Dr. N. S. FINZI (London) said that it was very difficult sometimes to decide whether a sarcoma started in the mediastinum or in the lung, whether it had involved the lung and spread into the mediastinum, or vice versa. One case he had encountered was very definite because the growth was in the apex of the lung. On other occasions he had felt almost certain that the primary growth was in the lung and had spread into the mediastinum and involved the walls of the aorta. He had seen at a necropsy a case in which the walls of the aorta and of the oesophagus were involved, and it was very difficult to prove that the condition did not start in the mediastinum.

The PRESIDENT (Dr. Woodburn Morison) said that radiology was a definite part of clinical examination—an extension of the method of inspection; he would like to see it mentioned in all textbooks under the head of "physical examination for clinical diagnosis." The radiologist was rarely a clinician, and the clinician was only occasionally a radiologist. The ideal would be for the clinician to be an expert radiologist, but until that time came, and until the clinician would willingly undergo the labour of acquiring a knowledge of radiology, the only course was co-operation. The term "radiological diagnosis" was often used and seldom justifiable.

Dr. MELVILLE, in reply, doubted whether his questions had been answered. Dr. Finzi was the only speaker to tackle the question of the site of origin of a sarcoma, and his conclusions were disappointing—merely that the sarcoma might have started in the mediastinum. So much was heard of primary sarcomas of the lung, and yet hardly anyone in that meeting could say definitely that he had seen such a thing. It was quite conceivable that a small focus in the prostate or ovary might have been overlooked, and metastases in the lung, which would be more evident, had occurred. True primary sarcoma of the lung was, he maintained, to use a Scottish term, "not proven."

X RAYS AND RADIUM IN THE TREATMENT OF CARCINOMA OF THE BREAST.*

BY

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(With Special Plate.)

CERTAIN considerations, as to the natural history and spread of cancer of the breast, influence so largely the question of treatment that we must spare a few moments to discuss them.

With the rarest exceptions, medical men are agreed that cancer starts as a local disease, or at any rate a local manifestation. In most types of the disease it tends sooner or later to spread—at first by the lymphatics and lymphatic glands, and later, in some cases, by the blood stream. If the disease is *completely* removed while it is still local, whether by surgery or by radiations, the patient will be cured. When, however, the disease has spread beyond the area removed, or beyond the area to which a sufficiency of radiations has been given, it recommences to grow, and tends subsequently to kill the patient. In rare cases, in old people, the disease remains localized, and shows no tendency to any distant spread.

In an occasional case, of the most extraordinary rarity, the disease, though well advanced, may completely disappear, perhaps for a time only. I have seen two such cases in the course of many years, during which I have seen thousands of breast carcinomas. One of these cases was shown at society, and the other occurred in my practice at St. Bartholomew's Hospital. We have reason to fear that, after being well for more than two and a half years, the latter is beginning to recur.

Obviously the mode and directions of spread are extremely important, and we must therefore carefully consider the lymphatic supply of the breast. It must be remembered

that the disease can pass either with or against the direction of lymphatic flow, and it has been shown by Sampson Handley that cancer cells may die out in one part of a lymphatic and cause it to shrink down to a fibrous thread, while further on, in the same lymphatic, they may develop into a tumour. The fact that cancer cells can be traced along the lymphatic channels seems to show that it is the cells themselves which spread the disease, for the cells of normal tissues do not appear to enter the lymphatics.

The lymphatics from the mamma pass mainly into the pectoral group of axillary glands, and occasionally directly to the subclavicular glands. Lymphatic cells also pass from the inner part of the mamma into the intercostal spaces and so into the sternal lymph glands. Lymphatic vessels from the upper part of the pectoral region also pass directly to the supraclavicular glands. The lymphatics from the pectoral group pass to the rest of the axillary glands, the subclavicular glands, and the supraclavicular glands, and thence to the glands in the posterior mediastinum. Those from the sternal glands pass into the anterior mediastinum and thence into the posterior mediastinum. The lymphatics on the surface of the upper abdomen are also connected with the pectoral lymphatics.

Thus it will be observed that, when the primary growth is in the outer part of the breast, further trouble may be first expected in the axillary and the subclavicular glands, and later in the supraclavicular glands and the posterior mediastinum. If it is in the inner part of the breast, the inner end of the intercostal spaces and the anterior mediastinum are the danger zones. If in the upper part of the breast the supraclavicular glands must be suspected. In practice a recurrence under the costo-coracoid ligament, very difficult to feel but causing much swelling of the arm and forearm, is very common; probably almost all, if not quite all, the cases of great lymphatic obstruction in the arm after carcinoma of the breast are due to this cause. In advanced cases the disease often invades the pleura, possibly by the sternal glands or the intercostal glands, possibly by way of the mediastinum. It is obvious that the cells will eventually reach the blood stream by the thoracic duct.

