THE FALLACY OF X RAYS IN ABDOMINAL DIAGNOSIS.*

BY

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WE flatter ourselves that we live in the age of scientific medicine. No one would wish to belittle the value of scientific methods, but there is a real danger that in our quest for the precise and the scientific we are tending to neglect the practice of medicine. Notwithstanding all the aids which science can give there still remains the personal factor—call it judgement, intuition, or what you will; medicine is still essentially an art. In recent years laboratory methods have been developed to such an extent, and their precision is so alluring, that we are apt to forget the simple truth that, medicine being an art, a diagnosis cannot be made in a test tube.

The advent and evolution of the x rays has added a valuable diagnostic method to the surgeon's armamentarium, but it is by no means an infallible one. After all, radiology is but an aid to diagnosis, and not a substitute for clinical observation. We are far too ready to accept as gospel the diagnoses which are made for us in the laboratory or in the x-ray room, sometimes, I fear, to the exclusion of clinical examination. In cases of fracture it is not unknown for a house-surgeon to say, quite openly and without blushing, that he has not made a diagnosis, but has sent the patient to the radiologist for a report. This is quite wrong. We should make our own diagnosis before we call in the help of the radiologist to confirm it. We should not be slaves to the laboratory. Laboratory investigations are good servants but bad masters. As the Americans have pithily put it, "Don't let the radiologist wag your tail."

In connexion with radiology, especially in abdominal work, there are two great fallacies of which we must beware. First, the fallacy that radiology can be a substitute for a careful and thorough clinical examination. In diseases such as gastric and duodenal ulcer, in which physical signs are often absent, it is very tempting to have a radiograph taken without obtaining the detailed and exact history of the case, which is so essential for diagnosis. Secondly, the assumption that there is such a thing as a radiological diagnosis is a fallacy. A radiological diagnosis, as such, does not exist. Apart from the clinical signs and symptoms a proper diagnosis is impossible. Radiology is not a final court of appeal; it is part only of the considerations on which the diagnosis is based. The radiological findings should fit in with, and agree with, the clinical signs and symptoms. If they do not do so, we had better start afresh and review the clinical findings to see if we have missed something or overrated the importance of some sign or symptom.

We should beware of regarding the radiologist's report as infallible. We are apt to be misled by the saying that the "camera cannot lie." Even if this were true, we must remember that a radiograph is not a photograph, but a shadow, and may be distorted by the angle of exposure of the film. Further, the shadows have to be read in the light of past experience, and there is ample scope for error in the interpretation thereof. The radiologist may guess, draw inferences not warranted by what

he has actually seen, and then jump to conclusions which may be misleading, and may suggest an erroneous diagnosis.

The chief fallacies which lie in wait for the surgeon may be grouped under four heads:

1. Fallacies incidental to x rays.
2. Fallacies due to technique.
3. Fallacies of misdirection.
4. Fallacies of interpretation.

1. FALLACIES INCIDENTAL TO X RAYS.

Radiography is often used to estimate the degree of intestinal stasis by observing the time taken for a barium meal to pass through the alimentary tract. Repeated observations have taught me that this is a most fallacious and misleading method of estimating intestinal stasis. A more reliable method is to note the time that elapses before a dose of charcoal is passed completely per rectum. Comparison of the two methods shows that radiology very greatly exaggerates the degree of stasis which exists. In 150 consecutive cases investigated, charcoal was passed in an average of forty-two hours, whereas in the same patients the barium meal was not passed for an average of sixty-eight hours—an exaggeration of 60 per cent. Why there should be this discrepancy is not obvious. Possibly part of the barium adheres to the mucosa, and gives a shadow after the bulk of the meal has passed. At any rate, it is a fallacy to bear in mind, and apparently is one incidental to the method.

