its sequel, the habitual taking of purgatives, by inducing a chronic catarrh of the lower bowel, is probably an ancillary factor. The fact that a concretion so often causes ulceration and perforation of the appendix brings home the importance of constipation, that bane of civilization and blessing of the patent-medicine vendor. If, however, it were of prime importance, appendicitis would be far commoner in women than in men, because the constipation ratio must be about ten women to one man, while the appendicitis ratio is about three men to two women. We therefore conclude that constipation aggravates the condition but does not cause it. Liquid paraffin with a

high-carbohydrate-low-protein diet is a useful prophylactic for cases awaiting interval appendicectomy.

Heredity.—The disease often seems to run in families, though this may be due to dietetic or other factors, perhaps even to the diagnostic inclinations of the medical attendant, but so far no constant familial predisposing anomaly has been discovered, except perhaps the retro-cæcal appendix.

Other diseases.—For some reason, children who suffer from tonsils and adenoids seem very liable, even years later, to appendicitis, possibly because the unhealthy state of these organs is shared by the appendix, which contains a large amount of lymphoid tissue. Typhoid fever, tuberculosis and dysentery are occasional aetiological factors, while thread-worms, round-worms or foreign bodies may be found in the appendix.

Previous attacks.—As pointed out later, a fibrotic, stenosed appendix is obviously handicapped in a fight against opposing organisms and is likely to retain a concretion; it should therefore be removed.

Some anatomical points

Roughly, the appendix may be in one of three positions, in order of frequency:—

(a) 'Normal' (about 50 per cent). The organ has a mesentery and lies free in the peritoneal cavity with the tip pointing towards the spleen.

(b) Retro-cæcal (about 40 per cent). The meso-appendix is very short or absent, the appendix being as a rule directly behind the cæcum, though it may lie on either side of it. The tip points upwards and the organ may be very long.

(c) Pelvic (about 10 per cent). The appendix dips over the brim of the pelvis or lies in it.

At operation the retro-cæcal appendix is commoner than in the dissecting room, possibly because its situation may predispose it to disease. A little reflection will show that each of these positions offers differences in symptoms, signs, spread of infection and site of abscess. An experienced surgeon can often forecast the position and state of the appendix, but even the elect may be deceived, which gives zest to the problem and encouragement to others.

Pathology, with notes on accompanying symptoms

This will be considered under the following heads:—

Catarrh.

Acute inflammation.

Gangrene.

Recurrent appendicitis.

Chronic appendicitis.

Effects of position of appendix.

Catarrh.—We can dismiss this in a few words, as genuine catarrh is part of a widespread

intestinal condition following the ingestion of contaminated food and accompanied by diarrhoea. Its description as a separate entity is based more on analogy with other mucous membranes than on pathological findings. As the owner is unaware of his appendix unless it is in a state of spasm or its peritoneal coat is stretched or inflamed, catarrh in itself is symptomless.

Acute inflammation.—Just as boils begin in the hair follicles or in the sweat glands, so appendicitis probably begins in Lieberkuhn's follicles or in the solitary glands, with both of which the appendix is richly supplied. From here the inflammation spreads rapidly in the submucous layer, causing pressure on the lymphatics and small veins. The appendix begins to swell, and within a few hours the infection has reached the peritoneal coat.

Now, the peristalsis-stimulating nerve of the appendix, as of the rest of the gut, is the vagus, which terminates in Auerbach's plexus between the muscular layers. Inflammatory obstruction of the appendicular outlet, combined with inflammatory irritation of the plexus, therefore rouses the appendix to a fine fury of forcible contraction, which, together with the distension of the organ, causes acute pain. The physiology is not certain, but the pain impulses probably reach the brain *via* the solar plexus and the lesser splanchnic nerve, which it will be remembered connects with the ninth, tenth and eleventh dorsal segments, exactly the level at which the pain is felt.

It is important to distinguish between this early visceral pain and the localized pain which does not begin until the parietal peritoneum becomes affected. The early pain is referred vaguely to the deep mid-abdominal region, it does not vary with the position of the appendix, it comes on in spasms and is associated with nausea and vomiting; localized pressure produces generalized pain and increases the nausea, a point that helps to distinguish the condition from ordinary colic, where pressure brings relief and the patient often holds his abdomen during spasms. These early signs are not always observed, but they are seen at their best in children, and unfortunately are often thought to be caused by a bilious attack. It cannot be too strongly urged and too constantly remembered that an attack of abdominal pain with vomiting, especially in a child, should be looked on as appendicitis until proved otherwise. In my experience, even in the early stage a careful abdominal and rectal examination will generally reveal some localized tenderness, though its absence does not exclude appendicitis, while the pulse and temperature are usually raised slightly, the former more than the latter. Should one operate in the presence of these equivocal early signs? The answer is 'Yes' if there is localized tenderness: 'Yes' if the patient is under fifteen or over fifty, and 'Yes' if the symptoms are obviously severe or increasing. But the point is discussed in more detail later.

Further progress is naturally variable, depending on the ferocity of the attack and the strength of the defence, but in an average acute case the condition at the end of a further 24 hours is as follows: the appendix is intensely red, congested and swollen, about the size and shape of a bent little finger; the mucous membrane is thickened and ulcerated, the wall teems with leucocytes, the now roughened coat is covered with flakes of purulent lymph, and is lightly adherent to surrounding structures. The most serious thing, however, is the threat to the veins, thrombosis of which will cause gangrene, the veins of the meso-appendix being also thrombosed in a severe case. By now the parietal peritoneum is becoming inflamed, producing the so-called 'typical' signs of acute appendicitis, which are, of course, rigidity and tenderness in the right iliac fossa. As the patient's temperature is probably between 99 and 102 and his pulse between 90 and 130 the diagnosis of acute appendicitis is obvious and the treatment, immediate operation, equally so.

