alternative, committed myself to a diagnosis of acute tubercle, with a hopeless prognosis. In spite of this the child persisted in slowly recovering, and a month ago the last x-ray film showed that everything had cleared up, except for some thickened pleura in the middle of the left lung. (Plate, Fig. 2.) The patient is looking well, and there are no physical signs in the chest.

Cases of missed empyema are, I believe, not so rare as we might expect. As in the case just related, the long-drawn-out nature of the illness, the loss of weight, the pallor, and profuse sweating, may lead to an erroneous diagnosis of tubercle. I see them occasionally.

Recently I examined a boy of 12 who had been ill many weeks with these symptoms. There was dullness and bronchial breathing over most of one lung. I put in a needle and found pus, which was up to the second rib. This boy was operated on next day, and did very well.

I was once asked to see a young man, said to be dying of tuberculosis, as it was thought a second opinion might be a comfort to the relatives. I was told of the long illness, the wasting, the drenching night sweats, and the physical signs, which put the diagnosis beyond all doubt. He was not expected to live for more than twenty-four hours. When I visited him I was surprised to see him lying so quietly, as distressing dyspnoea had been described to me as a marked symptom. I then learned that during the previous night the shortness of breath had become extreme, leading to partial unconsciousness and such violent struggling that it took three men to hold the patient in bed. In the throes of this struggle suddenly there was a report audible to all in the room; the patient's chest had burst, and pints of pus were ejected as from a hose, with immediate relief. Certainly I saw the wall splashed by pus 4 feet from the floor at a distance of 6 feet from the bed. There was a circular opening, about the size of a shilling, in the third right interspace in front, leading to the pleural cavity. The subsequent operation was entirely successful.

The remaining group of cases, that involving the tubercle bacillus, is not one with which, as a rule, the general practitioner has much to do, unless he has a patient for whom some optimistic surgeon has resected a rib. As the sinus will discharge for the rest of the patient's life, he will see quite plenty of it.

CONCLUSIONS.

1. Do not be misled by physical signs.
2. In cases of *any* doubt use the exploring needle.
3. Remember that primary clear effusion is tuberculous.
4. When pus is found, open operation should not be countenanced till the lung process has subsided. This means, in pneumococcal cases, after the crisis; in streptococcal cases, three weeks or more from the onset of the illness; and in tuberculous cases, never.

TREATMENT OF LYMPHATIC GLANDS IN CARCINOMA OF THE CERVIX UTERI.*

BY

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In the majority of cases of malignant disease the problem of the surgeon is how to treat metastases, and it is as well to consider why these distant growths should be so much more difficult to deal with than the original tumour.

The destruction of the original tumour by means of excision or cautery dates back thousands of years; all the advance made on the surgical side has been concerned with a better treatment of metastases. When it was realized that carcinoma tended to spread by lymphatic drainage, operations were devised to remove all the lymphatic glands and vessels which drained that area. This increased the severity of the operation very considerably, and the high primary mortality in many cases, such as Wertheim's operation, was due to the greater shock, the risk of haemorrhage, and the increased possibility of sepsis in such a large area of disturbed tissue.

When radiotherapy first came into use, and it was found possible to heal the primary growth, it appeared likely that the lymphatic areas would be dealt with far more

satisfactorily than by excision. Unfortunately, this has not so far proved to be the case, and the reason is by no means clear.

The most likely cause appeared to be insufficient irradiation. In many cases the glands are situated further from the surface, and they are therefore undoubtedly more difficult to irradiate with adequate intensity, but it is equally true that in other cases—for example, the lymphatics of the neck—the glands are, comparatively speaking, superficial, and no such difficulty exists. Accumulating experience would seem to indicate that the metastases are more radio-resistant than the primary growth.