A fallacy which is a fruitful source of error is that due to the frequency of local spasm in the alimentary tract. Whether this spasm be the result of the barium meal or not is immaterial. At any rate, it is one of the fallacies incidental to radiography, and is often very misleading. It is said that this source of error may be eliminated by the administration of full doses of belladonna, but I am sceptical, for on many occasions, in spite of this precaution, I have seen spasm demonstrated, for instance in a typical hour-glass stomach, a diagnosis to which the radiographer adhered in spite of

FIG. 1.—Gastric spasm suggesting cancer.

the absence of any clinical signs. A second radiograph, taken a week later after careful preparation, still showed an hour-glass constriction. At the operation no abnormality of the stomach was found, and the radiographic appearances were evidently the result of spasm secondary to a diseased appendix.

Fig. 1 is from a radiograph suggesting gastric carcinoma. The patient obviously had malignant disease, but although there were some symptoms pointing to the stomach as the affected organ, gastric analysis definitely excluded cancer of the stomach. Operation revealed a primary carcinoma of the liver.

It is obviously a fallacy to assume that an ulcer does not exist because one is not shown by the x rays. Duodenal ulcers are not often shown by radiography, but are frequently inferred to be present when they are non-existent. Whether gastric ulcers are shown depends mainly on their size and depth.

2. FALLACIES DUE TO TECHNIQUE.

A gastric or duodenal ulcer may be missed if the exposure be not made in the dorsal, prone, and oblique positions. In one case, for example, a well-marked gastric ulcer was not obvious on the plates taken in the dorsal and oblique positions. In another instance a marked depression due to an indurated ulcer on the anterior wall of the duodenum was visible only in the prone position. It is not often that a duodenal ulcer is shown so clearly, and the case is of interest as it was one in which operation would hardly have been justified apart from confirmation by the x rays. This

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patient's only symptom was a single severe haemorrhage, which was attributed to ptomaine poisoning. He had never had indigestion in the slightest degree, not even in the days preceding the attack. The only suspicious sign when I saw him, a month after the haemorrhage, was marked rigidity of the right rectus muscle. As this still persisted a month later, duodenal ulcer was suspected. This is the only instance I have encountered of haemorrhage being the first and only symptom of a duodenal ulcer.

Errors in diagnosis may occur if the stomach be not adequately filled with the barium meal. Fig. 2 shows a radiograph of the stomach which was diagnosed by the radiographer very confidently as inoperable carcinoma. There were no clinical symptoms of malignant disease, and a radiograph by another radiologist showed a perfectly normal stomach.

3. FALLACIES OF MISDIRECTION.

Not infrequently a radiological examination diverts the attention from the disease suspected to some abnormality of less serious import. Some years ago a lady was sent to see me with a history of recurrent attacks of appendicitis. Clinically, the doctor's diagnosis seemed to be correct. Routine examination showed albumin in the urine, so I had a radiograph of the kidneys, which revealed a right renal calculus. This led to a revision of the diagnosis. I removed the stone, believing this to be the cause of her recurrent pain. A few hours after she had left the nursing home she was seized with severe abdominal pain accompanied by a temperature of 104° F., and returned to the nursing home on the same evening with a very acute attack of appendicitis. In this case I think I should have disregarded the x rays as far as diagnosis was concerned, and removed the appendix first, leaving the stone to be dealt with later.

FIG. 2.—Simulation of gastric cancer.

FIG. 3.—False suggestion of presence of appendix.

4. FALLACIES OF INTERPRETATION.

The possibilities of errors of interpretation are numerous. This is not surprising when we remember that we are looking, not at a photograph, but at a shadow of something opaque to the x rays. In many instances the cause of the shadow must be a matter of inference, or even of guesswork. Gall-stones are a fruitful cause of this difficulty. Quite small gall-stones may be visible while large ones are not shown. Scybalous masses may give a radiological picture indistinguishable from gall-stones as to situation and appearance.

Calcereous glands and phleboliths sometimes mimic stones in the ureter very closely. Fortunately, a differential diagnosis can usually be made by passing a ureteric catheter. A pitfall to be avoided is that the stone may be passed between the taking of the radiograph and the operation. To guard against this contretemps a second radiograph should be taken as short a time before the hour fixed for the operation as is convenient, and all urine passed before the hour fixed for the operation should be carefully filtered through muslin. In spite of this precaution I have known a stone to be passed into the bladder between the taking of the radiograph at 11 a.m. and operation at 2 p.m.