If all cases conformed to the above plan, diagnosis would be easy, but 'Nature moves in circles: Art in straight lines', and part of the fascination of our craft lies in trying to find out what Nature will do next. At the stage now reached one of several things may happen. The whole affair may settle down, but the appendix is left with some fibrosis and perhaps some adhesions, so not only is it liable to further attacks, but also it will be handicapped if they should occur. If the case is first seen in the defervescent stage, more than 48 hours after symptoms began, sulphanilamide Ochsner-Sherren treatment is correct. The patient is put in the high Fowler position and given nothing by the mouth except water and sulphanilamide, the pulse and temperature being charted every two hours. If unfavourable signs appear, such as increase of pulse, pain or tenderness, if the patient vomits or seems to be deteriorating, then immediate operation is done. Perhaps Ochsner-Sherren treatment would be less abused—in both senses of the word—if it were more realized that such operative interruption forms part of it.

Another essential part of the treatment is a competent nurse. If all goes well, during the first three days the temperature will show a distinct but diminishing evening rise, and on the fourth the patient may be given a little liquid nourishment. In India this treatment often fills the relations with a fear that the patients will starve to death; they may be reassured if they are told that most people can live for at least three weeks on water, but they are more likely surreptitiously to give the patient a meal. This is one reason for the need of a competent nurse. By the end of a week the symptoms will usually have subsided, and the appendix is removed some two months later, by which time the inflammation and plastic adhesions have disappeared.

The attack may, however, be too severe or the resistance too weak for palliative measures to be successful, or the patient may not have come under skilled treatment; in such cases the appendix becomes more and more oedematous, until the base becomes occluded. Just as in war it is a disaster to be cut off from the base, so it is in the appendix, for the natural line of retreat for the septic contents is cut and the organ becomes distended with pus. As the tension increases, a patch on the anti-mesenteric border near the tip, where the blood-supply is least, becomes completely cut off from its blood-supply and undergoes 'tension gangrene'. Through this weak spot perforation occurs, perforation at the base being commonly associated with a concretion. To revert to treatment for a moment, it is at this juncture that castor oil has caused so many deaths, because it not only makes the appendix blurt out its contents, so to speak, but by increasing peristalsis ensures that the contents are well churned up in the peritoneal cavity.

Perforation.—It is some consolation to the anxious surgeon to know that this disaster is rare during the first 36 hours of an acute inflammation, though in gangrene it can occur within 18 hours. (These figures are admittedly arbitrary, but are roughly correct.)

Classically, the signs of perforation are a sudden sharp pain followed by relief and accompanied by a varying amount of shock. The pulse rate rises suddenly and the temperature falls. After some hours the picture changes to one of generalized abdominal pain with 'board-like' rigidity, a rising pulse and temperature, absolute constipation and perhaps vomiting. Even now the cause of the peritonitis can generally be diagnosed by the position of maximum tenderness, which, taken in conjunction with the history and the other symptoms, is of the greatest help, as it indicates where the incision is to be made. It may be mentioned in passing that, apart from abdominal emergencies, this rigidity may be caused by basal pleurisy, coronary thrombosis, tetanus (quite common in India) or spinal injury. The rigidity of coronary thrombosis and pleurisy affects chiefly the upper abdomen, while that due to hysteria or malingering can be softened by distracting the patient's attention, and that due to gastric crisis is rare in India.

In some cases, as in that related at the beginning of this paper, it is possible, by carefully evaluating the history, symptoms and signs, to diagnose correctly the imminence of perforation. Sometimes a rather indefinite lump may be felt, but unlike the firm, trustworthy lump described in the next section, it is, if not composed of faeces, acutely tender, the muscle over it is rigid and the skin hyperæsthetic; a sort of crepitus may be detected, and the experienced examiner gets the impression that firm pressure would burst the appendix or its omental covering; needless to say, this must never be done. Further, gentle palpation on the opposite side

will often reveal the beginning of rigidity there and also cause pain on the affected side. All these signs point to the urgency of operation. In children below fifteen with acute appendicitis, perforation is *always* imminent unless it has already occurred.

The omentum.—In the adult this indomitable organ loses no time in getting to the seat of trouble, but it is not until after at least 48 hours or more that it is able to form a barrier strong enough to isolate it: hence the danger of the first 48 hours. When its efforts are successful it cannot only wrap up the inflamed organ safely, but can do this with such effect that an abscess and even the appendix itself can be completely absorbed. If there has been an abscess, therefore, and one contemplates doing an interval appendicectomy, it is worth while having an *x-ray* examination made, so as to be sure that the appendix is still there.

In a child the omentum is short, and may not reach the appendix, which is one reason for the urgency of operation; another is that the omentum and adhesions are more tender than in the adult and the inflammation is apt to be more severe.

Old people in general do not spring to action with the alacrity of the young, and this applies also to their omentum. Their pulse and temperature, like their outlook on life, are not easily disturbed, and early signs and symptoms may pass unnoticed. Thus it comes about that there may be no suspicion of appendicitis until perforation has occurred. These cases therefore require great judgment. If, when the patient is first seen, he is unlikely to live, he should be left to die in peace, but if he has peritonitis and a reasonable hope of life (in other words, if the pulse and blood pressure are good, a pulse over 120 or a systolic blood pressure below 75 being sure signs of impending dissolution in these cases), the peritoneum may be drained under a local anæsthetic and vigorous accessory treatment given. In early cases without peritonitis, it is safest to operate, while in late unperforated cases or when there is a lump, Ochsner-Sherren treatment is indicated. A fluctuating lump or a frank abscess is, of course, opened. From all this it will be seen that in old people appendicitis, though happily rare, is a serious disease, and the young surgeon or practitioner is advised to call in consultation a man of established reputation, otherwise he may lose his own.