In a bacterial infection we know that the glands do much in preventing the spread of the disease. The organisms have to pass through a cordon of glands before getting to the rest of the body, and, as a rule, those glands deal with the invaders very successfully. The idea that the glands act in the same way in malignant disease is at first sight a tempting one, but is it not possible that the glands in the case of neoplasm act in the very opposite manner—namely, by forming a centre in which the malignant cells can grow more readily? If the malignant cells which wander from the original tumour had the same opportunity of growth as in the glands, should we not find large masses in the tissues all the way along to the glands? If microscopic sections are taken of the area between the original tumour and the lymphatic gland, the lymphatic vessels will very often be found to be completely blocked by cells, but it is not until the glands are reached that large masses of cancer are found. It seems obvious, therefore, that the cells which are waylaid on their journey from the tumour do not have the same power of division and growth as those at a distance—namely, in the lymphatic glands. This can only mean that either the body has a resistance to the neoplastic cells in the intervening space, or that there are factors in the glands which actually encourage growth. The latter hypothesis is suggested at least by the fact that a tonsillar extract has a definite growth-promoting substance for tissue culture, and that tonsillar growths are very radio-resistant.

So far we have considered only the question of cell growth. There is, however, another aspect of the case that must be considered—whether the cells in these special positions are more radio-resistant. Here we are faced with the problem whether the action of radiotherapy is a direct or an indirect one. If we think of radio-action as being purely direct, then it is only possible to think of the individual cell as being more resistant. There is, however, a growing suspicion that the disappearance of growth in the body is not mainly direct action, but to a very large extent indirect action through the changes brought about in the surrounding cells. If this is true, then it may well be that the changes in the glandular tissue are far less than those in the other tissues of the body, and therefore the action on the malignant cell is less intense.

It is not difficult to suggest experiments that might help to throw light on this subject—for instance, the direct implantation of tumours into glands before and after irradiation. It has, of course, been shown by Murphy and others that implanted tumours do not take so well in an area that has been previously irradiated, but I know of no experiments in which a comparison has been made between the effects of inoculating an irradiated gland and of inoculating a gland with an irradiated tumour, the dose of irradiation being the same in both cases. The mere fact that a previously irradiated area prevents an inoculated tumour from taking may prove to be of great significance in early cases of malignant disease. It will perhaps be found that, by a prophylactic irradiation of the glands, cells will be unable to settle down and grow as effectively as they otherwise might.

It is perhaps presumptuous for a mere clinician to try to discuss these biological problems of radio-sensitivity; the most we can do is to try out various techniques by which the infected lymphatic areas can be better irradiated, and experiment with various doses.

One of the earliest types of malignant disease to be successfully treated by irradiation was carcinoma of the cervix uteri. In early days the treatment was somewhat crude, but in spite of this fact good results were obtained locally. At the present time there are several different

* Read in opening a discussion in the Section of Obstetrics and Gynaecology at the Annual Meeting of the British Medical Association, Winnipeg, 1930.

techniques used in the vaginal application, and it can be said that any one of these will get rid of the growth in the cervix and vagina.

It is possible that in some of the techniques the area irradiated is rather more extensive than others, but in no case can sufficient irradiation be applied per vaginam efficiently to deal with the glands far back in the pelvis—for example, near the bifurcation of the iliac artery. Of recent years the problem of glandular metastases in cases of carcinoma of the cervix has been approached by means of x-ray therapy. This combined method is extensively used in the Radium Institute in Paris and in many other centres. We at St. Bartholomew's are doing two series of such cases, one by means of radium plus x rays, and the other by means of vaginal application of radium and intra-abdominal radium.

It was in 1919 at the Brussels Radium Institute that the first attempts at intra-abdominal radium were made; briefly the technique used was as follows. After placing the patient in the Trendelenburg position, the abdomen was opened and examination made of the pelvis. Next, an incision was made at the base of each broad ligament, and a tube of radium, containing 10 mg. of radium element screened with the equivalent of 1 mm. of platinum plus rubber, was placed in each broad ligament; in addition, three or more needles were placed through the lower end of the uterus. The ligatures from these containers were brought out through the abdominal wall at the lower end of the incision; the whole pelvis was then packed with six to eight yards of gauze, and the end of this gauze left hanging from the wound, together with the sutures. The abdomen was then closed, except for the place occupied by the sutures and tag of gauze. After a lapse of four or five days the gauze was pulled out, likewise the containers.