Involvement of the mediastinal and tracheo-bronchial glands may often be discovered by a skiagram, as also pleural metastases and blood-disseminated metastases in the lungs: they obviously cannot be seen in the earliest stages, but only when they have formed definite tumours. They tend to have a typical rounded appearance. For this reason, and also for future reference, skiagrams, both anterior and antero-lateral, should be taken of every breast carcinoma before x-ray treatment.

ACTION OF RADIUM RAYS AND X RAYS IN CARCINOMA.

The alpha and the beta rays of radium need only be considered shortly. The former have, as their low penetrating power would indicate, apparently no value in the treatment of carcinoma of the breast. With beta rays the matter is not so definite, but anyhow much better results have been obtained by gamma rays and by x rays in this disease, so that I shall not deal with the beta rays in this paper.

In vitro it is found that there is a certain minimal dose which, when applied to experimental growths, will inevitably prevent their development. This is the "lethal dose," and will cause the growth to be absorbed by the tissues of the animal into which it is implanted, and it will then immunize this animal against future implants of a similar growth. Larger doses of rays will equally prevent development of the irradiated graft, but will not immunize to the same extent, so that, when about twenty times the lethal dose has been given, the graft no longer immunizes. Doses smaller than the lethal dose will reduce the ratio of successful implantations without preventing them in every case. The lethal dose is much higher than can be applied to living tissues without causing their necrosis.

The irradiation of the tissues into which a cancer graft is to be made will reduce the percentage of successful takes compared with controls. When the tissues and growth are irradiated together the latter will disappear with a dose of the order of half the lethal dose.

* The opening paper of a discussion in the Section of Radiology at the Annual Meeting of the British Medical Association, Edinburgh, 1927.

FIG. 1.—Acute burn. Before treatment.

FIG. 2.—Acute burn. Three weeks after treatment.

FIG. 3.—Acute burn. Six weeks after treatment.

FIG. 4.—Acute burn. Two and a half years after treatment.

FIG. 5.—Chronic burn. Three months after termination of six months' treatment.

FIG. 6.—Chronic burn. Same case, two years later.

The action of the rays in a human being varies with the type of disease. In general the more rapidly growing the neoplasm the more readily will it succumb to irradiation; but, as the rapidly growing forms spread more quickly, a wider area and more distant glands will need to be treated in such cases, and a greater number of successful results will subsequently be spoilt by distant metastases. With the rapidly growing forms the effect of the rays is rapid, a change being seen in a day or two, while in the more slowly growing forms the changes may take a good many weeks.

The type of ray used also has an influence on the type of reaction. As the wave-length of x rays decreases, so their effect takes longer and longer to appear. With gamma rays, however, the effect appears in about the same time as x rays produced by 150 kilovolts continuous current. I am distinctly of opinion that the carcinomata and epitheliomata respond better to x rays, the shorter the wave-length, if full doses are given. Consequently the radium gamma rays are the best, provided that they are applied in sufficient quantity. With some types of sarcoma it is probably a different story. The lymphosarcoma probably responds at least as well to medium wave-lengths if applied in sufficient concentration.

Comparison of Radium Gamma Rays and X Rays.

With modern apparatus x rays can be obtained in large quantities to rival which we should have to use what we at present regard as enormous quantities of radium. On the other hand, this can to a certain extent be counteracted by the facility with which the radium can be applied for prolonged periods, even continuously for many days. In the rare instances in which comparatively large quantities of radium can be secured and they are used in a similar way to x rays, they are not concentrated into a point focus, but spread over a large radiating surface, with the result that the relative depth dose is greatly increased. Much more commonly the radium is used considerably nearer the surface than an x -ray focus can possibly be placed, but spread over a large area. It is left in place usually for a number of days or even weeks.

The radium rays are much more penetrating, and, for the same amount of damage to healthy tissues, seem to exert more effect on carcinomata than x rays. However, with radium used in this way, the underlying lung must get a large dose and subsequent lung damage may be expected. With x rays, on the other hand, the use of a glancing method (subsequently described) will to a large extent prevent this.

Radium used for external applications, therefore, has the advantages, compared with x rays, of more penetrating rays of a more suitable wave-length, multiple foci or a series of large foci, and continuous application. Its disadvantages are that it is not so easy to give an even dose over the large deep area required in breast carcinoma, and that it is not possible to avoid injury to the lung.

Radium is used also in quite another way—namely, by burying a number of radium containers in the tissues. As a rule hollow needles containing either radium salt or radon are employed. When small quantities are used in each needle for a week or more the radon is at a very decided disadvantage compared to the salt, for, in order to obtain the same total dose, a considerably larger amount of radon has to be used at the start and the effects are different. The needles are used deep to the growth if possible, or in its deeper layers, not in the middle of it. The gland areas are, of course, needled at the same time. X rays are not used in any way comparable to this.

I have an impression that the results with buried radium are better than with external methods, *provided that the wounds remain aseptic*. This can only be accomplished by meticulous care, owing to the damage inflicted by the radium on the tissues. I have advanced in explanation the hypothesis that around the radium needles there are zones in which the cells of the growth receive a true "lethal" dose, and that the absorption of these may weaken the resistance of the remaining cells to smaller doses of rays.