To revert to the omentum. The clinical sign of its successful activity in a case of appendicitis is a lump, of recent origin, and varying tenderness felt in the right iliac fossa; it should be noted that it is often as low down as Poupert's ligament and sometimes as far out as the loin. The early stage of tentative adhesions, when the omentum is exploring the ground, naturally cannot be felt, the lump not usually being palpable before the third day, by which time it may contain some pus. If this is present in small amount, it is so walled off that it generally

absorbs. For this sort of case, therefore, we can state a rule. If there is a lump, wait; if not, operate. In the former case operation will do just what Nature is trying to prevent, namely, infect the peritoneum, while in the latter it will save it from infection. If, as time goes on, an abscess forms, it should be opened, but no more should be done, as attempts to remove the appendix at this stage may spread infection and prove fatal.

In those difficult cases where one is called out into the country to see a patient—perhaps a person of importance—and will have to leave him with no operating surgeon within call, it is wiser to operate unless the signs of recovery or localization are unmistakable. By this I mean that the bowels are acting normally, the pulse rate and temperature are coming down, there is no generalized abdominal tenderness, and the tongue is getting cleaner. In all cases with signs of spread, or, in these circumstances, even those that appear to be stationary, in all cases with a rising pulse rate, and in all cases of children, operation is the safest treatment. The case of the elderly patient has already been dealt with, but in the surroundings now under discussion the bias should be more towards operation if survival seems probable.

A few words may be said here about acute peritonitis and its treatment. Some members of the modern school advocate palliative treatment, arguing that a drain can deal with only a very small area of the vast peritoneal bed. The truth is that the treatment depends on the cause, and in the rare pneumococcal or gonococcal peritonitis, treatment with sulphapyridine is obviously correct. If, however, as far more frequently happens, peritonitis is due to a leaking viscus the leak must be stopped and an exit provided if much noxious fluid has already collected. If possible the appendix should be removed, a glove drain being inserted to drain the bed for two or three days. If the appendix cannot be removed it should be drained. In cases opened within a few hours of perforation the drain may well be omitted, if the appendix is safely removed. In all such cases intravenous soluseptasine is an invaluable adjuvant, and sulphanilamide may be powdered into the peritoneum and given by mouth. After operation the patient should be kept in the high Fowler position.

Gangrene.—In the limbs or any other organ the cause of gangrene is stoppage of the blood supply. It is also the cause in the appendix, and can happen in various ways, some of which have already been indicated, namely, inflammatory thrombosis of the veins of the appendix, the meso-appendix or both. In these events the symptoms of acute inflammation will have preceded those of gangrene, so they need not be further described.

Now any destructive or chronic inflammation is followed by fibrosis and cicatricial contraction, witness the stricture following urethritis or the

deformities following burns. In the same way, inflammation of the wall of the appendix is followed by stricture, and of the surrounding tissues by adhesions. It is well known that slight congestion of the urethra can cause complete retention of urine in a patient with stricture; in the same way, slight inflammation in an appendix with a stricture at the base can convert the organ into a closed sac. Swelling and tension at the stricture impair the blood-supply to the distal part, the contents rapidly decompose, and the appendix becomes distended, thrombotic and gangrenous. A similar sequence of events can be caused in a somewhat different way by the jamming of a concretion in the base of the appendix, the presence of a concretion and the act of jamming being made more likely by the presence of fibrosis.

The danger of obstructive gangrene lies in its rapidity and in the deceptive mildness of the early symptoms. A previously healthy British soldier when seen at 11 a.m. said that in the early morning he had had a sudden severe colicky pain in the abdomen, after which he had vomited and then felt slightly better; the colicky pain had continued for a few hours, but had stopped by the time I saw him. There was no significant history, his bowels had acted on the previous day and he had felt quite well until his attack. At the time of my examination the temperature was 97.8 and the pulse 88. The tongue was clean and moist and the abdomen soft and flat, but there was a very slight localized tenderness in the right iliac fossa. Rectal examination gave negative results. To my mind the combination of vomiting without diarrhoea preceded by sudden severe mid-abdominal colic, which had now disappeared, leaving behind slight localized tenderness and a slightly quickened pulse, justified laparotomy. I opened the abdomen an hour later and removed a 'normally' placed distended appendix, completely gangrenous and with a hard concretion, the size of a green pea firmly impacted in the base. The history and symptoms of this case tell the story of the pathology chapter by chapter.

I. At that early hour of the day when life is at its lowest ebb and unstriped muscle at its most irritable, the expulsive efforts of the appendix impact the stone firmly in the base. II. The efforts are now redoubled, causing sudden severe colic, awakening the patient and stimulating the vomiting centre. III. The impacted stone cuts off the blood-supply to the appendix, which is thereby doomed. IV. The expulsive efforts of the dying appendix and the impulses carried by its dying nerves become feebler and feebler and finally cease, so colic and vomiting do the same, and the patient feels better. V. The dead appendix irritates the parietal peritoneum and causes local tenderness, while its toxic contents raise the pulse rate. VI. Operation. VII. Recovery. So the story has a happy ending because of the episode in

chapter VI, but had this episode been delayed by even a few hours, the appendix would have burst, and although the end of the story would have been more exciting it would have probably been tragic.

Shortly afterwards I saw a similar case, but the pain and tenderness were more vague and the pulse was 50. I put him to bed and ordered two-hourly pulse and temperature records; he was quite well next day and has remained so. He had indigestion.

It will be noted that in the second case even after some hours there was a lack of localization and a slow pulse, though this happened to be exceptionally slow. In spite of the textbooks I have found the pulse a most valuable guide in acute abdominal conditions. It is generally quickened in gangrenous appendicitis, but unfortunately not always. To sum up; gangrene of the appendix is an emergency of the first order, its symptoms and signs are few, but they include sudden severe colic and vomiting, generally a quickened pulse, and to the careful examiner who does not forget to examine the rectum, some localized tenderness. In doubtful cases a delay of two hours is permissible, but if there is still doubt it is wiser to operate. Most patients would rather have an operation than a post mortem.