Sometimes structures not existent are said to be there in a radiograph. Fig. 3 is a radiograph showing an appendix; this was confirmed by another radiographer (Fig. 4), but the appendix had been removed three years previously!

Gastric ulcers sometimes produce a radiological picture of cancer. At the operation a small gastric ulcer is found. Conversely, a gastric cancer may be present without any evidence on the film, although sometimes on screening it may be observed that the peristaltic waves become less active as they approach the pyloric end of the stomach. In one case a radiograph of the stomach, beyond a slight spasm, showed no abnormality. Clinically the case was diagnosed as malignant. The whole of the cardiac end of the stomach was a mass of new growth almost obliterating the cavity of the cardiac half. In spite of the extent of the growth there was no suggestion of organic disease in the radiograph.

A mass of impacted faeces remaining *in situ*, even after free purgation, may give both clinical and radiographical evidence of obstruction. On one occasion a well-marked filling defect was confirmed by a barium enema after apparently thorough clearing out of the bowels. Later the lump disappeared, and a further radiograph revealed a normal ascending colon. In such a case there is the

FIG. 4.—Another radiograph of Fig. 3.

possible fallacy that the impaction of faeces may be due to early carcinoma not advanced enough to produce a filling defect, so that radiological confirmation may not be forthcoming until the disease is too far advanced for surgical treatment.

A not uncommon radiological diagnosis is adhesions in the right iliac fossa. In my experience this diagnosis is rarely confirmed on the operation table. The massive shadow seen in the radiograph may be, not distended ileum, but a dilated rectum or pelvic caecum. In one patient a diagnosis of intestinal obstruction in the small intestine

secondary to amoebic dysentery was made by the radiologist. At the operation there was a cicatricial contraction of the ascending colon, but no abnormality of the small intestines.

Adhesions are sometimes diagnosed because part of the intestine cannot be moved on the x-ray table. Such a diagnosis is often fallacious.

The last, and most insidious, fallacy to which I will refer is the claim that the progress of healing of a gastric ulcer can be gauged by radiography. This fallacy has arisen in connexion with the intensive alkaline treatment of gastric ulcer. We are asked to believe that by this method healing of a gastric ulcer can be brought about in three or four weeks. I think that most surgeons who have had much operative experience in these cases, and who have followed up their results, will agree that the pathological evidence is against such a claim. To believe that such pathological changes can occur in such a short time requires a liberal dose of credulity.

May I say in passing that naturally I do not question the correctness of the principle of reducing gastric acidity in gastric ulcer. More than twenty years ago I put

FIG. 5.—Gastric spasm, appendix kink.

forward the view that gastro-jejunostomy is a physiological operation, and acts, not by drainage, but by diminishing the acidity of the gastric contents. This theory was ridiculed at the time, but is now accepted by most authorities. Whether the intensive alkaline treatment is a good method of achieving this is a subject outside the scope of this discussion, but I think the evidence on which its efficacy is tested is open to grave objections.

What are the facts? We know that the symptoms of gastric ulcer may be intermittent. Under treatment a patient may have long intervals of comparative freedom from pain, but the ulcer is not necessarily healed. Secondly, we know that after a successful gastro-jejunostomy the ulcer may not be healed for many months, and when healed there is usually some cicatrization at the site of the ulcer, which interferes with the normal peristaltic waves as seen on the screen. In spite of these facts we are told that with intensive treatment the ulcer may heal and the stomach be normal in three or four weeks. Is the radiological evidence sufficiently reliable to justify these assumptions? Experience teaches us, first, that an existing ulcer may be missed altogether by radiography; secondly, that an ulcer may be diagnosed radiographically which does not exist; thirdly, that the position of the patient at the examination may determine the apparent size of the ulcer and even whether it is shown at all. In view of the many possible sources of error it seems to me that radiological inferences as to the effect of the intensive alkaline treatment on a gastric ulcer, of the very existence of which

we are not certain, are to be accepted with great scepticism. In short, to talk of cure on radiological evidence is a fallacy.