TREATMENT BY IRRADIATION ALONE.

1. *Primary Growth Localized in Breast: no Palpable Glands.*

(a) *Operable* (as far as local condition is concerned).—Should we treat an operable case with radiations when surgery is not contraindicated? The answer is: At present, only if the breast is subsequently removed. The loss of time, possibly two months, is probably more than compensated for by the diminished likelihood of insemination of the growth at the operation. So far we have treated very few truly operable cases either with radium or x rays, and we have not yet had the breast removed after complete disappearance of the growth and so proved the absence of cancer cells.* Therefore we cannot say that our technique is yet good enough to recommend the treatment of the disease by irradiation alone when it is operable. When other causes contraindicate operation the case must be considered as inoperable and treated as such.

(b) *Inoperable*.—We have succeeded in a number of cases in rendering the growth inactive for long periods by x rays, but we have seldom observed its complete disappearance. With radium needling, properly done, our results are more encouraging. In a large proportion the growth completely disappears, and the only questions then are whether all the cells have disappeared, whether the gland areas have received a large enough dose, and whether the mediastinum is also involved.

2. *Primary Growth in Breast: Palpable Glands in Axilla.*

The radiation treatment of such a case depends largely on the skiagraphic evidence. If the typical rounded mediastinal glands are seen, nothing but mediastinal treatment is of any value, and as this usually prevents a sufficient dose being given to the breast and axilla, the question of surgical help must be considered. If the mediastinum is not demonstrably involved, it is best to assume for the time being that it is free and treat the breast just as if operable, with the exceptions that the subclavicular and probably also the supraclavicular regions must be treated, and, if the growth is in the inner part of the breast, the inner ends of the intercostal spaces also. If the mediastinum is subsequently found to be involved, it can then be treated by x rays.

3. *Primary Growth with Supraclavicular Deposits on the Same Side.*

Such cases must always be regarded as having the mediastinum affected, even when too early to show with x rays, and unless mediastinal treatment can be adopted together with correct dosage of the breast, axilla, and supraclavicular regions with x rays, no permanent success can be hoped for. Combined radium and x -ray treatment might be used in some of these cases.

4. *With Definite Mediastinal Involvement.*

Until comparatively recently I regarded these cases as almost hopeless and attempted nothing radical. I have, however, had several cases which have done so extraordinarily well that I no longer despair. It is now more than three years since I treated the first by my present technique and the patient is still well. Another has been under treatment over two and a half years and has had very extensive recurrences, but has recovered in a miraculous way.

5. *Treatment of Distant Metastases.*

Bone metastases are usually very painful, and there may for a time be only one or two. Treatment of such metastases gives so much relief that it cannot be refused, even though it is certain that the patient will ultimately succumb to other metastases. Even when the pelvic bones are riddled with disease I have observed much relief from radical treatment, lasting often for six months or more. There are, of course, limits, and generalized disease, masses in the liver, and so on, should not be treated by irradiation.

* This has now been done (October, 1927).

RECURRENTS AFTER OPERATION.

Local.—The general lines of treatment of these will be similar to the methods of dealing with a primary growth detailed already.

Distant.—In the axilla, the coracoid region, and in the mediastinum, the treatment will be as when the primary growth is present. Metastases in distant parts must be dealt with on their merits; they are worth treating on account of the great relief from pain and disability, though when once there are deposits in distant bones there is no hope of ultimate cure. In that bane of us all, the recurrence in the sacrum, pelvic bones, and lumbar spine, complete relief of pain can often be given for many months, and I have seen a patient live for three years after a recurrence in the lower end of the femur had been cured by x-ray treatment.

TREATMENT BY RADIATION COMBINED WITH SURGERY.

There are many problems to be discussed under this heading.

1. Radical Operation Preceded or Followed by Irradiation.

Surgery has had so long an innings, and the procedure has become so standardized, that the statistics should be fairly definite. There are, however, only few figures giving five-year results, and these seem to vary considerably. With radiation used in addition, it is extremely difficult to determine the results. To start with, the procedure is not standardized; consequently if it is any good at all, obviously the best method will give the best results. It is my personal belief that thorough irradiation improves the results, but that small and ineffective dosage hastens the appearance of recurrence, though it probably cannot induce it. One great difficulty in treating these patients is the mental attitude. The surgeon may make the patient believe that it is necessary to do a big operation to remove a "harmless little growth" or "an inflammatory focus," but this leaves the radiologist little chance of explaining that radium or x rays, with all their attendant expense, must be used to diminish the possibility of its return, especially if radical methods are used.

The Erlangen school holds that irradiation after a radical operation is of no value owing to the disturbance of the blood supply; but the rarity of local recurrence in treated cases, compared with its comparative frequency in untreated cases, leads to the belief that the treatment is beneficial.

The prophylactic use of x rays may be either pre-operative or post-operative.