Mention of delay and doubtful cases recalls the subject of leucocyte counts and other aids to diagnosis. How often does one see the inexperienced, undecided surgeon relying on them instead of on himself? A leucocyte count has its uses, the chief of which is to distinguish between an inflammatory condition such as appendicitis and non-inflammatory one such as ureteric colic, but a skilful clinician will generally make the distinction at the bedside, and it must never be forgotten that the most fulminating and gangrenous conditions may be associated with a normal white count or even with a leucopenia. Aids to diagnosis are not an excuse for lack of courage or lazy thinking and they have only a subordinate place in abdominal emergencies.

Recurrent appendicitis.—This is not the same thing as chronic appendicitis, and, as its name implies, it consists of a series of subacute attacks which leave behind them a varying amount of fibrosis or cicatricial contraction; progress and symptoms naturally depend on the tissues affected, for instance, a stricture of the appendicular wall does not produce the same pathological or clinical picture as morbid adhesions to the Fallopian tube. The beginning—or the end—of the disease may be an acute attack or even an abscess; fibrosis and adhesions are specially apt to follow the latter.

There is the further complication of concretions, which are frequent inhabitants of an appendix partly occluded by fibrous tissue. If these main conditions, namely, stricture, adhesions and concretions, either alone or combined, are borne in mind it is often possible to visualize the pathology from the symptoms.

In simple stricture any flare up is likely to prove serious because of the risk of appendicular obstruction and consequent gangrene, although in recurrent cases the omentum can often prevent a cataclysm. Adhesions most commonly cause binding down or kinking of the appendix, with consequent partial obstruction and attacks of colic. At different times I have found the appendix adherent to the liver, the small intestine, the large intestine, the ovary, the presacral nerve, the uterus, the Fallopian tube, the ureter, the bladder and the sac of a hernia; from which diverse lesions it will be easily realized that a variety of symptoms can occur.

The presence of concretions gives rise to the very common symptom of appendicular colic; the organ naturally tries to—and often does—get rid of these unwelcome intruders, so it goes into paroxysms of peristalsis in order to do so, arousing the characteristic sensation of colic and nausea; it seems probable that, through vagus and sympathetic stimulation, appendicular colic also causes a certain amount of gastric and duodenal disorder, but this is more characteristic of true chronic appendicitis, to be discussed in the next section.

When an acute attack supervenes on a 'recurrent appendix' the question of treatment may be extremely difficult to decide and, even if the surgeon thinks that conservatism is indicated, it may need more courage for him to hold his hand than it would for him to operate. In these cases one's thoughts generally run somewhat on the following lines:—

'The patient has survived previous attacks without operation, so will probably survive this one; there must be adhesions round about, which will localize any inflammation, so a peritoneal disaster is not likely; I think I'll wait, and remove the appendix in a few weeks' time. . . . On the other hand, a fibrotic appendix is more likely to get obstructed than a healthy one, so it may go gangrenous or rupture, and of course in a couple of months' time he'll say he is perfectly well, so he may refuse operation. . . . I think I'll examine him again.' In India there is the further difficulty that if a doctor gets a name for advising operation, his patients are apt to seek advice elsewhere, and we all know the patient who at the mere mention of an operation 'Must ask my relations'; which means that he goes off to another practitioner—generally unqualified—who gets the credit if he recovers. If not, the patient often comes back praying for operation when it is too late, as no wise surgeon will open a hopeless abdomen.

The problem may be made easier by the fact that these recurrent cases often call one in after the worst is over, 'because I've had these attacks before, but they've never lasted so long as this, do you think it might be appendicitis?' The indications for delay and an outline of the Ochsner-Sherren treatment have already been given, so need not be repeated. On the other hand, the problem may be more serious, because

'This is the worst attack I've ever had, doctor,' says the patient, and promptly hiccoughs, retches or vomits, all signs of peritoneal involvement, and consequently calling for operation.

Many cases lie between these extremes, and a knowledge of the principles already outlined, together with a clear visualization of the pathology and its probable progress, form the best guide to treatment. We therefore see that a good surgeon must be a good pathologist, a good physician and something of a psychologist, so that he can judge every case from every point of view. But a recurrent appendix must come out before the next attack.

Chronic appendicitis.—All surgeons and some pathologists can find something wrong with an appendix that has been removed, but the pathology is complicated by the fact that as years go on the appendix tends to fibrose, and Keith states that by the age of 70 half mankind have a fibrotic appendix.

Although some gastro-enterologists are beginning to question the existence of true chronic appendicitis, perhaps as a swing-away from their former over-incrimination of a frequently innocent organ, there are two distinct types of true chronic inflammation, which might be called the atrophic and the hypertrophic. The former, as just pointed out, is more or less physiological for about half of humanity; it begins at the tip and works to the base. When doing a hysterectomy or other abdominal operation on a patient over 50, I have several times found the tip of the appendix fibrotic and the rest of the organ normal, but I have never had the chance of seeing the same appendix years later. If I had, I should probably have found the whole organ fibrosed. Clinically the condition is not important though it may give rise to some dyspepsia and may, of course, be complicated by other lesions. It is my practice to remove an appendix whenever I see it atrophic.

The hypertrophic type is much more interesting. It occurs in younger people, in my experience more often in women than in men, and is often retro-cæcal. The tip of the appendix is frequently bulbous and tender and there are no morbid adhesions to other organs. The essential lesion is a chronic inflammation of very low grade followed by a sort of hyperplastic fibrosis: it begins in the submucous coat and later involves the mucous and muscular layers, the lumen being occluded in the former case and enlarged in the latter. The process also affects the nerve plexuses of Auerbach and Meissner, which may proliferate very markedly (Masson), and it is a pleasing deduction that this is the cause of the symptoms, which are those of the cholecystitis or peptic ulcer type, but without relation to food. The pain is often brought on by exercise or mild constipation and may be accompanied by mental depression. On examination there is some tenderness over the appendix, masked if it is retro-cæcal, and pressure may evoke nausea. The diagnosis is best made by

x-rays and treatment is appendicectomy through an incision large enough to allow an exploration of the whole abdomen.