To sum up, my remarks may appear to be destructive rather than constructive criticism, but I do not think this is really the case, for I would remind you that it is only by constantly bearing in mind the pitfalls which lie in wait for us that we can learn to avoid them. To most of you these pitfalls may be familiar, but even so, we cannot recall them to our minds too often. I am not speaking for the experts, but as one of the humble surgeons eager to pick up some of the crumbs of wisdom which may fall from the tables of the expert physicians and radiologists.

In conclusion, I need hardly say that nothing I have said is intended to suggest that radiography is not of value. It is the infallibility of radiology, not its utility, which I wish to call in question. In its proper place its value is incontestable. Radiography combined with ureteric injections has enhanced enormously the accuracy of urological diagnosis. Without radiography the satisfactory treatment of fractures of the limbs would be impossible unless one resorted to operation in nearly every

FIG. 6.—After appendectomy.

case. At present radiology is our greatest help in deciding as to the necessity for an operation in an individual case. But in abdominal diagnosis it is in its infancy, and must not be regarded as a final court of appeal. If it is so used it becomes a danger and a snare. The point I wish to emphasize once more is, that there is no such thing as a radiological diagnosis. In making a diagnosis all the aids which science can give should be called to our assistance, bearing in mind that they are helpers and not masters, and that radiology is only one of these aids.

We must not forget that every new invention, every new discovery, brings in its train disadvantages which cannot be wholly eliminated, but may be minimized with care and attention. Radiology is no exception, so we must recognize its pitfalls and its limitations. In spite of these, its value is unquestionable, and will be even greater in the future as we learn from experience how to make more accurate deductions from what we see.

Lastly, I would put forward two practical suggestions. First, if the radiographical findings do not support the clinical signs and symptoms they should be disregarded. An operation should rarely, if ever, be performed on a purely radiological diagnosis. Likewise an operation which is advisable for clinical reasons should not be deferred through lack of radiological confirmation. Secondly, I would urge closer co-operation between the surgeon and the radiologist. They should not work in watertight compartments. The surgeon should be present at the radiological examination and draw his own conclusions from what he

secs. Each should form an independent opinion and then in consultation try to agree on a diagnosis; likewise the radiologist and—may I suggest it?—the physician, should be present at the operation, to see how far the condition found is in accordance with their previous conceptions. Such a practice would be to their mutual advantage, and would lead to greater accuracy in diagnosis.

Above all, we must keep a sense of proportion. Too much science may mean too little common sense. Radiology, like any other invention, must be used with discretion and with that

"Good sense, which only is the gift of Heaven,
And tho' no science, fairly worth the seven."

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I FIND some difficulty in making a suitable reply to Mr. Paterson's remarks, because, in the first place, I agree with many of his statements; and secondly, where I find myself differing, the defence seems so easy that I am inclined to distrust it, and to wonder if I have overlooked vital points. An unpleasant vision obtrudes itself of Mr. Paterson—in the final broadside which, as opener, he will be privileged to deliver—pulverizing the whole position, and leaving the radiologists disconsolate among the smoking ruins.

However, this risk must be taken, and I will fire my first shot by challenging Mr. Paterson's statement that the barium meal is of little value in the investigation of intestinal stasis. Mr. Paterson prefers the administration of charcoal. I myself, following a *tu quoque* method, might inquire whether or not steps were taken to make sure that the whole of the charcoal passed in forty-two hours. One would be justified in asking this question, because in opaque meal work one may see a small part of the barium meal reach the rectum in a few hours, although the main mass lags far behind. The fallacy of the charcoal method lies, however, in the fact that no one can tell for how long it lay in any particular part of the alimentary canal. With the barium meal localized stasis can be observed. A good practical rule is to disregard stasis up to twenty-four hours; this will eliminate most cases of so-called ileal stasis, and leave us with two important sites—the caecum and the rectum. I shall return later to the question of caecal stasis; stasis in the rectum, sometimes known as the dyschezia of Hurst, is a most important clinical entity; its existence may be suspected from symptoms, but can be proved only by x-ray examination.