(a) *Pre-operative.*—The basis of this treatment is that the rays will damage the carcinoma cells and so prevent their development if any are scattered in the wound. The use of large doses, however, may prevent the wound from healing, especially if there is much tension on it, and there may result either sloughing or complete failure of the cut edges to unite. Having had two cases in which one of these events occurred, I have not dared to employ it again, though the principle seems sound. The use of small doses to stimulate the defence mechanism is a very questionable proceeding.

(b) *Post-operative.*—Radium can be used either in some form of moulded apparatus or in the form of plaques. It is advisable that there should be a space between the radium and the skin in order to get even irradiation at the deeper levels. It is doubtful, however, if the axilla will get so effective a dose as with x rays, and it is not possible to protect the lung. X rays are applied to the pectoral area by a glancing method, and to the supra-clavicular and coracoid regions from the front and back. I prefer to separate the two treatments by an interval of three months so that the axilla is treated twice, the first area being that in which recurrence is the more likely from the original position of the growth.

As to dosage in prophylactic treatment, I hold very strongly the view that the methods used should be exactly the same as when a demonstrable recurrence is present, and the doses just as full. We assume that there still remains some disease and use the most thorough methods to eradicate it. It has lately become the custom in

Germany to split the dose into smaller treatments at long intervals. This is based on the following theory: Experiments with beans have shown that there is a certain minimal dose which will kill a growing bean. If one-third of this dose is applied and repeated on two subsequent occasions at some weeks' interval, the bean grows normally. Now, if a resting (dry) bean be treated in the same way with three fractional doses it will fail to develop. It is assumed that the cancer cells in a prophylactic treatment are in a similar resting stage and that they can be killed by summated doses without harming the remainder of the tissues. I disbelieve this theory because I think it is wrong to consider the cancer cells as in the same state as the resting bean.

A quite different method of prophylactic treatment is the leaving, during the operation, of small radium tubes in places where recurrences are most likely to take place, or rather, in the lymphatic path along which the cells are most likely to spread. The placing of the radium tubes will depend upon the position of the primary growth. They are most usually placed in the supraclavicular and the subclavicular regions, and in the muscles at the inner ends of the upper three or four intercostal spaces. My only criticism of this method is that its zone of action is limited, and, to get at all a large dose, it is necessary to give too much in the immediate neighbourhood of the radium.

2. Local Removal of the Growth and Irradiation.

My view on this is that, if we can get rid of the deposits in the axillary glands, it is almost certain that we can also get rid of the primary growth, and its surgical removal is therefore an unnecessary disturbance. When the mediastinum is involved, however, it may facilitate the technique to remove the breast without doing an extensive dissection. It is best done after the radiation treatment to diminish the likelihood of insemination. Each of such cases should be carefully considered by the surgeon and radiologist in consultation. Local removal may also be performed in cases apparently cured by radium or x-ray treatment, in order to be sure that the technique is good enough to cause all the carcinoma cells to be absorbed, but if once this fact is established it will no longer be necessary.

3. Exposure of the Growth, Irradiation, Closure.

This method has been proposed to get over the difficulty of the dose of medium x rays being limited by the sensitiveness of the skin. I have no experience of the use of x rays or radium in this way; radium buried in the tissues will be considered separately. Similarly the open wound might be treated after a radical operation, but anything like a full irradiation would probably prevent proper healing.

4. Radium Surgery of Access.

The technique for the introduction of the needles in a breast case is not simple and considerable practice is needed to get satisfactory results. Only a study of the skiagrams of his cases will enable a surgeon to realize how different is the position of the needles from what he had imagined. The supreme importance of asepsis cannot be too greatly emphasized, and it is no ordinary asepsis that is needed. Normally the tissues can deal with quite a large number of bacteria, but they are rendered much more vulnerable to bacterial attack after being exposed to radium rays in the large doses required. Therefore far greater precautions must be taken than with healthy tissues—as much care as is necessary to keep the tissues of a diabetic free from sepsis in an operation.

The treatment of recurrences by radium needling is only sound when the recurrence is absolutely local. Multiple recurrences are generally evidence either of some deeper focus or of extensive superficial invasion, and need to be treated accordingly.

AFTER-EFFECTS OF RADIATION.

Immediate.

Some patients suffer from sickness, which may be considerable if the dose is large. This can be much diminished or even abolished by certain precautions. In the first

place, spreading the treatment over several days is very effective. Next the avoidance of direct radiation passing through the chest helps a great deal when it is feasible. Then, having well ventilated treatment rooms, from which all corona discharge is eliminated, also assists considerably. The administration of 10 grains of chloretone before the treatment, and three times a day during it, is also of assistance. Lastly, the patient should be advised to drink plenty and to eat very little during the course of treatment. When the treatment is divided, the amount of radiation must be increased.

Subsequent.

A certain amount of erythema of the skin must be obtained if the results are to be successful, and this should be just short of vesication. If the treatment is repeated, telangiectases may be expected to form a year or two afterwards, and, if several times repeated in full doses, they are inevitable.