During 1923-24 the author used a modification of this technique in thirteen cases. In his experience it seemed to give rise to a rather severe peritoneal reaction, and for a time it was abandoned. An examination of the figures, however, revealed the fact that seven of the thirteen had lived for a period of five years or more, although two of these have recently died. It was therefore decided once more to try intra-abdominal irradiation, but to modify the technique. This has now been done as follows. At least six weeks are allowed to elapse after the vaginal treatment, so as to allow the cervix and vagina to heal before irradiating the pelvis. The abdomen is then opened with the patient in the Trendelenburg position, and a careful examination made, not only of the pelvis, but of the aortic glands and liver; if these are involved it is obviously useless to proceed further. If the pelvic glands alone are involved, or even if there seems to be no glandular involvement, twenty radium needles are placed right round the pelvis. Each of these needles contains 2 milligrams distributed over an active length of 32 millimetres; the walls of the needles are 0.5 mm. of platinum. The uterus is held well forward, and, starting at one sacro-iliac synchondrosis, the parietal peritoneum is picked up with forceps and the needle inserted as far as the eye just under the peritoneum. The next needle is placed about one centimetre from the first, until the outer border of the uterus is reached. This generally involves the use of five or six needles; sometimes an extra needle is placed deeper in Douglas's pouch, so as to irradiate the utero-sacral fold and the tissues lying below it. The same operation is carried out on the opposite side of the pelvis. Each needle is provided with a strong silk suture and a coloured glass bead, which is passed along the suture close to the eye of the needle. The glass bead serves two purposes: first, it prevents the suture from cutting through the thin peritoneum; secondly, it is very useful in finding the needles when removing them later. When the needles are in position all the sutures on one side of the pelvis are tied together, and their ends pushed down into the pouch of Douglas. The uterus is then allowed to fall back into the pelvis, and three or four needles are placed in front of the broad ligament (again subperitoneal, except for the eye and the bead), in order to irradiate the obturator glands. These sutures are likewise tied together, and allowed to fall down in front of the uterus. The abdomen is then completely closed for seven days. At the end of that time it is again opened to remove the needles, and then closed.

Dodd of the Westminster Hospital avoids the second laparotomy by putting the sutures through the abdominal wall, each suture being covered by a tube; in addition, I understand, he generally removes any palpable glands.

Other techniques of irradiating the glands have been suggested; for instance, Professor Daels of Ghent described a method by which an extraperitoneal channel was made reaching from the anterior superior iliac spine to the ischio-rectal fossa on the same side. A tube of radium attached to a chain was then drawn along this channel.

Results of Intra-abdominal Irradiation.

The immediate results of the intra-abdominal irradiation as practised by the author are really very satisfactory. At first sight the idea of opening the abdomen twice within a week is rather startling, but it is surprising how little shock the patient experiences; as a rule the wound heals by first intention. Obviously it is an operation which cannot be performed on very feeble elderly patients, or if, on opening the abdomen, the pelvis is found to be full of adhesions.

The results from point of survival rate are as follows:

Patients Treated with Intra-abdominal Irradiation.

Degree	Name.	First Treated.	Died.		Living.	
			Period Survived.			
			Years.	Months.	Years.	Months.
2	A. D.	12/12/23		10		
2	K. H.	25/10/23	5	7		
4	A. A.	16/1/24			6	6
2	B. M.	23/1/24			6	6
3	A. H.	12/2/24		9		
2	E. P.	26/3/24		7		
3	E. W.	2/2/24		11		
4	C. McC.	10/4/24	1	10		
3	H. N.	23/4/24			6	3
3	M. B.	3/7/24			6	—
3	G. B.	—/9/24	6	—		
1	V. S.	5/3/25			5	4
3	M. M.	11/3/27	1	4		
1	M. I.	5/8/26			3	11

New Method.