As regards spasm shown by the barium meal, the significance of this appearance, and the means of differentiating it from local organic trouble, have occupied the best minds in radiology for three decades. It was originally taught by the late Dr. Carmen of the Mayo Clinic that persistent spasm of the stomach or duodenum which was not due to intrinsic disease could be abolished by belladonna. This doctrine now requires modification; but it remains a fact that spasm which resists all variation of posture, is present over long periods, and is not affected by belladonna given to the point of causing a dry throat and enlarged pupils, is nearly always an indication of organic disease somewhere in the alimentary tract or its offshoot, the gall-bladder. Mr. Paterson's case was no exception, as there was a chronic appendix. It should also be remembered that, in some cases, the spasm, so far as the patient is concerned, constitutes the disease; if one can find a drug which controls the spasm, the symptoms are relieved. In short, the demonstration and differentiation of spastic contraction is a most important part of radiological diagnosis. Referring again for

one moment to Mr. Paterson's case, the question arises whether a complete personal examination of the alimentary tract was made by the radiologist, as it would be unusual, though not impossible, for the appendix to escape notice under such circumstances.

Failure to find an organic lesion by x rays is, of course, no proof that such does not exist. Such negative evidence should not, however, be despised. In a case where the suspicion is slight, it is a point in favour of a verdict of "not guilty"; when the clinical evidence is weighty, negative x-ray findings at least exclude obstruction and gross deformity.

The importance of a proper technique is self-evident. The more frequent the examinations in a barium meal, and the greater the number of angles from which films are taken, the better are the chances of detecting an obscure lesion. Practical considerations, however, impose definite limits, and no doubt failures sometimes occur on this account.

As to fallacies due to misdirection, I think it is scarcely fair to include them at all. The demonstration of any possible cause of obscure symptoms should always be helpful. The trouble usually is that the radiologist has not a sufficiently free hand. A partial examination of the abdomen may result in misdirection, but a complete one should rarely do so. In Mr. Paterson's calculus case, as in his case of gastric spasm, complete examination by an experienced radiologist would most likely have called attention to the appendix. A complete radiological examination includes barium meal, barium enema, cholecystography, genito-urinary tract, and the teeth; the latter are often omitted, or done by someone other than the radiologist making the principal examination. Hence sometimes an early recurrence of symptoms after operation. In hospital work especially it is often necessary to bring heart and lungs into the field of investigation. To use a single method of diagnosis in itself is a sufficient limitation; but when that single method is not fully employed, misdirection, as Mr. Paterson calls it, is bound to occur.

Arriving now at fallacies of interpretation, we really come to grips with the matter at issue. There will always be errors in interpretation in x-ray work, as in other methods of diagnosis. I do not think, however, that the opener of the discussion has been fortunate in his instances, not one of which would be likely to mislead a competent radiologist who had seen the patients concerned, and knew their medical histories.

As to gall-stones, a large calculus may fail to show because of lack of calcium content; and no one can exclude isolated stones by any known method. A bag of stones, however, if it does not show positively, will nearly always give negative shadows with cholecystography. As to scybalous masses, a combination of castor oil, enemata, and cholecystography will always clear up such a case beyond a doubt.

No radiologist of experience will attempt, on purely radiological grounds, to distinguish between an inflammatory mass, including penetrating ulcer, and malignant disease. If, however, an elderly patient shows gastric deformity, with or without ulcer niche, and gives a history of stomach trouble dating back only a few weeks or months, experience teaches him that in over 90 per cent. of cases there is cancer. In writing his report he should, of course, carefully distinguish between x-ray findings and deductions which may in part be based upon history and symptoms. Those who consider that the radiologist has no concern with anamnesis and symptomatology should employ a lay radiographer to assist them, who would confine himself to technical matters.

A filling defect in the colon may, as Mr. Paterson says, be due to impacted faeces. It should never be accepted as due to growth until castor oil and soap enemata have done their worst upon the unfortunate patient. And even if it vanishes under such treatment its discovery has nevertheless been valuable as a warning. Very early carcinomata seem to cause, at times, a sort of physiological block which results in faecal collections. If the block occurs a second time I should consider exploration imperative; and I am not at all sure that it ought not to be done without waiting for a second time. I laid

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