When the skin is much changed by several treatments it is very susceptible to damage by any trauma—even a very hot bath will do it—and to infections when so damaged. These infections cause a very intractable ulceration, and the best treatment is to get them in the early stages, cultivate the infective agent, and then give the patient vaccines from this. Zinc ionization is also useful in healing the ulcerations.

When effective doses of rays are used on the chest wall, it is difficult to avoid the lung receiving such doses. Many such cases will then develop a characteristic lesion of the lungs. It does not occur in all cases unless the dose has been very large, and it may be due to the waking up of old disease foci which exist in most lungs. The acute form is produced by a large dose of radiation delivered over a few days, and shows itself first of all as a pneumonic patch in the lung with slight displacement of the heart and mediastinal contents towards the affected region. This displacement gradually becomes more marked and eventually typical mottlings appear in the affected lung. Later the typical appearance of bronchiectasis develops, generally, however, without the symptoms of this condition. (Figs. 1, 2, 3, 4.) In the chronic form, caused by irradiation at intervals over a long period, the changes are similar except that the pneumonic stage is not observed. In the final stage the patient is unconscious of any abnormality as a rule, but in one acute case a typical bronchiectasis remained. (Figs. 5, 6.)

TECHNIQUE.

X Rays.

In order to avoid the lung damage referred to, I devised a method with x rays, which I published at the Bilingual Congress of Radiology in London in 1922. Holfelder of Frankfurt subsequently devised a similar method, which in some ways is an improvement. The principle of each of these is to use the rays at a tangent to the chest and so to avoid damage to more than the superficial parts and the apex of the lung, in both of which it is inevitable. The rest of the lung is protected by lead or other opaque material. The disadvantage of this method is that rays are kept away from the mediastinum, so that skiagrams of the chest must always precede the treatment to show whether there is any obvious mediastinal involvement, and if such be the case a different technique is employed. If the mediastinum is not involved, the tangential method has the advantage that it is much less likely to cause radiation sickness than large doses on the mediastinum.

The supraclavicular region is treated by separate fields, front and back, either at the same time as the pectoral region or at a different time. I prefer the latter method, because I then give the axilla and coracoid regions a second dose, and, as these are the parts most infested by recurrences, the results are better. Ten or twelve weeks should elapse between the two treatments.

The focus-skin distance I use in each of the above is 50 cm., but more will be required if the radiation is less penetrating. I use continuous high-tension current at 170-185 kilovolts (Peeke tables), which is the limit that most tubes will stand. It is found that above 160 kilovolts the dose which will give a skin erythema is enormously larger than below.

For mediastinal treatment I use a number of fields converging on the mediastinum, for preference giving half the treatment on one pattern and the other half on another pattern over-

lapping this. The focus-skin distance is only 30 cm., and it is not found necessary to give a full erythema dose to any one area. The supraclavicular regions are taken in, whether enlarged glands can be felt in them or not.

Whatever method is employed, I have obtained the best results, so far as x rays are concerned, with the hardest rays.

Radium.

(a) *Needling.*—Long radium needles of an active length of 6 cm. if possible, are introduced into the deeper part of the breast or of the tumour, a parallel formation being adhered to and each needle being about 1 cm. from the next, those, however, on the outer edge being slightly closer together. Needles are also introduced into the axilla in similar formation when a primary tumour is being treated, and if possible into the coracoid and supraclavicular regions, especially if the axillary glands are palpable, because the disease has always passed beyond the palpable glands. The needles are made of platinum, with a wall 0.5 or 0.6 mm. thick, and contain 0.5 or 0.6 mg. of radium per cm. active length. They are left in for from six to ten days.

(b) *Combined Method.*—After a radical operation tubes are left at the inner end of each of the upper intercostal spaces—say 10 mg. with a 0.5 mm. platinum filter for two days—two or three others in the supraclavicular region, and another tube below the clavicle.

(c) *External Applications.*—Either a mould of special wax is made to fit tightly on to the whole breast area, or a splint in some light material, such as celluloid or special thin wood, is made. In the former case the radium tubes or needles are distributed evenly on the wax, which is usually some 3 cm. thick or even more. When the splint is used, little blocks are stuck into it which carry the radium at the requisite distance from the skin. When very large quantities of radium are used, necessitating considerable protection, they are usually carried on a separate apparatus allowing universal movement—something like an x -ray tube stand. Placing the radium directly on the skin does not achieve a sufficiently large depth dose and is out of date.

RESULTS.

On the whole the material with which we have to deal is so bad that our results cannot be good. By the use of radium needles, however, as described above, in a series of cases not so advanced as the bulk of cases supplied, the results are very hopeful indeed. With x rays we have generally had later cases to treat, and while the disease can usually be kept in check for a long time, complete disappearance of the growth is uncommon. Many such cases also are subsequently lost from distant metastases, usually in the pelvis and lumbar spine. A local recurrence of the disease, after apparently complete disappearance, makes us think that the technique is at fault, and we wonder whether it would not be wise in all cases to give a second treatment, possibly using a somewhat smaller dose than the first time, as a prophylactic.