We therefore come to the following conclusion : In patients below 40 with persistent abdominal discomfort suspect the appendix, but do not condemn it without convincing evidence; in patients over 40 consider also malignant disease, especially if the symptoms are of recent origin.

Effects of position

Normal position.—The appendix is nearer the surface than in other positions, so physical signs will be clearer and more typical. Should perforation occur, general peritonitis is likely because the organ lies in the general peritoneal cavity. An abscess tends to point anteriorly, can generally be felt and may cause surprisingly few symptoms.

Retro-cæcal position.—This presents difficulties both in diagnosis and at operation, the cardinal sign of rigidity being neither frequent nor marked. As the appendix lies on or near the ilio-psoas muscle, rigidity occasionally manifests itself as a limp when the patient walks in. It can also be detected by the simple expedient of straightening the right leg, which is often kept flexed. A bi-manual rectal examination is of great help. It is a comfort to know that although a retro-cæcal appendix may be hard to diagnose it is not so dangerous as the other kinds because it is shut off from the peritoneal cavity. Should an abscess form it is generally lateral to the cæcum and may point in the loin.

Pelvic position.—On rectal examination, tenderness and perhaps a mass with lower abdominal tenderness are the cardinal signs, and in addition the patient may complain of dysuria, dyschesia or dysmenorrhœa if the inflamed appendix happens to involve the bladder, rectum, uterus or adnexa. In pelvic peritonitis low abdominal rigidity and tenderness may be accompanied by diarrhœa. It is dangerous to confuse the condition with ureteric colic and to waste hours or even days in accessory examinations. Once again, a careful enquiry into the why, when, where and whither of the pain, accompanied by a thorough clinical examination, which includes the rectum, will usually solve the problem. In cases of doubt an injection of 1/50th of a grain of atropin should be given; if the pain is due to ureteric colic the atropin will relieve it within half an hour, about the time it takes to get the theatre ready. Although urine examination should always be done, it is not so helpful as one might expect, because many cases of renal or ureteric colic show no obvious hæmaturia or other gross urinary change. It is perhaps worth remembering that a skilled radiologist with good apparatus can do a pyelography in less than an hour, though this is not advised as a routine procedure. If a pelvic appendix forms an abscess, it often points into the rectum.

Differential diagnosis

Acute appendicitis.—A temperature of 103 or over in an adult is against this although it does not exclude it, but pyelitis, diaphragmatic pleurisy, liver abscess, malaria or enteric is more likely, and that rather elusive entity known as gastro-intestinal influenza is always a possibility. The detection of pyelitis may be difficult, but apart from the urine changes and the symptoms there is generally tenderness in the loin on deep inspiration. Pyosalpinx can be distinguished because it is bilateral, there may be a vaginal discharge, and the educated fingers can feel the swollen tubes in the posterior fornices, but it may cause difficulty. Ectopic gestation is easily confused with acute appendicitis if there is no history of menstrual irregularity, but a boggy mass can usually be felt *per vaginam* and the patient feels pain when the examining fingers move the cervix—a most valuable sign. But the treatment is the same, laparotomy.

In patients over 50 the commonest causes of recent severe flatulent dyspepsia are coronary occlusion and gallstones, both of which are often accompanied by vomiting. The detailed diagnosis of coronary disease is beyond the scope of this already long paper, but it should be suspected if there is dyspnoea with retro-sternal pain, pallor and sweating. As already mentioned, gastric crises are rare in India.

Recurrent and chronic appendicitis.—As radiography is essential for accurate diagnosis of these conditions, it will be considered by Captain Galstaun, but amebic dysentery, spastic constipation, tubercular peritonitis or adenitis (particularly in children), windy or tubercular cæcum, spinal caries, peptic ulcer, gallstones, jaundice, vomiting of pregnancy, cancer, and, finally, morbid interest in one's own insides have to be remembered. The last-mentioned can be diagnosed when the patient comes up with a written or (worse) a typed list of symptoms, with perhaps a sheaf of prescriptions and laboratory reports. These patients are often childless, but if the obvious remedy cannot be applied they may benefit by psychotherapy; further, they are often rich, so form a great temptation—and a frequent source of income—to the unscrupulous. From our present point of view, unless clinical and x-ray examinations give unequivocal evidence that the appendix is the cause of the trouble, and the patient can be convinced that it is, operation will benefit neither patient nor surgeon.

Complications

General peritonitis, sub-phrenic and pelvic abscess are obvious complications; further, infection may spread from the appendix to the lymph glands, which may form a retro-peritoneal abscess, or into the portal blood stream causing multiple abscesses in the liver (suppurative pylephlebitis). In one case of this that I saw, the tragedy was a double one, because the

patient's widow committed 'suttee'. Acute generalized septicaemia is a rare complication, although the appendix is often incriminated as being a focus of chronic sepsis.

In a mildly septic case, particularly in a fat person or a woman, the great care must be taken to prevent thrombosis of the saphenous, femoral or iliac veins. As it may cause pulmonary embolism the condition is a dangerous one. It should be suspected if the patient's temperature rises after the first week or ten days, and there may be some tenderness over the saphenous or femoral veins with perhaps œdema of the foot. Since abolishing the use of a pillow behind the knees for more than an hour at a time, making the patient move his legs as soon as he comes round and keep on moving them and his body several times a day, I have not seen a case. A simple appendix case can turn on his side within a few hours of operation. Femoral thrombosis is rare before thirty and almost unknown before twenty. It may be asked, 'What about the high Fowler position?' The answer is that the patient can still move his legs and turn partly on his side, and the pillow or Lawson Tait rest behind the knees can be moved, or replaced by a board put across the bed as a foot-rest.

Paralytic ileus deserves special mention because of its danger, its preventability and the fact that it is apt to affect the middle-aged, the well-nourished and the mildly alcoholic, in other words, the 'important' patient, whose demise may be as tragic for his surgeon as it was for himself.