4	M. H.	2/6/27	1	1		
2	M. B.	20/2/27			2	11
1	E. G.	12/3/28			2	4
3	K. L.	26/1/28			2	6
4	A. D.	11/2/28	1	—		
4	A. G.	8/3/28		2		
4	B. B.	19/4/28			2	3
1	E. N.	—/4/28		10		
2	F. D.	21/5/28	1	9		
2	A. G.	3/5/28			2	2
1	F. H.	8/6/28			2	1
4	F. O.	28/7/28			2	—
3	B. H.	10/9/28	1	—		
1	M. W.	19/2/28			2	4
3	E. W.	8/11/28			1	8
1	E. B.	3/1/29			1	6
4	M. P.	14/2/29	1	1		
2	B. P.	6/12/28			1	7
4	S. J.	28/2/29			1	5
4	K. C.	30/4/29			1	3
2	A. E.	6/6/29			1	1
1	E. W.	22/1/28			1	9
2	M. P.	29/11/29				8
3	F. A.	17/11/29				8

It is evident from the above table that sufficient time has not elapsed, and that the number of cases is insufficient to justify any conclusions whether this method of irradiating the glands will increase the five-year survival rate, but the immediate results are satisfactory enough to encourage the author to persevere with this method.

APPENDIX CONCRETIONS OPAQUE TO X RAYS.

BY

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(With Special Plate.)

A CONDITION to which very little attention has been directed in standard literature is that of appendicular concretions opaque to *x* rays, and large concretions in the appendix in general. Several points of very real interest to the surgeon are involved, and the case described here is sufficiently graphic to attract attention, first, as to the possible errors in pre-operative diagnosis arising from this cause, secondly, as to the embarrassment which may arise at operation, more particularly in an acute case, if we are not alive to the possibility of the occurrence of a really large appendicular concretion, and lastly, the troublesome sequelae which may be occasioned.

Case Report.

In April, 1929, a man, aged 39, was admitted to the Royal Southern Hospital in a condition typical of acute appendicitis with abscess formation. He stated that up to within a week of admission he had been perfectly well, when he had begun to feel pain in his right iliac fossa, which had, however, not prevented his working until twenty-four hours before his coming in, when it became very severe, and he vomited several times. An appendix abscess was obvious, and this was drained, with the escape of a concretion. The following day there came from the wound a calculus, the nature of which was not immediately recognized, the possibility of renal or biliary origin being entertained. This stone was analysed, and reported to contain calcium and magnesium phosphate, a slight trace of iron, a small amount of fibrin, and no bile pigments or salts. The pathologist remarked that it was of a very hard nature. As the wound failed to clean up in the usual time, lipiodol was injected up the sinus and a stereoscopic radiogram made, which demonstrated a track leading to a large round shadow, rather mottled in character. This was interpreted as a calcified gland acting as a foreign body in an abscess cavity, and exploration was decided upon. After a tedious dissection, a stone was disclosed lying in the lumen of the appendix, which was quite clearly traced in its entire length. The lumen at the centre was distended into a large bulbous swelling surrounding the calculus, which was removed from a cavity completely lined with mucous membrane. The appendix was then removed, its outer coats being densely adherent, but healing was rapid and uneventful.

Description of the Calculus.

In size, shape, and surface the calculus very closely resembled a walnut. It was a deep red-brown colour and extremely hard. On being cut across, the outermost shell only was found to be of this extremely hard consistency. Just within this layer was a second lamina of mineral salts slightly less hard, and the centre of the stone was occupied by a very much softer structureless mass. The hospital laboratory reported that the nucleus was composed of an amorphous debris most probably faecal in origin. The middle layer contained carbonate and phosphate of calcium and magnesium, the carbonate appearing to predominate. The outermost layer of all was composed almost wholly of triple phosphate with some calcium carbonate and earthy phosphate. Other writers have reported a similar composition^{1 2} and formation.³

Origin of these Calculi.