I have seen several cases with what seemed to be definite mediastinal spread, generally with deposits in the supraclavicular glands or other places as well, in which all external evidence of the disease has disappeared, the shadows in the mediastinum have become smaller and lost their characteristic outline, and so far the patient has remained well for two or three years or more. These are rather unexpected and I think we must regard them as lucky, though we always expect to see improvement.

On the whole, therefore, palliation and prolongation of life are the rule, cure the exception. From what we have seen it is obvious that better results may be expected by obtaining the cases in an earlier stage.

When a case is not too far advanced radium seems to give better results than x rays.

There is no question that we could be supplied with a better type of case. The surgical waiting lists at most hospitals are long and a certain number of cases have advanced beyond the curable stage in the weeks during which they wait for a bed. The comparatively short time required for their irradiation would spare more beds for keeping the waiting list short, and eventually more lives would be saved. The use of radium needling in earlier cases has immediately shown marked improvement in the results, and such methods, followed by extirpation if desired, seem to offer a better chance of cure than operation with subsequent irradiation. On the other hand, prophylactic radiation must not be withheld when operation

is the method preferred. So long as surgical removal of a cancer is a recognized method of treatment radiation must also find a place.

DISCUSSION.

Dr. J. H. DOUGLAS WEBSTER (London) advocated the closer co-ordination of radiological and surgical treatment. He thought that increased emphasis on the value of radiology, by diminishing the certainty that operations would be advised, would result in nervous patients seeking treatment earlier for small, painless lumps in the breast, and would thus improve the chances of cure. He believed that in many cases surgical intervention hastened a fatal issue. Local recurrences were less frequent when radiation treatment was commenced within two to four weeks after a surgical operation. Prophylactic x-ray therapy was of the greatest value after admittedly incomplete operations—as, for example, when the axillary glands could not be wholly cleared. Local improvement followed radiation treatment, even in inoperable cases, when surgical treatment was sometimes rendered possible thereby. The speaker pleaded for the extension of facilities for x-ray and radium treatment of cancer of the breast, since the results were often better than those of surgery. In his opinion operations ought to be forbidden in the case of active tumours which had not been sterilized by preliminary radiation.

Dr. A. E. BARCLAY (Manchester) expressed his admiration of Dr. Finzi's work, and recalled a memory of seeing him in the midst of a litter of broken x-ray tubes and other apparatus making an effort to get more intense radiations. Everyone had seen marvellous results with x rays and radium, and occasionally people had seen similar benefit without either. There were many types of cancer, and some were amenable to quite local radiations, while others were not. He mentioned two cases which had been operated on many years before and in which there had been supraclavicular recurrence. He decided to treat one patient with rays of ordinary wave-length and the other with deep therapy. The second improved remarkably, and they were very cheered to see the growth disappear, but the patient was dead within six months. The other patient, who was treated superficially, lived much longer. It often happened that the immediate results were good, but the ultimate results poor; he had therefore become conservative and could not share the optimism of either Dr. Finzi or Dr. Webster. While all could obtain wonderful results with x rays, it was essential that before they tried to do any good they must ensure that they did no damage. With regard to post-operative treatment, he noted that Dr. Finzi used the maximum dose which the tissues would stand; the speaker could not see the necessity for going to the length of damaging the skin. One extremely important point in post-operative treatment was the period when x-ray treatment should be started; if begun within a fortnight or three weeks of the operation there seemed to be a far smaller number of recurrences than in cases in which it was delayed longer.

Professor M. R. J. HAYES (Dublin) submitted figures showing the period after operation at which recurrence took place, and the site of recurrence in fifty-three consecutive cases of mammary carcinoma which had had no post-operative x-ray treatment. The period of recurrence in the 53 cases was as follows: 2 weeks in 1 case, 1 month in 5, 2 months in 4, 3 months in 7, 4 months in 2, 5 months in 1, 6 months in 2, 8 months in 2, 10 months in 1, 11 months in 2, 12 months in 7, 18 months in 3, 2 years in 2, 3 years in 9, 4 years in 2, and 5 years in 3. The site of recurrence is shown in the following table.