Apart from this the aetiology is not certain, but ileus is likely when the appendicular inflammation has been severe and the peritoneal reaction marked, or when there has been much handling or exposure of the gut at operation. For several years now it has been my practice at all abdominal operations never to allow more than a few inches of gut to be exposed at a time, and since keeping carefully to this system, I have seen much less post-operative ileus; the old method of wrapping up yards of gut in a hot towel laid on the abdominal wall is an invitation to ileus that will often be accepted.

In patients of the kind described above, and whenever ileus is expected, 10,000 units of anti-gas-gangrene should be given intramuscularly on the table and repeated if necessary for the next two days. A laxative pill on the night of operation followed by a small enema in the morning also gives great comfort.

If ileus does occur, there is no need for panic, as most cases get well, the prognosis being good if the pulse remains below 90, but bad if it remains above a 100. If the symptoms come on early and suddenly, they may be due to acute dilatation of the stomach, the treatment of which is a gastric tube left in position for many hours, aspiration and lavage being carried out through it. Ileus should never be confused with obstruction due to adhesions or kinks, because ileus comes on within 60 hours of

operation, while obstruction does not begin until eight or ten days after operation.

In early cases of ileus, a full dose of eserine or prostigmine and pituitrin followed by an enema generally gives relief. Later treatment depends on circumstances and, as with secondary uterine inertia, is more likely to be successful after a rest of several hours under morphia and atropin. If the general condition is good and there is no nausea or retching, castor oil, with an enema four hours later, should always be tried before further measures are adopted; these are fully described in the textbooks, so need not be detailed here, the underlying principle being to reduce sympathetic and increase vagus activity by such drugs as acetylcholine, prostigmine and pituitrin, to combat toxæmia, to keep the patient supplied with fluids, to support the heart and not to 'flog the tired horse'. A spinal anæsthetic is a better and more logical last resort than enterostomy, which will seldom achieve what a rectal and duodenal tube cannot.

Treatment

Conservative treatment and its indications have already been discussed, so we need consider only a few points about operative technique. The incision is a subject of interest and controversy, so I give my own experience. Twenty-five years ago I was a sincere advocate of the McBurney muscle-splitting incision; finding that it gave a limited exposure, took rather a long time and could not be readily enlarged, I tried the Morison muscle-cutting incision, but was not satisfied that, for what generally proved to be a simple operation, it was necessary to inflict such trauma on the abdominal wall. I then started using Battle's para-rectal incision, which has the advantage of bringing one down on a 'normally' placed appendix. But the nerves to the rectus muscle cross it, so one may be cramped for room; cutting one nerve, usually the eleventh dorsal, does not seem to matter, but to cut more is to invite an incisional hernia from paralysis of the rectus. However, I used it for many years, and once even removed a left ovarian cyst through it. I then began to employ spinal percaïne or a really good anæsthetist, so obtained really good relaxation of the rectus muscle, since when I have found nothing to compare with the paramedian incision. It can be indefinitely lengthened without harm, it gives good exposure and it heals strongly. Should there be any inaccuracy in the diagnosis, it avoids the loss of time and reputation caused by making two incisions. As a rule it is unsuitable for a case of frank abscess, the incision being made where the abscess is pointing.

The actual removal of the appendix proceeds along classical purse-string lines, but it is unnecessary to carbolize the stump, and in the 'interval' operation I first ligature the meso-appendix with the purse-string stitch, thus drawing it up to the cæcum and covering the raw area. Occasionally, with a long adherent

retro-cæcal appendix, it is easier to divide it first from the cæcum and dissect it out from base to tip. Most difficulties are caused by an inadequate incision or a bad anæsthetic. One of course takes advantage of what one hopes is a unique opportunity and examines the other viscera, dealing with any lesions found; the paramedian incision makes this easier.

While closing the wound I like to powder it, especially the subcutaneous fat, with thiazamide, and for sewing up the skin I have a weakness for a subcuticular stitch, which may have some psychological value, as a patient with a neat scar attributes it to a careful surgeon. Throughout the operation, indeed throughout any operation, gentle handling of tissues, perfect hæmostasis, and accurate approximation of divided structures must be observed, and will be rewarded by perfect healing. These are more important than speed, and the surgeon with one eye on the students and the other on the clock has no place in the modern operating theatre.

A final word about treatments with a name. Because of Ochsner-Sherren sulphanilamide, blood transfusion or some other treatment is fashionable, it does not follow that the surgeon has done all that is necessary if he prescribes it in the wrong case. Now, as always, treatment should be founded on knowledge and dictated by experience. Some forms of treatment come to stay, others are replaced by something better, and the rest survive only so long as faith in them endures.

When I was a student, the Sippey diet was considered a specific for gastric ulcer and the Weir-Mitchell treatment for neurasthenia. The latest edition of a famous textbook of medicine mentions neither of these names, but the index devotes a column and a half to vitamins. One wonders. . . .

Radiology in appendicitis

Indications.—Radiology is not to be thought of in acute appendicitis, and is but rarely needed in subacute cases, though in some instances, when inflammation of the uterine adnexa cannot be excluded clinically, an *x*-ray examination of the appendix may be helpful.

It is in cases of recurrent and chronic appendicitis, particularly those associated with chronic dyspepsia, that *x*-ray examination finds its fullest scope. The importance of a full radiological survey in such cases cannot be exaggerated. The gall bladder should be examined by cholecystography, the liver being screened *en passant*. On the following day a complete opaque meal examination can be done. It has been my experience in India that in a considerable number of the patients sent for *x*-ray examination for chronic dyspepsia, the symptoms are due to amœbiasis. The value of screening the liver is shown by the following case which I saw recently. Chronic appendicitis was suspected and the above routine carried out. On screening the liver I found it distinctly enlarged;

there was marked diminution in the movement of the right side of the diaphragm, with partial obliteration of the right costo-phrenic sulcus. The opaque meal showed some spasticity of the colon. Although the patient's stools were negative I suggested amœbiasis as the cause of this trouble. All signs and symptoms cleared up under emetine, and there is no doubt that *x*-ray saved the patient from an unnecessary laparotomy.