From this description it would seem clear that the stones in this instance were derived from local faecal accretions in the appendix. This method of origin

appears to be the common one, although foreign bodies⁴ have been described forming the nucleus, and the question has been raised⁵ as to the possibility of gall-stones finding their way to this position. Only one case is described in the article quoted, and this contained very many small faceted calculi about 2 mm. in diameter, containing calcium phosphate and organic matter, but no cholesterol, bile salts, or pigments. The writer quotes Howard Kelly⁶ and McAdam Eccles⁷ as subscribing to the belief that the majority of these bodies are faecaloliths formed *in situ* and not gall-stones. In one interesting case⁸ the calculus was formed chiefly of bismuth, which was traced to a bismuth meal taken by the patient for *x*-ray purposes two years previously. This stone measured $4\frac{1}{2}$ by $1\frac{1}{2}$ cm. O. T. Williams²² was struck by the observation that appendix concretions are commonly larger than the normal appendix lumen, and infers from this that they probably grow *in situ* as the result of salts being deposited on their periphery by the mucous membrane, the fact of the excretion of inorganic salts by the intestinal mucosa being recognized. He found support for this suggestion in the disproportionately large amount of calcium present in appendix concretions compared with enteroliths in general. He further found an increased quantity of fats, and suggested that the calcium occurred as a soap. Maver and Wells²³ agree that, as compared with enteroliths, concretions found in the appendix contain an excess of fats and of calcium, and support the suggestion that these are derived from the mucous membrane of the appendix itself, but they do not agree that the bulk of the calcium occurs as a soap.

DISCUSSION.

In the journals of the last twenty years references to this condition are sufficiently plentiful to make it abundantly clear that its interest is far from being purely academic, and is, in fact, of a highly practical nature.

Diagnosis: General Characteristics.—The *x*-ray appearance will, in most cases, be that of an irregularly calcified mass—that is, mottled. In the example quoted, the centre was faecal and the salts were deposited in the periphery, but the shadow was not particularly annular in form, and reference to the cases in the literature confirms the suggestion that this characteristic is not usually present. Although calcified chiefly in their outermost portions, appendicular calculi do not throw a ring shadow. Such a shadow has, however, been described with multiple nuclei. Gottschlich² and Fittig¹⁰ describe lamination. In this case the shadow is roughly circular in outline, and this appears to be the common form. Fusiform shadows are not described as a rule. Multiple shadows may occur; they are neither the rule nor the exception. When present, facets are found between opposed surfaces.¹ The largest number of calculi removed is reported as four, of which the biggest measured 2 by 1.5 by 1 cm.¹¹ Demonstrable movement of the shadow will depend upon the degree of inflammatory fixation, and must surely be limited as a rule. In practically all circumstances the respiratory excursion will be negligible. The size of the shadow is surprising. In the case described it measured 3.25 by 2.25 cm., and other instances have been recorded where the stones measured 2 by $1\frac{1}{2}$ cm.,¹² $4\frac{1}{2}$ by $1\frac{1}{2}$ cm.,⁸ and $2\frac{1}{2}$ by 3 cm.¹³ One observer reports his case as "unique in the annals of surgery." The appendix contained two tapering concretions measuring respectively 1.5 by 6 cm. and 4 by 1 cm.¹⁴ The pre-operative recognition of these stones seems to have been peculiarly rare. Writing in 1915 Pfahler and Stamin¹² state that they were able to trace only one case which had been correctly diagnosed before operation, this one having been discovered by Weisflog in 1906, when two stones were found in the appendix in the course of a radiological examination for ureteric calculi. Case, at Detroit, in 1916, reported two cases correctly diagnosed by *x* rays. In many of the cases reported there was an abscess formed in relation to the appendix, and a concretion lying free in the cavity.^{12 13} J. B. Murphy¹⁵ indicates the danger of all concretions in