Site of Recurrence.	First Year.	Second and Third Year.	Fourth and Fifth Year.
Local	12	3	1
Supraclavicular	10	4	3
Axilla	1	—	—
Local and supraclavicular	6	3	—
Local and axilla	4	—	—
Supraclavicular and axilla	1	—	—
Spine	—	1	—
Thorax	—	1	1

The prevailing surgical practice was to regard supraclavicular involvement as a contraindication to operation, but it was apparent from the figures given that in the first-year recurrences there was apparently no clinical manifestation of supraclavicular involvement at the time of the operation, nor was there any evidence of it in the cases which occurred within three years. It was reasonable to suppose that the earlier the recurrence the more malignant was the character of the disease. It might be contended that all the cases in this series were of a very malignant type, and therefore had surgical risks; nevertheless, they indicated the advanced and almost hopeless stage in which the average patient with recurrent mammary carcinoma came to the radiologist for treatment; they showed also how essential it was always to include the supraclavicular space in prophylactic treatment as well as the pectoral region and the axilla. Such treatment was started usually in the second or third week, and most of the cases were treated according to the older methods, but during the past three years high-voltage rays had been employed. Time was too short and cases too few to compare the results of the newer with the older technique, but his impression was that for the prophylactic treatment of mammary carcinoma massive doses of highly penetrating rays were not only unnecessary but harmful; he believed, as Wintz had stated, that by their injurious effects on the healthy tissues they helped rather than hindered the recurrence of the disease. For precise measurements and accurate dosage on the surface and in the depths of the tissues the newer technique had obvious advantages, but for the prophylactic treatment of mammary cancer he considered that the rays produced by 135 to 155 kilovolts were the most effective. Of fifty patients who had prophylactic treatment seven were known definitely to have had recurrences, and of these seven one died within one year, four in the second year, one was doing badly from a deep-seated recurrence after five years, and one had recurrence after eight years which responded to further treatment, but she died later from the disease. In eleven cases the result was unknown, and thirty-two were known to be alive and free from recurrence after the number of years shown in the following table:

Years: 1	2	3	4	5	6	7	8	9	10	14
Cases: 1	5	4	4	6	3	2	3	2	1	1

The radiologist should have more information than was sometimes forthcoming about the histology of the cases he treated, for there was much evidence to suggest that there might be an optimum quality and quantity of radiation capable of producing a maximum inhibitory or lethal effect on a particular type of neoplastic cell. It was mainly along biological lines that future researches must extend, and the first endeavour should be to discover the relationship which existed between the quality of the radiation employed and the biological effects which were produced not only in the particular type of neoplastic cell, but also in the normal cells surrounding it.

Dr. W. M. LEVITT (London) said that Dr. Finzi had asked him to report on the histological examination of these cases after intensive irradiation had been applied. Four patients had been investigated histologically; they had received intensified treatment by a method which gave them the full tolerance dose for about a fortnight. The histological examination was made about three months after the irradiation. In one case it was found that there had been a most remarkable decrease in the number of malignant cells, and that there was a complete absence of mitosis in the cells which remained. In two cases there was very little decrease in the frequency of the malignant cells, but a complete absence of mitosis, and in the fourth case apparently there was no change in the character of the malignant cell. The obvious question related to the essential element in the malignancy of a tumour; was it the presence of a mitosis or some other characteristic? It was impossible to say. In one of these cases the tumour on removal had been cut right through, and what appeared to be malignant tissue had been left behind, but without mitosis, and the portion of tissue which had been cut through nine months before had not continued to grow. In connexion with the pre-operative treatment of malignant

disease, Dr. Levitt suggested that local excision after irradiation might give a more satisfactory result. With regard to post-operative irradiation, if it was agreed that the selective sensitiveness of the carcinoma cells over the normal cells was proportional to their vital activity, then post-operative irradiation for prophylactic purposes was contraindicated altogether, because any malignant cells which were left after complete operation were in a sort of hibernating condition. They did not commence to grow for quite a time afterwards, perhaps as long as two or three years. In the bulk of cases he thought that pre-operative radiation was preferable to post-operative.

Dr. R. E. ROBERTS (Liverpool) said that the treatment of malignant disease was one of the most depressing occupations anyone could undertake. In any large hospital the x-ray department was the dumping-ground for all the surgical inoperabilities. It might be hoped that life was being lengthened, but it was a question whether it was not rather a case of prolonging death. No one could foretell exactly what response would be forthcoming from treatment. It was most disappointing when good curative or perfect prophylactic results followed operation that the patient should die after twelve or eighteen months from secondaries. The speaker thought that those secondaries must have been present from the time of the operation. The question of voltage was a very difficult one, but he thought that Professor Hayes had hit the nail on the head when he stated that for each type of malignant disease there was an optimum voltage; some cases responded best to high voltage and others to medium. The type of treatment had to be gauged by the general condition of the patient. In Liverpool a good deal had been done in the treatment of malignant disease by injections of lead, and in the treatment of several of those cases subsequently by x rays he had found that the lead injections apparently assisted the x-ray action, the patients doing better than those who were subjected to x rays without having had the lead treatment; there was a more intense secondary radiation.

The PRESIDENT (Dr. Woodburn Morison) asked what it was they were attempting to do when they irradiated breast carcinoma. If they were trying to destroy every individual cell in the breast they were committed to what was physically an impossibility. This could be easily demonstrated from the standpoint of pure physics. It would be found that calcification had taken place in some areas approximating quite unchanged cancer cells. From the physical point of view they could never accomplish in that way the pure destruction of a breast carcinoma. Dr. Barclay had mentioned two patients, one of whom, treated with deep therapy, had improved at first but died within six months, and the other, treated superficially, had lived much longer; but his comparisons were not complete. He should have taken an untreated patient and observed how long life lasted. He wondered what would be the general average duration of life if a case of cancer were left entirely alone, and how it would compare with the duration in cases in which operative followed by radiological treatment had been applied.