Preparation.—As a corked bottle cannot be filled, so an appendix with the proximal part of the lumen blocked with mucus or fæces cannot. The patient should have an aperient such as cascara evacuant or pulv. glycyrrhizæ co. the night before, and a hot (about 110 degrees Fahrenheit) high saline enema early on the morning of the examination. This *must* be efficient. Aperients that cause gas, such as castor oil, should not be used.

Examination.—The stomach and duodenum should first be examined to exclude (or otherwise) peptic ulcer and duodenitis. Any other condition in this part of the bowel should also be looked for. Any of the well-known proprietary brands of barium emulsion may be used—they are all excellent. I have found no advantage in using such additions as buttermilk in the opaque food. In many cases this meal alone will fill the appendix.

The stimulus of epsom salts, one to four drachmas in three to four ounces of water, according to the methods of Czepa or Cambies—the former in the meal itself and the latter two to three hours after (preferred)—makes filling certain in cases where the lumen is not obliterated, particularly when in doubtful cases the procedure is repeated. As already mentioned, it must be borne in mind that, after the age of 50, the appendicular lumen tends to stenose, so that non-filling in such patients is not a matter of the same importance as in younger subjects. A method popular in France is to use a smaller quantity of the opaque emulsion, 100 c.cm. followed by 2 c.cm. of castor oil. Its advocates claim this method to be as successful as the epsom salts method.

Whatever the method used, *the normal appendix should fill at seven hours, if not before*. At this time there is some meal left in the terminal ileum, so the ileo-cæcal junction can be studied. It may be necessary to eliminate such pathological states as ileo-cæcal tuberculosis, regional ileitis (Crohn's disease), or malignant disease.

The normal five hours' examination for stomach or duodenal residues should not be omitted. After this the patient should be given a pappy, bulky meal, such as spaghetti and a milk pudding. At ten hours the terminal ileum should be empty; this is referred to later. If the appendix has filled at this time, the patient should be further examined at 24 hours and for some time after the cæcum has emptied. If on the other hand the appendix has not filled, then a

second meal should be given. In rare cases a third one may be necessary at 24 or 36 hours.

The importance of varied and adequate compression (German 'Dosierte kompression') in examination of the caecal region and appendix cannot be overstressed. I have often seen cases in which, without such compression, the appendix would not have been visualized, but in which and with such a compression, a beautiful delineation has been obtained.

A properly designed compressor will usually enable the radiologist to separate the appendix from overlying bowel. Because of the ease with which the patient can be rotated to any requisite position, it is usually convenient to examine opaque-meal cases in the erect posture, but in examining the appendix, particularly when the caecum is low, it is often necessary to have the patient supine.

Radiological signs.—These may be divided into direct and indirect.

Direct signs.—Of the normal filled appendix the shadow is usually 8 to 10 cm. in length and 2 to 4 mm. in width. It is nearly always curved in some direction. A retro-caecal or peri-caecal appendix should be searched for, and any variation in length or calibre looked on with critical eyes. Anatomical variations or non-rotation of the gut or non-descent of the caecum may cause abnormal positions of the appendix. I recently had a case of inverted caecum in a heavily-built patient; the appendix was at the upper end of the caecum, lying transversely and adherent to the posterior abdominal wall above the umbilicus. Foreknowledge of this odd circumstance was of inestimable help to Colonel Williamson when he came to remove the appendix.

Except for some constriction normally seen proximally which is *not* pathological, the lumen should be regular. Other irregular constrictions or kinks should be noted and duly judged. A bulbous, Indian club type of tip is not normal. If definite, it is always pathological. A filiform appendix usually means constriction consequent on chronic inflammation. The presence of soft concretions, though in itself not important, becomes so when indicating bulges in the normal contour. In this connexion it must be stressed that irregularity of the lumen, to be of diagnostic value, must be constant. Such irregularities may be due to peristalsis, which can be watched, the observations being helped, if need be, by palpation and taking a series of small skiagrams. If the irregularity is due to stenosis, or to a necrotic or inflammatory bulge, it will be constant. Before the advent of pyelography, I once examined a case with a shadow the size and shape of a date stone in the right iliac fossa, in the position of the right ureter. The patient's symptoms suggested renal colic, but at operation the calculus was found in the appendix. Peristalsis is seen in the appendix; if not, the cause must be looked for. Delay in emptying, after the caecum is empty,

is considered by French authors as a sign of prime importance in chronic appendicitis, the reason being a fibrosed wall. On the other hand, segmentation of the meal in the appendix is usually the result of peristalsis and is of no importance *per se*.

The normal appendix should be mobile. Occasionally such mobility may be restricted as the result of a short mesentery. Fixation at the tip, or definite kinks, suggest adhesions. Very rarely one sees the 'controlling' appendix of Arbuthnot Lane, where the appendix is adherent across the terminal ileum, fixing it down to the posterior abdominal wall and causing ileal stasis or even obstruction. A common adhesion is between the terminal ileum and the inner border of the caecum, with the appendix somewhere in the angle between the two. Appendicular inflammation here would tend to spread to the peritoneal coats of both. Tenderness directly over the appendix is important, but it must be carefully checked by comparison with other sites.

Indirect signs.—Non-filling of the appendix when the technique has been properly and persistently carried out, in subjects below middle age, must be regarded with considerable suspicion. I have, however, searched for appendices which, unknown to the patient, had been removed, and, conversely, on three occasions I have seen perfectly-filled appendices which had been 'removed'. The lady owner of one of these was most indignant at my discovery and took a deal of convincing.

McLean of Glasgow, followed by Harnett and myself, has shewn the importance of a ten-hour residue in the ileum after the five-hour 'motor' meal of a bulky nature. This positive gastro-ileal reflex, while not definitely pathognomonic of appendicitis, is strongly suggestive of some intra-abdominal chronic inflammatory process. It was present in 98 out of 101 cases in my series, proved at operation.

Though this ileal stasis may be due to mechanical obstruction by bands of adhesions over the terminal ileum, it must be regarded in the majority of cases as a reflex phenomenon. The purely gastric stasis described by Barclay in these cases cannot be said to have the same value, as it may have other causative factors, even habitus.

In the absence of a filled appendix, fixation of and tenderness over the *caput caeci* are of diagnostic value, as is an easily elicited caecal spasm.

The dysenteries may cause considerable confusion in diagnosis. Any case with proved dysentery, or radiological appearances in the colon suggestive of dysentery, may show either a non-filling appendix due to spasm or to mucus in the lumen, or that type of appendix seen when dysenteric catarrh has caused irregularity of the lumen. Such an appendix may also be tender on pressure. It is difficult or even impossible

to differentiate such signs from those due to appendicitis *per se*, so the radiological diagnosis will be in doubt. In such cases, unless the appendix is incriminated by overwhelming clinical evidence, it should be spared. When there is real doubt and the case is not acute, laboratory and therapeutic (*e.g.*, emetine) tests may decide the matter.

It will be obvious that radiological evidence in chronic appendicitis, as in many other diseases, must be carefully weighed with all the other findings, clinical and laboratory. It is only by such consideration that a correct opinion can be arrived at, and that confession of failure in diagnosis called 'exploratory laparotomy' avoided.

Medical News

WOMEN'S BRANCH OF THE I.M.S. GRANT OF COMMISSIONED RANK

In their *communiqué* dated 13th January, 1942, the Government of India announced their decision to recruit women medical graduates to the Indian Medical Service with relative rank only. They are now pleased to announce that officers so recruited will be granted Commissioned rank from the date of their appointment in the Indian Medical Service in the same way as other officers of the service.

THE MEDICAL PRACTITIONERS' CO-OPERATIVE SOCIETY, LIMITED, BOMBAY

THIS Society is a Co-operative Society, which was started at the outbreak of this war, because of the extensive profiteering and adulteration in drugs that was taking place in Bombay.

They supply medical requisites to the members of the medical profession, at prices fixed according to the by-laws of the society and in consultation with the assistant registrar of co-operative societies without any profiteering or adulteration.

We have recently received a copy of the proceedings of the last annual general meeting. There are 250 doctors as shareholders of the society.

ABSTRACT OF THE MINUTES OF THE BENGAL COUNCIL OF MEDICAL REGISTRATION, DATED THE 11TH AUGUST, 1942

THE Council noticed with regret the delay in the amendment of the Bengal Medical Act and also the delay in the orders relating to the improvement in the Licentiateship course.

The Council noted that, as recommended by them at their previous meeting, the State Medical Faculty of Bengal was moving the Central Government for the inclusion of the M.M.F. qualification of the Faculty in the Schedule of the Indian Medical Council Act.

The Council approved the recommendations of the Special Committee to provide for extra students, under certain conditions, in the recognized medical schools other than those in Calcutta and Chittagong, with a view to provide against a falling off in the number of medical school students.

LABORATORY ASSISTANT AND RADIO-GRAPHERS FOR ARMY

(NEW TERMS OF APPOINTMENT)

THE Government of India have recently considered the question of an improvement in the terms of appointment of laboratory assistants and radiographers for the Army with a view to employing better qualified recruits. They have decided that, in future, candidates for appointment should be science graduates and should

be appointed in the rank of warrant officers, class I, on a pay of Rs. 100-10-130, *plus* free single quarters (or compensation in lieu thereof), free furniture, conservancy water and lighting and free rations as for Indian troops.

Persons already in government service who volunteer for service as laboratory assistants or radiographers may draw the civil pay of their substantive civil appointment, *plus* 25 per cent of that pay as a compensatory allowance while serving in India and 50 per cent when serving overseas, in lieu of military pay and allowances, if the former are more favourable.

GRATICULES

IN many types of measuring instruments mechanical methods in which vernier and micrometer scales were employed are now being replaced by optical methods in which the standards of measurement are provided by gratitudes. These are the cross-lines seen in surveying telescopes and other instruments. This replacement has largely been made possible by the development of special photographic methods in the laboratories of the British Scientific Instrument Research Association for the reproduction of gratitudes, and accurately divided circles bearing circular measuring scales.

Prior to the development of these methods it was necessary to rule each circle or graticule individually. This ruling was carried out by means of a diamond on the uncoated glass surface, or by a steel tool which cut through a layer of resistant material spread over the surface, thus exposing the underlying glass which could then be etched where the rulings had been made. Both these methods are subject to severe limitations. In the first place, by the ruling processes it is difficult to obtain lines with abrupt ends or to stop lines short at a point of intersection with another line. Under the high magnification to which gratitudes are subjected any gap or overrun becomes plainly visible. In the second place, a complicated graticule is exceedingly difficult to produce by any method of ruling and etching.

In the photographic method of graticule production a master of the graticule is drawn which may be a hundred times the required size. Sharp edges can be given to the lines of the master and all spacings can be accurately proportioned. From this master, reproductions can be easily and rapidly made with the elimination of all capricious and uncontrollable operations. One important feature of these gratitudes is that, although prepared by a photographic process, the transparent portions of the finished graticule are devoid of any film, thus eliminating the optical defects which arise in using ordinary photographic emulsions of silver halides in gelatine or collodion.

The use of the photographic process enables complicated gratitudes to be reproduced with ease, results in economy of production, and, as the processes involved are controllable, permits of a production time-table. When circles or scales so made are used for purposes of measurement, the brilliancy of the image seen, the opacity of the graduation marks against a bright background, and the large magnification employed, make it possible for readings to be taken with great ease and precision.