Dr. FINZI, in reply, said that he believed it to be correct that every tumour had an optimum wave-length at which the treatment would do more harm to the carcinoma with less harm to the surrounding tissues than at any other wave-length. So far as he had gone, it seemed to him that with the pushing up of the voltage better results were obtained in carcinoma, and he still thought the optimum wave-length had not been reached, because it was at present above the range which tubes would stand. Dr. Barclay had suggested that the immediate results were good and the ultimate results bad; the speaker thought that this was simply because the right technique had not yet been worked out. He denied that he was an indiscriminating optimist with regard to radiation treatment of breast cancer; he was an optimist in the case of localized breast carcinoma, but the trouble was that they did not get cases like that to treat. In the cases described in his paper as having been treated with radium needles the results had been so satisfactory that at present the surgeon had refused to remove the breast because he could not feel

anything at all. Thus there could be no actual proof that in these cases the carcinoma cells had disappeared, but it was known that in the cervix every carcinoma cell could be made to disappear; that had been shown by others, using either radium or x rays. He rather thought that that was the objective in breast carcinoma. As to massive doses for prophylaxis, he would retain his view; he believed in the hibernating cell, and that it was ready to grow. Dr. Roberts had asked whether any good at all was being done; but the older radiologists had seen patients who had remained well for five to ten years after treatment. He regarded the skin erythema as necessary because the dose which produced it was about the optimum for eradicating carcinomatous disease—he would not use the term “carcinomatous cells.” Some had maintained that carcinoma started as a generalized disease with a localized manifestation; Dr. Finzi did not believe that the disease originated in the blood or tissues generally, but that it started locally and subsequently became general; otherwise, how could any disease at all be treated? He did not now get burns in the lung, because he had improved his technique. The goal of their attempts was to destroy all evidence of disease, and so to treat the patient that no carcinoma cells would develop. It was possible that there might remain encysted hibernating carcinoma cells in the tissues, but so long as these did not develop all was well.

The Section of Radiology.

At the conclusion of the meeting Dr. L. A. Rowden (Leeds) made a protest against the confinement of the Section proceedings to one day only of the Annual Meeting; Dr. A. E. Barclay associated himself with the protest, which the President of the Section promised should be conveyed to headquarters.

Memoranda :

MEDICAL, SURGICAL, OBSTETRICAL.

CHRONIC FIBROUS EPIPLOITIS.

THE publication by Mr. R. Charles B. Maunsell, in your issue of June 11th (p. 1051), of his article on chronic fibrous epiploitis, prompts me to record a case which presents many similar features.

A Chinese boy, aged 10, was brought to me with symptoms of intestinal obstruction of three days' duration. A large, hard, tender mass occupied the lower portion of the abdomen, and extended from just above the umbilicus to the symphysis pubis.

The abdomen was explored by a right paramedian incision below the umbilicus. On opening the peritoneal cavity a dense, tough membrane was found spread out in front of the abdominal viscera, in a manner very similar to that described by Mr. Maunsell. This membrane was divided in the line of the peritoneal incision, thus exposing the intestines; about two feet of small bowel were found to be gangrenous. Strong septa, similar in structure to the membrane lying in front of the viscera, passed backwards from it to the posterior abdominal wall, thus dividing the abdominal cavity into a series of loculi and binding down and constricting the intestines. One of these septa had, by obstructing the upper part of the ileum, resulted in the gangrenous condition of the two feet of gut immediately below it. The septa and adhesions were divided sufficiently to free healthy bowel above and below the gangrenous portion, preparatory to resection. At this point, however, the patient suddenly collapsed; a Paul's tube was inserted into the ileum proximal to the gangrenous portion, and the patient was returned to the ward. Subcutaneous saline injections, and the administration of glucose solution by the mouth and rectum, resulted in so great an improvement that, although by no means optimistic as to the chances of ultimate recovery, I opened the abdomen again through the original incision on the third day following the first operation. It was found that the gangrenous portion of intestine had walled itself off from the rest of the abdominal cavity, occupying a loculus of which the walls were largely formed by the adventitious membrane. The afferent and efferent healthy gut passed through the walls of this loculus to join with the gangrenous portion. The gangrenous intestine was resected, the cut ends closed, and side-to-side anastomosis was performed. Unfortunately, however, the extensive nature of the resection proved too much for the patient in his debilitated condition, and he died a short time after the completion of the operation.

Microscopical examination of a piece of membrane removed for section showed that it was composed of fibrous tissue, upon which were superimposed the changes of acute inflammation. These changes, which were secondary to the gangrenous condition of the intestine, prevented any conclusions being reached as to the intimate structure of the fibrous membrane. The thickness of the membrane was approximately $\frac{1}{4}$ mm.